Carleton University

Office of the Vice-Provost and Associate Vice-President (Academic)

memorandum

DATE: May 30, 2024

TO: Senate

FROM: Dr. David Hornsby, Vice-Provost and Associate Vice-President (Academic), and Chair, Senate Quality Assurance and Planning Committee

RE: Mechatronics Engineering (BEng)
New Program Approval

SQAPC Motion

THAT SQAPC recommends to Senate the approval of the BEng in Mechatronics Engineering program as presented, to commence in Fall 2025.

Senate Motion

THAT Senate approve the proposed BEng in Mechatronics Engineering program as presented to commence in Fall 2025.

Background

Mechatronics is a multi-disciplinary engineering field that integrates the education of Mechanical, Electrical and Electronics, and Systems and Computer Engineering. The objective of this new engineering undergraduate program is to formally prepare its graduates for working in the design, manufacture, and end-use sides of mechatronic devices (the quintessential examples being any industrial, commercial, or consumer robotic-like device). By having three equal departmental partners involved in the development if this program, the goal can be a sincere synthesis of materials from the different root disciplines (instead of the commonly used approach of having a single department define the core of mechatronics and then add patches for the other departments).

Attachments

Self-Study with Appendices (Volume I)
Discussant Report
Site visit Agenda
External Reviewer Biographies
External Reviewers' Report
Unit response to the External Reviewers' Report and Implementation plan
Dean's response to the External Reviewers' Report
SQAPC outcome memo
Dean's letter of support

Courseleaf Entries
Faculty CVs (Volume II)

Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP)

Upon the above motion being passed by Senate, the required documentation will be submitted to the Ontario Universities' Council on Quality Assurance for approval. A submission to the Ministry for approval will follow. These approvals are required before the program can commence.

Carleton University

Office of the Vice-Provost and
Associate Vice-President (Academic)

Institutional Quality Assurance Process

Mechatronics Engineering

New Program Approval Template

(Volume I)

March 2024

Approvals Table

This table will record that the brief has been approved by: 1) the program lead on behalf of the team; 2) the head of the academic unit or chair of the program committee (in the case of interdisciplinary programs not administered exclusively by one academic unit) on behalf of the unit or program committee; 3) the Faculty Dean(s).

Interdisciplinary Academic Team: Rishad Irani and Mohammad Biglar Begian from Mechanical and Aerospace Engineering, Carlos Rossa and Chao Shen from Systems and Computer Engineering, and Michael Feuerherm and Niall Tait from the Department of Electronics	March 25, 2024
Program Leads	**Date**
Chair of Interdisciplinary Curriculum Committee: Samuel Ajila, Associate Dean (Policy and Planning), FED	March 25, 2024
Chair/Director	**Date**
Larry Kostiuk, Dean, FED	March 25, 2024
Dean(s):	**Date**

Committees Reviews and Approvals

Vice-Presidents' Academic Research Committee (executive summary)	
Provost's Budget Working Group (executive summary)	
Curriculum Committee	
Faculty Board	
Senate Committee on Curriculum, Admissions on Studies Policy	
Senate Quality Assurance and Planning Committee	
Senate	
Quality Council	

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A. The Program

A.1. Program overview

a. New Program Concept

Mechatronics as a technical term that emerged out of the 1970s to describe hybrid devices with near equal reliance and contributions from mechanical and electronic components working together to achieve the functionality needed. An example of such a mechatronic device is a robot – a machine with an articulating set of links performing some manipulation where the forces that create this motion are electric motors. Over the next five decades, like almost everything else, these devices fell under the control of programmable (software) semiconductors, so despite the name remaining binary as Mechatronics Engineering, these devices are the full integration of mechanical, electrical, and software engineering. Such devices are now ubiquitous in our lives.

For an engineer to be a leader in the design and development of mechatronic devices requires a balanced understanding and respect for each of the founding disciplines. This breath of knowledge historically arose in a person from having either a mechanical or electrical engineering degree. Hopefully, they took some technical electives in the other disciplines and then through considerable post-graduation efforts in their work life come to know the other fields. This informal merging of knowledge is inefficient, so the Departments of Electronics, Mechanical and Aerospace, and Systems and Computer Engineering are proposing to bring that convergence together formally in an undergraduate program of Mechatronics Engineering with its own unique goals.

b. Goal of New Program

The objective of this new engineering undergraduate program is to formally prepare its graduates for working in the design, manufacture, and end-use aspects of mechatronic devices. By having three equal departmental partners involved in the development if this program, the goal can be a sincere synthesis of materials from the different root disciplines (instead of a commonly used approach of having a single department define the core of mechatronics and then add patches for the other departments).

A key academic goal in the upper years is that courses will be used to explicitly blend mechanical-electrical-software principles into a single viewpoint, instead of just stacking the materials next to each other from different departmental courses and hoping the blending occurs within the students' minds. This will require some new courses be part of the program structure.

The size goal of this program would be 30 first year admissions in year 1 and growing by 30 more students per year until it reaches a steady state admission of 150 new first year students by year 5 (*i.e.*, annual first year admissions being 30 – 60 – 90 – 120 – 150 – 150 – 150 …).

c. Program Structure

Table A.1 shows the new Mechatronics Engineering program, which consists of 8x0.25 credits; 37x0.5 credits; 1x1.0 credit; and 4x0.0 credit courses (21.5 credits in total) broken down by year and nature of materials.

Table A.1: Overview of Proposed Mechatronics Program.

Year	Nature of Course Materials	Credits
1	Math / Chemistry / Physics / Basic Science	2.5
	Complementary Studies / Communications	0.5
	Engineering Core	2.0
	Profession Related	0.0
2	Math	1.0
	Communications	0.5
	Electrical Engineering	1.5
	Mechanical Engineering	1.5
	Systems and Computer Engineering	1.5
3	Engineering Core	1.0
	Electrical Engineering	1.0
	Mechanical Engineering	2.0
	Systems and Computer Engineering	1.5
	Professional Related	0.0
4	Complementary Studies	0.5
	Mechanical Engineering	0.5
	Systems and Computer Engineering	0.5
	Mechatronic Specific	1.5
	Capstone Project	1.0
	Engineering Elective	0.5
	Profession Related	0.5

Table A.2 shows the program structure as it would appear in Calendar format, while the proposed calendar description of individual courses can be found in Appendix 1.

Table A.2: Structure of Mechatronics Engineering in a Calendar format.

Mechatronics Engineering – Bachelor of Engineering

First Year

1. a) 4.0 credits in:		**4.0**
CHEM 1101 [0.5]	Chemistry for Engineering Students	
ECOR 1041 [0.25]	Computation and Programming	
ECOR 1042 [0.25]	Data Management	
ECOR 1043 [0.25]	Circuits	
ECOR 1044 [0.25]	Mechatronics	
ECOR 1045 [0.25]	Statics	
ECOR 1046 [0.25]	Mechanics	
ECOR 1047 [0.25]	Visual Communication	

	ECOR 1048 [0.25]	Dynamics	
	MATH 1004 [0.5]	Calculus for Engineering or Physics	
	MATH 1104 [0.5]	Linear Algebra for Engineering or Science	
	PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion	
	b) The Introduction to Engineering Disciplines requirement must be met through the successful completion of		
	ECOR 1055 [0.0]	Introduction to Engineering Disciplines I	
	ECOR 1056 [0.0]	Introduction to Engineering Disciplines II	
	ECOR 1057 [0.0]	Engineering Profession	
2.	**0.5 credit in Complementary Studies Electives**		**0.5**
3.	**0.5 credit in Basic Science Electives**		**0.5**
Second Year			
4.	**6.0 credits in:**		**6.0**
	MATH 1005 [0.5]	Differential Equations & Infinite Series for Eng. Students	
	MATH 2004 [0.5]	Multivariable Calculus for Engineering Students	
	SYSC 2310 [0.5]	Digital Systems	
	SYSC 2320 [0.5	Intro to Comp Organization & Architecture	
	SYSC 2006 [0.5]	Foundation of Imperative Programming	
	ELEC 2507 [0.5]	Electronics I	
	ELEC 2501 [0.5]	Circuits and Signals	
	ELEC 2602 [0.5]	Electric Machine and Power	
	MAAE 2401 [0.5]	Mechatronics Thermodynamics and Heat Transfer	
	MAAE 2101 [0.5]	Engineering Dynamics	
	MAAE 2300 [0.5]	Fluid Mechanics I	
	CCDP 2100 [0.5]	Communication Skills for Engineering Students	
Third Year			
5.	**a) 5.5 credits in**		**5.5**
	SYSC 3310 [0.5]	Real Time Systems	
	SYSC 3600 [0.5]	Systems and Simulation	
	SYSC 4505 [0.5]	Automatic Control Systems	
	ELEC 3508 [0.5]	Power Electronics	
	ELEC 4709 [0.5]	Integrated Sensors	
	MAAE 2203 [0.5]	Solids Mechanics for Machines	
	MAAE 2001 [0.5]	Engineering Graphical Design	
	MECH 3002 [0.5]	Machine Design	
	MAAE 3004 [0.5]	Dynamics of Machine	
	ECOR 2050 [0.5]	Design and Analysis of Engineering Experiments	
	ECOR 3800 [0.5]	Engineering Economics	
	b) Successful completion of		
	ECOR 2995 [0.0]	Engineering Portfolio	
Fourth Year			

6.	**4.0 credits in:**		**3.0**
	SYSC 3220 [0.5]	Computer Systems Design	
	SYSC 4709 [0.5]	Industrial Automation	
	MAAE 3505 [0.5]	Mechatronics I	
	MAAE 4706 [0.5]	Mechatronics II	
	MECH 4503 [0.5]	An Introduction to Robotics	
	ECOR 4995 [0.5]	Professional Practice	
	MECT 4907 [1.0]	Engineering Design Project	
7.	**0.5 credit in** Complementary Studies Electives		**0.5**
8.	**0.5 credit in** Engineering Elective or ECOR 2606		**0.5**
Total Credits			**21.5**

d. Current International, National and Provincial Profile

Information obtained from Ontario University websites[1] shows that seven post-secondary institutions offer a degree in Mechatronics Engineering. They are Ontario Tech[2], Waterloo[3], Queens[4], Toronto Metropolitan[5], Lakehead[6], McMaster[7][8], and Western[9]. Both McMaster and Ontario Tech offer two different degrees: Bachelor of Engineering and Bachelor of Engineering and Management. Waterloo offers a Bachelor of Applied Science, Toronto Metropolitan offers a Bachelor of Engineering, while Queens offers a Bachelor of Science in Engineering. Lakehead offers two degrees - Bachelor of Engineering and Bachelor of Engineering/Master of Business Administration. Western offers the BEng degree program in Mechatronics Systems Engineering[10].

The proposed approach in the design of Carleton's new degree program is most like that of Waterloo. At Waterloo the Mechatronics degree program courses come from the Mechanical Engineering program, the Electrical & Computer Engineering program, and the Systems Design Engineering program. Our design approach, though similar to that of Waterloo, is distinctive in the sense that it will give our graduates the opportunity to pursue careers in automation, manufacturing, telecommunication, and even in product and software design (Systems design). It is very important to note that Carleton University will lead the way in the Ottawa area and Ottawa valley if this degree program is approved.

Nationally, Simon Fraser university in BC offers two different degree programs in Mechatronics – Mechatronics Systems Engineering and Business double degree. Similar

[1] https://www.ontariouniversitiesinfo.ca/search?s=mechatronics
[2] https://ontariotechu.ca/programs/undergraduate/engineering/mechatronics-engineering/index.php
[3] https://uwaterloo.ca/future-students/programs/mechatronics-engineering?utm_source=mur-einfo&utm_medium=referral&utm_campaign=mur-ouac
[4] https://engineering.queensu.ca/
[5] https://www.torontomu.ca/mechanical-industrial/mechatronics/home/
[6] https://www.lakeheadu.ca/programs/undergraduate-programs/engineering/node/3569
[7] https://www.eng.mcmaster.ca/future-students/future-undergraduate-students/
[8] https://www.ontariouniversitiesinfo.ca/programs/137
[9] https://www.ontariouniversitiesinfo.ca/programs/313
[10] https://www.eng.uwo.ca/future-students/

degree programs in Robotics and Automation are offered in other Universities such as University of Manitoba, Winnipeg, and Algonquin College (yet to be accredited), Ottawa.

e. Societal Need and Student Demand

The world today is a small village thanks to different technologies around us. We now have tools such as brain implant smart systems, electric vehicles (EVs), 3D wearable devices, etc. that use intelligence and allow us to operate dynamically in our environment fully connected and active. These "intelligent" systems or devices may be referred to as "Mechatronics" devices. To manage these devices effectively and efficiently, and innovate further, we need experts that can understand the intersection between mechanical, electronics, and computer systems parts. The complexity involves maintaining the balance between these intelligent devices necessitating the need to train young (and old) people in the art of designing and developing these new technologies. Since the demand for these new technologies is increasing daily, there is demand for more experts in the domain, and Carleton University Faculty of Engineering and Design will fill the gap by starting a new degree program in Mechatronics Engineering. Many graduates of this new program will end up working for automobile industries especially the EV sectors in Ontario and around Canada. We also see growth in in the Aeronautic industries in Quebec and in Southern Ontario. There are many small to medium industries around Ottawa developing smart systems and Internet of Things (IoT), and our graduates will be in demand in such sectors. Finally, we expect that a small percentage of the cohorts will end up in graduate programs within the faculty to maintain innovation in the domain.

The origin for proposing this Mechatronics Engineering program at this time is demand driven and can be linked to data presented by the Carleton University's VP Students and Enrolments at the senior leadership retreat in January 2023. There was zero ambiguity from the University's Recruitment Office that Mechatronics Engineering was (and has been for several years) part of the first tier of programs students asked if Carleton offered. Furthermore, when the students were told that Carleton did not have this program, they simply walked away. This impression of demand at fairs and school events was confirmed by Faculty of Engineering and Design's Recruitment and Outreach Team. To provide a somewhat quantitative measure of this demand, the latest available data (2018 – 2021) from the Ontario University Application Centre (OUAC) was reviewed. In 2021, there were 1972 student who applied to Mechatronics (up 23 % from 2018) of which there was only 371 registrants (*i.e.*, 19 % of applicants registered). This 19 % is low compared to all engineering programs, which is almost twice that and sits at 36 %. One reason for this lower conversion rate of applications to registrations could be associated with whether the high school averages of those applying to mechatronics were lower than all of engineering, and thereby suggesting that the lower conversion rate was driven by unacceptable applicants. The average OUAC applicant for all engineering disciplines at all institutions is ~91 %, while for mechatronics programs it is 92 %. Given the high academic quality of students applying to

mechatronics, the data therefore suggests that Ontario has a supply-side shortage of seats in mechatronics.

At a more quantitative level, the Government of Canada's Job Bank Labour Market Information website lists the prospects for employment for Mechatronics Engineering[11] to be on par with Mechanical Engineering[12].

This combination of push and pull for potential students, and the decision contributors in their lives, bodes well for meeting enrolment targets.

A.2. Mission and strategic directions

a. Connections to Carleton's Strategic Integrated Plan (SIP)

Carleton's SIP (https://carleton.ca/president/strategic-integrated-plan-sip/) is based on three strategic directions, and proposed Mechatronics Engineering program aligns with all them through:

Share Knowledge / Shape the Future - This Mechatronics Engineering program will better prepare our students for success in the ever-changing world of technology that involves electromechanical devices driven by classical and artificial intelligence software. Pulling the disciplines of mechanical, electrical and software engineering together is technologically interdisciplinary and creates a culture of collaboration. Developing and teaching new courses that arise from a need of different disciplines is a pedagogical step forward. Through what will be a response to student and industry demand for graduates in this area, the Faculty of Engineering and Design will be modeling organizational excellence.

Serve Ottawa /Serve the World - Canada's largest technology park located in Kanata, as well as Ontario in general, is a hub for the design and manufacturing of mechatronic devices such as robots, cars (conventional or autonomous), 3-D printer (or even a regular printer), drones, etc. For a large segment of the population, mechatronic devices are what they see as being 'cool' about engineering, so opportunities for community engagement abound with the public locally and globally.

Strive for Wellness / Strive for Sustainability - So many mechatronic devices relate to needs accommodation for people in terms of accessibility (*e.g.*, motorize wheelchairs and long-term health care beds), as well as devices used in medical treatments (*e.g.*, medical haptics).

[11] https://www.jobbank.gc.ca/marketreport/outlook-occupation/25070/ca
[12] https://www.jobbank.gc.ca/marketreport/outlook-occupation/2757/ca

b. Connections to Carleton's Equity, Diversity, and Inclusion (EDI) Action Plan

Carleton's EDI Action Plan (https://carleton.ca/edi-plan/) is based on shaping our shared future on strength and ambition derived from our diverse community to impact curriculum and pedagogy, student support, leadership, and research.

Mechatronics Engineering is a modern enabling technology, which in theory, is designed and built to make activities more readily available for all. A recruitment strategy for students to enroll in this program will be to imagine how their world can become more equitable and more inclusive if they were to become a practitioner in mechatronics.

A.3. Relationship to other academic programs at Carleton

a. Relationship to Other Programs within Faculty of Engineering and Design

Mechatronics is a multi-disciplinary engineering field that integrates Mechanical, Electrical/Electronics, and Systems and Computer Engineering. The new Mechatronics Engineering program parallels all other engineering programs with the same common first year, purposely designed to facilitate potential movements of students across programs) after first year. The three departments: Electronics, Mechanical and Aerospace, and Systems and Computer Engineering participated in the design of this new program. These programs will contribute most of the core courses in the new program, as well as the additional new courses. As a result, they are aware of and accepting of the added teaching responsibilities, subject to the additional resources discussed later.

Starting in the second year and through to completion this new program involves 31, 0.5-credit courses and a capstone design project. Students will take seven courses from Systems and Computer engineering (only one is a new course; Industrial Automation), nine from Mechanical and Aerospace (four are new; Thermodynamics and Heat Transfer, Mechanics of Solids, and Mechatronics I and II), and five from Electronics (all existing). Industrial Automation and Mechatronics I and II will become part of the technical electives with their departments, so the creation of the Mechatronics will have benefits for the students in other programs within those departments.

b. Relationship to other programs within the University

In total, the Faculty of Science provides seven service courses, while the Faculty of Arts and Social Sciences provide three complimentary studies courses. Appendix 2 contains the letters of support from the departments involved.

B. Program Learning Outcomes and Assessment

B.1 Program learning outcomes

The program outcomes (Table B.1) for the new Mechatronics Engineering program have been developed to reflect and align with the graduate attributes outlined by the Canadian Engineering Accreditation Board (CEAB).

Table B.1: Learning outcomes.

Learning Outcomes
1. Use the concepts developed in the University level Mathematics, Natural Science, and Engineering core principles to solve engineering problems related to complex computer systems, electronics, and mechanical devices and systems.
2. Identify, analyze, and formulate complex engineering problems related to mechatronics systems to draw (or reach) a conclusion as to an engineering solution.
3. Integrate techniques and concepts from mechanical and electronics engineering to formulate viable solution to mechatronics problems.
4. Design and develop secure mechatronics systems using engineering techniques and methods in computer systems and software
5. Investigate mechatronics infrastructure-specific problems through appropriate methods that include practical experimentation, simulations, engineering analysis and information synthesis to reach valid conclusions.
6. Conduct risk analysis to determine requirements and develop specifications for mechatronics systems' infrastructure.
7. Work independently and in teams using relevant leadership techniques and interpersonal skills and group dynamics to resolve conflicts.
8. Communicate complex engineering concepts using a variety of communication techniques that include oral presentations, technical reports, design documentation, and instructions.
9. Incorporate economics and business practices including project, resource, risk, and change management into the practice of mechatronics engineering product development and understand their limitations.
10. Identify and address professional development needs to maintain technical and professional currency and competence and to contribute to the advancement of knowledge in mechatronics engineering.

B2 Mapping learning outcomes to provincial degree-level expectations (DLE)

Table B.2: Learning outcomes and degree level expectations.

Learning Outcomes	Degree Level Expectations Met [a]
1	1. Depth and breadth of knowledge
1, 2, 3	2. Knowledge of methodologies
3, 4, 5	3. Application of knowledge
7, 8	4. Communication skills
5, 6	5. Awareness of the limits of knowledge
9, 10	6. Autonomy and professional capacity
2, 3, 4, 5, 6	7. Experiential Learning

a - XXX

B.3 Program structure and curriculum map

Table B3.1 – Program Components.

Component/Activity	Comments	BEng
Engineering core courses	Six courses	3.0 credits
Math / Chemistry / Physics / Basic Science	Seven courses	3.5 credits

Professional related courses	These include four 0.0 credit courses and one 0.5 credit course	0.5 credit
Complementary Studies / Communications	Three courses	1.5 credits
Electrical Engineering	Five courses	2.5 credits
Mechanical Engineering	Six courses	3.0 credits
Mechatronic Specific	Five courses	2.5 credits
Systems and Computer Engineering	Seven courses	3.5 credits
Capstone Project	Two-course equivalent	1.0 credit
Engineering Elective	One course	0.5 credit
	TOTAL	21.5 credits

Table B3.2: Core course requirements.

Engineering core courses – 3.0 credits		
ECOR 1041	[0.25]	Computation and Programming
ECOR 1042	[0.25]	Data Management
ECOR 1043	[0.25]	Circuits
ECOR 1044	[0.25]	Mechatronics
ECOR 1045	[0.25]	Statics
ECOR 1046	[0.25]	Mechanics
ECOR 1047	[0.25]	Visual Communication
ECOR 1048	[0.25]	Dynamics
ECOR 2050	[0.5]	Design and Analysis of Engineering Experiments
ECOR 4995	[0.5]	Professional Practice
Math / Chemistry / Physics / Basic Science – 3.5 credits		
MATH 1004	[0.5]	Calculus for Engineering Students
MATH 1104	[0.5]	Linear Algebra for Engineering Students
MATH 1005	[0.5]	Differential Equations & Infinite Series for Eng. Students
MATH2004	[0.5]	Multivariable Calculus for Engineering Students
CHEM 1101	[0.5]	Chemistry for Engineering Students
PHYS 1004	[0.5]	Introductory Electromagnetism & Wave Motion
Basic Science Elective [0.5		
Professional related courses – 0.5 credit		
ECOR 1055	[0.0]	Introduction to Engineering Disciplines I
ECOR 1056	[0.0]	Introduction to Engineering Disciplines II
ECOR 1057	[0.0]	Engineering Profession
ECOR 2995	[0.0]	Engineering Portfolio
ECOR 3800	[0.5]	Engineering Economics
Complementary Studies / Communications – 1.5 credits		
CCDP 2100	[0.5]	Communication Skills for Engineering Students
Complementary electives – two courses [1.0]		
Electrical Engineering – 2.5 credits		
ELEC 2501	[0.5]	Circuits and Signals
ELEC 2507	[0.5]	Electronics I
ELEC 2602	[0.5]	Electric Machine and Power
ELEC 3508	[0.5]	Power Electronics
ELEC 4709	[0.5]	Integrated Sensors

Mechanical Engineering – 3.0 credits		
MAAE 2001	[0.5]	Engineering Graphical Design
MAAE 2101	[0.5]	Engineering Dynamics
MAAE 2300	[0.5]	Fluid Mechanics I
MECH 3002	[0.5]	Machine Design
MAAE 3004	[0.5]	Dynamics of Machine
MECH 4503	[0.5]	An Introduction to Robotics
Mechatronic Specific – 2.5 credits		
MAAE 2401	[0.5]	Mechatronics Thermodynamics and Heat Transfer
MAAE 2203	[0.5]	Solids Mechanics for Machines
MAAE 3505	[0.5]	Mechatronics I
MAAE 4706	[0.5]	Mechatronics II
SYSC 4709	[0.5]	Industrial Automation
Systems and Computer Engineering – 3.5 credits		
SYSC 2006	[0.5]	Foundation of Imperative Programming
SYSC 2310	[0.5]	Digital Systems
SYSC 2320	[0.5]	Intro to Comp Organization & Architecture
SYSC 3310	[0.5]	Real Time Systems
SYSC 3320	[0.5]	Computer Systems Design
SYSC 3600	[0.5]	Systems and Simulation
SYSC 4505	[0.5]	Automatic Control Systems
Capstone Project – 1 credit		
Engineering Design Project [1.0] – 1.0 credit in MECT 4907		
Engineering Elective – 0.5 credit		
Basic Science Elective [0.5]		

Table B.3.3: Program curriculum map summary

Learning Outcomes	**Year(s) to be Assessed** [a]	**Program Components** [b]	**Level** [C] **(I, R, M)**	**Activities and Artifacts** [d]
1. Use the concepts developed in the University level Mathematics, Natural Science, and Engineering core principles to solve engineering problems related to complex computer systems, electronics, and mechanical devices and systems.	1st and 2nd	Engineering core, Math / Chemistry / Physics / Basic Science	I, R	Exam or Lab Report or Assignment
2. Identify, analyze, and formulate complex engineering problems related to mechatronics systems to draw (or reach) a conclusion as to the engineering solution.	3rd and 4th	Mechatronics specific courses	R, M	Exam or Lab Report or Assignment
3. Integrate techniques and concepts from mechanical and electronics engineering to formulate viable solution to mechatronics problems.	2nd and 3rd	Electrical and Mechanical engineering courses	R, M	Exam or Lab Report or Assignment or Capstone project
4. Design and develop secure mechatronics systems using engineering	3rd and 4th	Systems and Computer	R, M	Exam or Lab Report or

techniques and methods in computer systems and software		Engineering courses		Capstone project
5. Investigate mechatronics infrastructure-specific problems through appropriate methods that include practical experimentation, simulations, engineering analysis and information synthesis to reach valid conclusions.	3rd and 4th	Mechanical, Mechatronics courses	I, R, M	Exam or Lab Report or Assignment
6. Conduct risk analysis to determine requirements and develop specifications for mechatronics systems' infrastructure.	3rd and 4th	Professional related and Mechatronics courses	I, M	Exam or Lab Report or Assignment
7. Work independently and in teams using relevant leadership techniques and interpersonal skills and group dynamics to resolve conflicts.	3rd and 4th	Professional related, Capstone project, other technical courses	R, M	Exam or Lab Report or Assignment
8. Communicate complex engineering concepts using a variety of communication techniques that include oral presentations, technical reports, design documentation, and instructions.	3rd and 4th	Complementary Studies / Communications, Capstone project	R, M	Exam or Lab Report or Assignment
9. Incorporate economics and business practices including project, resource, risk, and change management into the practice of mechatronics engineering product development and understand their limitations.	3rd and 4th	Professional related, Mechatronics courses, and Engineering elective	R, M	Exam or Lab Report or Assignment
10. Identify and address professional development needs to maintain technical and professional currency and competence and to contribute to the advancement of knowledge in mechatronics engineering.	3rd and 4th	Complementary Studies / Communications and Professional related courses	I, R, M	Exam or Lab Report or Assignment

a - The year the learning outcome will be assessed, with each learning outcome assessed a minimum of two times.

b - Program components should include those core courses, elective courses, options (co-op, internship, mention Français, international experience), and other program requirements (language requirement, international experience) which contribute most directly to the achievement of the particular learning outcome.

c - Level of delivery of each program component related to the particular learning outcome: I = introductory; R = Reinforcement; M = Mastery (relevant to the expected outcome at the degree level).

d - Activities can include presentations, group work, performance, role play, etc. Artifacts can include exams, papers, reports, portfolios, cases, etc.

B.4 Program learning outcomes assessment plan

The Interdisciplinary Academic Team (IAT) will be responsible for defining the assessment methodology and will conduct the program-level learning outcome assessment. This team will

delegate the collection of the learning outcome data to the three departments teaching the different courses; the team will analyze the data and provide the results to the three departments. Each department's academic planning committee will determine if there is need for course change and forward their recommendations to the faculty academic planning committee (F-APC). The F-APC, after approval of course/program/calendar change, will forward its decision to the Engineering Faculty Board (EFB) for approval.

In general, learning outcomes will be assessed using several sources (from departments) of data. Each source of data will provide an indicator of the level of achievement for each learning outcome, using a four-point rubric (similar to CEAB graduate attributes assessment). Assessments may include:

- Assessment of student deliverables, such as course assignments, course exams, course project reports, and capstone projects.
- Student self-evaluation via surveys
- Course instructor evaluations based on course work and
- Focus groups such as department program-level committee with students and/or faculty members.

The IAT will provide a written report every three years to the relevant Department Chairs regarding the program learning outcomes analysis. The Director of IAT and the Department Chairs will provide direction and oversight to program changes and can use the outcomes of the program learning assessments for continual program improvement. As the program length of the BEng degree will be four years (five for cooperative education students), the first assessment, which is scheduled to be conducted in the third year of the new program, will only have partial data. However, the assessment
will still be conducted to provide early indicators for program improvements.

B.5 Program essential requirements

"Program essential requirements are defined by the Ontario Human Rights Commission as "the knowledge and skills that must be acquired or demonstrated in order for a student to successfully meet the learning objectives of that… program." The program essential requirements are components that contribute to the achievement of the learning outcomes of the program.

"An appropriate accommodation at the post-secondary level would enable a student to successfully meet the essential requirements of the program, with no alteration in bona fide standards or outcomes, although the way the student demonstrates mastery, knowledge and skills may be altered."

-Ontario Human Rights Commission's Policy on Accessible Education for Students with Disabilities (2018)

The aim of accommodation in a post-secondary context is to provide equal opportunities to all students to enjoy the same level of benefits and privileges and meet the requirements for acquiring an education. Based on these principles, an accommodation

will be considered appropriate where it will result in equal opportunity for an otherwise qualified student with a disability to attain the same level of performance or enjoy the same level of benefits and privileges experienced by others, without compromising bona fide academic requirements.

Paul Menton Centre For Students with Disabilities (PMC)

The Paul Menton Centre is responsible for assessing requests for academic accommodation of students with disabilities through evaluations that are carried out on an individual basis, in accordance with human rights legislation and University policy, and with the support of relevant, professional/medical documentation. Students will only receive academic accommodation if the functional limitations of their disability impact directly on their academic performance."

The program essential requirements of the Mechatronics program have been reviewed in consultation with the Paul Menton Centre to ensure capacity for reasonable academic accommodation of students with disabilities, in accordance with the Carleton University Academic Accommodation Policy. The learning outcomes can be attained as outlined in the program description with the use of appropriate academic accommodations.

C. Governance

The Dean of Faculty of Engineering and Design will appoint a Director of the new Mechatronics Engineering program from the academic ranks of the Departments of Mechanical and Aerospace Engineering; Electronics Engineering; and Systems and Computer Engineering. The Chairs of the Departments of Mechanical and Aerospace Engineering; Electronics Engineering; and Systems and Computer Engineering will each appoint two faculty members each from their Departments. These seven academics will constitute the Program Committee for Mechatronics Enigneering and will form the core of decision-making body for the program on academic matters.

This Program Committee will meet a minimum of twice a year to assess the student's progress, provide course-based feedback to the relevant departments who teach the courses, and suggest direction as the improvement and continue assessment at the program level. The Program Committee will also be responsible for Cyclical Program Review and the accreditation processes with the Director being the point of contact.

Based on the advice and recommendations from the Program Committee, each department will take the lead role in terms of course and calendar changes that is delivered by their units. The faculty level, standard processes will apply with Academic Planning Committee considering the propose changes to the Engineering Faculty Board (EFB) for approval.

D. The Faculty

D.1. Faculty appointed to the unit or program.

The undergraduate program in Mechatronics Engineering is an integration of the fields of mechanical, electrical, and software engineering and will be offered as a collaboration between three of the Faculty's engineering departments. Many full-time faculty members from these three departments have teaching and research expertise in core aspects of mechatronic systems, therefore a significant proportion of the faculty body would be involved on some level in a Bachelor of Engineering in Mechatronics Engineering.

While essential expertise for Mechatronics is already well-represented in our faculty members, as part of the program deployment, new faculty positions will be allocated so as to further increase complementarity across the departments involved, ensuring full coverage of topics and robustness against leaves, etc. For example, in the Department of Systems and Computer Engineering, new hires could include colleagues in the field of applied artificial intelligence and machine learning for mechatronic systems with applications in currently less covered domains like automotives and aerospace. Similarly, for the Department of Electronics, new positions could include expertise in sensors, actuators and machines, controls, power electronics and management, and digital and embedded systems, appropriate to complement the expertise of current faculty members.

The departments have a good balance of senior and junior faculty. Recruitment of new faculty to support the program will continue to balance this distribution. Core faculty in the departments currently include various ranks from tenured faculty members to instructors, with no anticipated retirements in the foreseeable future. Senior faculty have research programs including post-doctoral fellows and collaborate with adjunct faculty which will help influence the evolution of the curriculum. Recruiting activities in our departments also focus on improving our EDI ratios, encouraging gender balance and diversity in our faculty members. This is a long-term endeavour that we continue to make progress on.

The teaching workload in the departments is balanced between the graduate programs and undergraduate programs such that, except for an otherwise approved reduced teaching load, each faculty member generally teaches one graduate course, and the rest of the default overall course load is dedicated to undergraduate education, including the supervision of undergraduate 4^{th} year level capstone engineering projects (similar to honours projects in other disciplines). This will continue with the introduction of the mechatronics program and will not impact the delivery of existing undergraduate/graduate programs, provided new faculty positions are created and filled.

Table D.1: Core program faculty (to be completed by the unit)

Faculty Name (Department)	**Rank**	**Appointment Status**	**Percentage Appointment**	**Supervision Privileges***	**Area of Specialization/Field Affiliations**
Mojtaba Ahmadi (MAAE)	Full Professor	Tenured	100	D	Robotics and controls
Richard Dansereau (SYSC)	Full Professor	Tenured	100	D	Signal processing (audio, video), multimodal signal processing
Alex Ellery (MAAE)	Full Professor	Tenured	100	D	Space robotics
Jim Green (SYSC)	Full Professor	Tenured	100	D	Artificial intelligence and machine learning, machine intelligence
Robert Langlois (MAAE)	Full Professor	Tenured	100	D	Dynamics
Jie (Peter) Liu (MAAE)	Full Professor	Tenured	100	D	Machinery condition monitoring
Ronald Miller (MAAE)	Full Professor	Tenured	100	D	Nanomechanics and materials
Seeraman Rajan (SYSC)	Full Professor	Tenured	100	D	Sensor systems, signal processing, adaptive signal processing, compressive sensing
Jurek Sasiadek (MAAE)	Full Professor	Tenured	100	D	Robotics and controls
Howard Schwartz (SYSC)	Full Professor	Tenured	100	D	Adaptive control, Cooperation, adaptive and learning systems
Niall Tait (ELEC)	Full Professor	Tenured	100	D	MEMS, sensors
Xin Wang (MAAE)	Full Professor	Tenured	100	D	Solid mechanics, fracture and fatigue
Mohamed Atia (SYSC)	Associate Professor	Tenured	100	D	Embedded systems, sensor fusion, autonomy
Mohammad Biglarbegian (MAAE)	Associate Professor	Tenured	100	D	Robotics and controls
Hicham Chaoui (ELEC)	Associate Professor	Tenured	100	D	Control, robotics, energy systems
Robin Chhabra (MAAE)	Associate Professor	Tenured	100	D	Space robotics
Rishad Irani (MAAE)	Associate Professor	Tenured	100	D	Mechatronics
Fidel Khouli (MAAE)	Associate Professor	Tenured	100	D	Dynamics, aeroelasticity, UAVs
Shichao Liu (ELEC)	Associate Professor	Tenured	100	D	Cyber-physical systems, nonlinear system control
Carlos Rossa (SYSC)	Associate Professor	Tenured	100	D	Haptic, human-robot interaction, medical robotics
Hima Dhulipati (ELEC)	Assistant Professor	Preliminary	100	CD	Electric machines, EV's, energy management
Irina Garces (MAAE)	Assistant Professor	Preliminary	100	CD	Soft robotics
Hashim Mohamed (MAAE)	Assistant Professor	Preliminary	100	CD	Autonomous systems
Nafiseh Kahani (SYSC)	Assistant Professor	Preliminary	100	D	Software verification, software testing, software security

Fateme Rajabiyarzdi (SYSC)	Assistant Professor	Preliminary	100	D	Human-machine interactions
Chao Shen (SYSC)	Assistant Professor	Preliminary	100	D	Vision-based control, autonomous systems, perception
Karen Taylor (MAAE)	Instructor III	Confirmed	100		Diverse undergraduate mechanical engineering
Edward Cyr (MAAE)	Instructor II	Preliminary	100		Diverse undergraduate mechanical engineering
Mehdi Eshaghi (MAAE)	Instructor II	Preliminary	100		Diverse undergraduate mechanical engineering
Michael Feuerherm (ELEC)	Instructor II	Preliminary**	100	CM	Aerospace electronics, communication circuits
Derek Gransden (MAAE)	Instructor II	Confirmed	100		Diverse undergraduate mechanical engineering
Pakeeza Hafeez (MAAE)	Instructor II	Preliminary	100		Diverse undergraduate mechanical engineering
Tashfeen Karamat (ELEC)	Instructor II	Preliminary**	100	-	Navigation systems
Rose Gomar (SYSC)	Instructor	Preliminary	100	N/A	Embedded systems
Lynn Marshall (SYSC)	Instructor	Preliminary	100	N/A	Software engineering

*D=full privileges; M=full privileges at master's level only; CD=co-supervision privileges at doctoral level, full privileges at master's level; CDM=co-supervision privileges only at both doctoral and master's level; CM=co-supervision privileges at master's level, no privileges at doctoral level
** Applied for confirmation fall 2023, should be official any time

D.2. Faculty research funding.

With the obvious exception of Instructors, all faculty members are highly active in research that is either directly related to Mechatronics or to engineering topics that support it. The evidence of this is clear from existing programs, and the Mechatronics program is expected to run in precisely the same way. This ensures up-to-date lecture content and experiential/research opportunities for Mechatronics students. The faculty members directly involved in the program have an established research program, with strong, sustained funding, in domains of applications that directly relate to the core disciplines of mechatronic engineering.

Colleagues take every opportunity to instill knowledge acquired through research into undergraduate education. This can take several forms, including direct examples of research problems as exercises in class or laboratory sessions (some of the courses taught by the colleagues are electives at the 4^{th}-year level), supervision of 4^{th} year level capstone projects which involve the analysis and design of mechatronic systems. Such a support of undergraduate student learning through research expertise/experience, is evidenced by the many undergraduate students whom colleagues have supervised over the years (see section D.3).

Table D.2: Operating Research Funding by Source and Year (to be provided by OVPAVPA or FGPA)

	Source						
Year	Tri-Council	Internal	Canadian	US	International	Other	Totals
2019	$1,275,462	$45,000	$497,110	-	-	$60,000	$1,877,572
2020	$1,721,675	$85,000	$1,140,375	$96,136	-	-	$3,043,186
2021	$1,602,018	$162,285	$602,001	-	$98,744	$226,501	$2,691,549
2022	$522,500	$245,000	$1,930,845	-	-	$84,000	$2,782,345
2023	$1,181,638	$260,000	$1,704,840	-	$77,600	$226,921	$3,450,999
2024	$809,973	$105,000	$318,250	$78,533	-	$63,026	$1,374,782
TOTALS	$7,113,266	$902,285	$6,193,421		$176,344	$660,448	$15,220,433

D.3. Distribution of thesis supervision.

At the undergraduate level, supervisory activities typically take place in fourth year with a two-semester long, 1.0 credit capstone project course. The departments strive to offer team-based, multi-disciplinary projects, making a capstone project akin to a team-based honours thesis/project.

Project topics are often proposed by faculty members, although occasionally they are proposed by student groups themselves. The capstone project coordinator also helps to assign students to suitable projects. When project topics are proposed by faculty members, students typically "shop" around for a topic of interest to them. For this reason, a faculty member may not supervise a capstone project each year, however, core faculty members are typically involved in capstone project supervision every year.

Given that this is an undergraduate program, and that students in Mechatronics Engineering will be able to complete their capstone projects with supervisors from three different departments, capacity for capstone supervision is not expected to be an issue.

Core faculty members in the three departments that will be associated with the Mechatronics program have already supervised capstone projects relevant to Mechatronics. For example, electric vehicles, autonomous vehicles, drones, robotics, and sensor systems. These examples serve to illustrate that the departments are already active in training students in mechatronics. It is also worth noting that, although these are all examples of mechatronic systems, not all were supervised by a faculty member who has been identified as core to the Mechatronics program. This illustrates the fact that a wide range of faculty members can be involved in mechatronics.

At the graduate level, students typically find a faculty supervisor prior to admission through website information and direct inquiries. Or, in certain cases, the Associate Chair, Graduate Studies, can help connect students with thesis supervisors. As far as graduate research supervision is concerned, it is expected that the listed faculty will continue at their current pace, since the new program in Mechatronics Engineering will not increase their teaching load (it may only change which courses they teach).

Table D.3: Distribution of thesis supervision (to be completed by the unit)

Faculty Name (Department)	**Rank**	**Completed (past 5 academic year total)**				**Current (current academic year)**			
		Undergraduate	**Master's**	**PhD**	**PDF**	**Undergraduate**	**Master's**	**PhD**	**PDF**
Mojtaba Ahmadi (MAAE)	Full Professor	(3)	(4)	(2)	(2)	(1)	(2)	(5)	(1)
Richard Dansereau (SYSC)	Full Professor	(54)	(0)	(4)	(0)	(12)	(2)	(1)	(0)
Alex Ellery (MAAE)	Full Professor	(0)	(7)	(0)	(0)	(0)	(3)	(3)	(0)
Jim Green (SYSC)	Full Professor	(62)	(17)	(4)	(4)	(15)	(2)	(4)	(0)
Robert Langlois (MAAE)	Full Professor	(4)	(8)	(0)	(0)	(2)	(6)	(3)	(0)
Ronald Miller (MAAE)	Full Professor	(1)	(4)	(3)	(5)	(0)	(0)	(5)	(1)
Jie (Peter) Liu (MAAE)	Full Professor	(18)	(5)	(1)	(2)	(0)	(2)	(1)	(0)
Seeraman Rajan (SYSC)	Full Professor	(40)	(8)	(4)	(4)	(3)	(4)	(7)	(2)
Jurek Sasiadek (MAAE)	Full Professor	(3)	(11)	(10)	(5)	(0)	(3)	(5)	(0)
Howard Schwartz (SYSC)	Full Professor	(17)	(4)	(2)	(0)	(0)	(0)	(4)	(0)
Niall Tait (ELEC)	Full Professor	(25)	(1)	(1)	(0)	(5)	(0)	(1)	(0)
Xin Wang (MAAE)	Full Professor	(1)	(3)	(2)	(1)	(0)	(3)	(2)	(0)
Mohamed Atia (SYSC)	Associate Professor	(24)	(6)	(3)	(0)	(0) (sabbatical)	(2)	(3)	(0)
Mohammad Biglarbegian (MAAE)	Associate Professor	(11)	(5)	(2)	(0)	(7)	(1)	(0)	(1)
Hicham Chaoui (ELEC)	Associate Professor	(15)	(4)	(2)	(2)	(0)	(8)	(12)	(2)
Robin Chhabra (MAAE)	Associate Professor	(5)	(5)	(0)	(0)	(3)	(3)	(5)	(0)
Rishad Irani (MAAE)	Associate Professor	(11)	(7)	(2)	(1)	(3)	(4)	(2)	(0)

Fidel Khouli (MAAE)	Associate Professor	(3)	(9)	(0)	(1)	(0)	(5)	(2)	(0)
Shichao Liu (ELEC)	Associate Professor	(20)	(3)	(0)	(0)	(0)	(3)	(3)	(0)
Carlos Rossa (SYSC)	Associate Professor	(25)	(1)	(0)	(0)	(12)	(1)	(2)	(1)
Hima Dhulipati (ELEC)	Assistant Professor	(10)	(1)	(0)	(0)	(5)	(2)	(0)	(0)
Irina Garces (MAAE)	Assistant Professor	(3)	(0)	(0)	(0)	(2)	(5)	(0)	(1)
Hashim Mohamed (MAAE)	Assistant Professor	(7)	(2)	(0)	(0)	(0)	(2)	(2)	(0)
Nafiseh Kahani (SYSC)	Assistant Professor	(8)	(0)	(0)	(0)	(13)	(4)	(2)	(0)
Fateme Rajabiyarzdi (SYSC)	Assistant Professor	(19)	(1)	(0)	(0)	(10)	(0)	(3)	(0)
Chao Shen (SYSC)	Assistant Professor	(25)	(0)	(0)	(0)	(13)	(2)	(0)	(0)
Karen Taylor (MAAE)	Instructor III	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Edward Cyr (MAAE)	Instructor II	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Mehdi Eshaghi (MAAE)	Instructor II	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Michael Feuerherm (ELEC)	Instructor II	(25)	(0)	(0)	(0)	(0)	(1)	(0)	(0)
Derek Gransden (MAAE)	Instructor II	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Pakeeza Hafeez (MAAE)	Instructor II	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Tashfeen Karamat (ELEC)	Instructor II	(25)	(0)	(0)	(0)	(5)	(0)	(0)	(0)
Rose Gomar (SYSC)	Instructor	(0)	N/A	N/A	N/A	(10)	N/A	N/A	N/A
Lynn Marshall (SYSC)	Instructor	(41)	N/A	N/A	N/A	(51)	N/A	N/A	N/A

D.4. Current teaching assignments

While the distribution of teaching assignments can vary somewhat between our departments, the allocation of teaching workloads usually follows a few general guidelines:

- Unless a reduced workload has been approved, the default teaching assignment for faculty members typically involves two undergraduate courses, one graduate course in their area of expertise, and the supervision of capstone projects.
- The distribution of teaching assignments aims to help faculty members gain experience teaching students from first year through graduate school.
- The assignment of the two undergraduate courses will often be split with one at the introductory/lower-year level and one at the senior/upper-year level.
- Additional teaching assignments will typically be given to faculty members who are not engaged in research.
- At the request of the faculty member or as needed, the assignment of a graduate course may be replaced with a third undergraduate course.

Although most courses in engineering are not optional, a few elective courses are assigned to faculty members to teach as required to ensure a good balance of program-specific topics in our course offerings. It is anticipated that the Mechatronics Engineering program will only add a few new courses to that list.

Several of the courses in the new Mechatronics Engineering program will be the same as those already being offered. Since Mechatronics Engineering is a combination of fields from multiple departments, the list of foundational topics and areas of specialization is wide, ranging from things like programming and digital systems to materials and sensors, and from circuit designs and controls to mechanics and robotics.

The hiring of new faculty members for the Mechatronic Engineering program will facilitate the distribution of teaching assignment, including such things as allowing additional sections of currently offered courses to be created as enrollment increases, and the creation of new elective courses to meet the needs of the new program.

Table D.4: Distribution of Teaching Assignments (to be completed by OVPAVPA or FGPA and confirmed by the unit)

Faculty Name (Department)	Courses Taught			Notes
	2023-24	2022-23	2021-22	
Mojtaba Ahmadi (MAAE)	MAAE 4907 MECH 4806	MAAE 2101 MECH 4806 MAAE 4907	MAAE 2101 MECH 4806 MAAE 4907	
Richard Dansereau (SYSC)	SYSC 4405	SYSC 4405 SYSC 5602	Sabbatical leave	Reduced load due to Associate Dean role
Alex Ellery (MAAE)	AERO 4842 MAAE 4907 MECH 4007 MECH 5108	AERO 4842 MAAE 4907 MECH 4007 MECH 5800	AERO 4842 MAAE 4907 MECH 4007 MECH 5800	
Jim Green (SYSC)	SYSC 3010 SYSC 4415 BIOM 5405	SYSC 3010 SYSC 4415 BIOM 5405	SYSC 3010 SYSC 4906 BIOM 5405	
Robert Langlois (MAAE)	MECH 4006 MECH 5501	MECH 4006 MECH 5501	MECH 4006 MECH 5501	Reduced load due to Associate Dean role
Ronald Miller (MAAE)	MAAE 2300	MAAE 2100	MAAE 2100	Department Chair
Jie (Peter) Liu (MAAE)	Sabbatical leave	MAAE 2202 MAAE 4907 MECH 5302	MAAE 2202 MAAE 4907	
Seeraman Rajan (SYSC)	SYSC 3500 SYSC 5602	Sabbatical leave	SYSC 5602 BIOM 5800 BIOM 6800	Reduced load due to institute directorship or CRC chair recipient; BIOM 5800/6800 are part of the directorship administrative duty
Jurek Sasiadek (MAAE)	MAAE 4907 MECH 4503 MECH 5503	MAAE 2101 MAAE 4907 MECH 4503 MECH 5503	MAAE 2101 MAAE 4907 MECH 4503 MECH 5503	
Howard Schwartz (SYSC)	SYSC 3600 SYSC 4505 SYSC 5401 SYSC 3999	SYSC 3600 SYSC 4505 SYSC 5401 SYSC 3999	Sabbatical leave	SYSC 3999 is part of administrative duty
Niall Tait (ELEC)	ECOR 1055 ELEC 4709	ECOR 1055 ELEC 4709	ECOR 1055 ELEC 4709	Department Chair

Xin Wang (MAAE)	MAAE 4907 MECH 4003 MECH 4103 MECH 5808	MAAE 3202 MAAE 4907 MECH4003 MECH 5808	MAAE 4907 MECH 3002 MECH 4003	
Mohamed Atia (SYSC)	Sabbatical leave	Leave	SYSC 3310 SYSC 3320 SYSC 5807	
Mohammad Biglarbegian (MAAE)	MAAE 3500 MAAE 4907 MECH 5805			New hire 2023
Hicham Chaoui (ELEC)	Sabbatical leave	Leave	ELEC 3105 ELEC 3907 ELEC 5305	
Robin Chhabra (MAAE)	MAAE 4907 MECH 5801	MAAE 4907 MECH 5801	MAAE 3500 MECH 5801	CRC appointment, reduced load
Rishad Irani (MAAE)	MAAE 3004 MAAE 4907 MECH 5508		MAAE 2101 MAAE 4907 MECH 5508	
Fidel Khouli (MAAE)	Sabbatical leave	AERO 4306 AERO 4602 MAAE 4907	AERO 4602 MAAE 3004 MAAE 4907	
Shichao Liu (ELEC)	Sabbatical leave	SREE 3002 ELEC 4602 ELEC 5200	SREE 3002 SREE 3003 ELEC 5200	
Carlos Rossa (SYSC)	SYSC 3600 SYSC 3610 SYSC 4206 ECOR 1055	SYSC 3600 SYSC 3610 SYSC 4906	SYSC 3610 SYSC 3600 SYSC 3600	ECOR 1055 is part of an administrative duty
Hima Dhulipati (ELEC)	EGEN 5305 ELEC 3508 ELEC 3907	ELEC 3508 ELEC 3907		New hire 2022
Irina Garces (MAAE)	EGEN 5508			New hire 2023; maternity leave until 2025
Hashim Mohamed (MAAE)	AERO 4504	AERO 4504		New hire 2022

	MAAE 3500 MAAE 4907 MECH 5804	ECOR 4907 MAAE 3500 MECH 5804		
Nafiseh Kahani (SYSC)	SYSC 3120 SYSC 4111 SYSC 5807	SYSC 3120 SYSC 4111 SYSC 5807	SYSC 3120 SYSC 4111	Reduced load during first year teaching at Carleton
Fateme Rajabiyarzdi (SYSC)	SYSC 4201 SYSC 4906 BIOM 5403	SYSC 4201 BIOM 5403	BIOM 5403	Reduced load during first year teaching at Carleton
Chao Shen (SYSC)	SYSC 3600 SYSC 4505 SYSC 5807	SYSC 4505 SYSC 2510 SYSC 5807	SYSC 4505 SYSC 2510 (reduced load)	Reduced load during first year teaching at Carleton
Karen Taylor (MAAE)	ECOR 1055 MAAE 2001 MAAE 2101 MAAE 2300 MAAE 2400 MAAE 4917	ECOR 1048 ECOR 1055 MAAE 2202 MAAE 2300 MAAE 4907	ECOR 1048 ECOR 1055 MAAE 2202 MAAE 2300 MAAE 4907	
Edward Cyr (MAAE)	AERO 3002 ECOR 1047 ECOR 1048 MAAE 2101 MAAE 4907	AERO 3002 ECOR 1047 ECOR 1048 MAAE 2101 MAAE 4907	AERO 3002 ECOR 1047 ECOR 1048 MAAE 2101 MAAE 2300 MAAE 4907	
Mehdi Eshaghi (MAAE)	ECOR 1047 ECOR 1048 MAAE 2300 MAAE 3300 MAAE 4907 MECH 4604	ECOR 1047 ECOR 1048 MAAE 2202 MAAE 2300 MAAE 4907 MECH 4604	ECOR 1047 ECOR 1048 MAAE 2202 MAAE 2300 MAAE 4907 MECH 4604	
Michael Feuerherm (ELEC)	ECOR 1044	ECOR 1044	ECOR 1043 ECOR 1044	
Derek Gransden (MAAE)	AERO 4306	AERO 3101		New hire 2022

	ECOR 1047 ECOR 1048 MAAE 3202 MAAE 4907 MECH 4604 MECH 4705	ECOR 1047 ECOR 1048 MAAE 4907 MECH 4604 MECH 4705		
Pakeeza Hafeez (MAAE)	AERO 2001 ECOR 1047 ECOR 1048 MAAE 2001 MAAE 2700 MAAE 4907	AERO 2001 MAAE 2001 MAAE 2400 MAAE 2700 MAAE 3004 MAAE 4907		New hire 2022
Tashfeen Karamat (ELEC)	ECOR 1043 ELEC 4906	ECOR 1043 ELEC 4906	ECOR 1043 ECOR 1044 ELEC 4504	
Rose Gomar (SYSC)	SYSC 2310 SYSC 3320 SYSC 4310			New hire 2023
Lynn Marshall (SYSC)	ECOR 1041 SYSC 2004	ECOR 1041 ECOR 1042 SYSC 2004 SYSC 2006 SYSC 2310	SYSC 2004 SYSC 2006 SYSC 3310	

D.5. Contract instructors

Contract instructors can be an important resource to help manage year to year variations in available teaching resources due to sabbaticals, illnesses, teaching release, and unanticipated changes in teaching requirements. However, our reliance on contract instructors is relatively low and has been declining overall in recent years. Increasing numbers of full-time faculty through new hires have allowed us to significantly reduce our reliance on contract instructors.

Several of the courses in the new Mechatronics Engineering program are established courses that are commonly taught by full-time faculty members. A higher number of students in these courses may require the creation of additional sections which may require the temporary use of extra contract instructors until new faculty members are hired. However, like our other programs, with the addition of new faculty positions as expected, the delivery of the new Mechatronics Engineers program should not rely on contract instructors.

E. Program Admission and Enrolment

E.1. Admissions requirements

The admission requirements for all B.Eng. programs are the same. Admission requirements are based on the Ontario High School System. Prospective students can view the admission requirements through the Admissions website (https://admissions.carleton.ca/). The overall average required for admission is determined each year on a program-by-program basis. Holding the minimum admission requirements only establishes eligibility for consideration; higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available. All programs have limited enrolment and admission is not guaranteed.

For admission into first year, an Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses is required. The six 4U or M courses must include four prerequisite 4U courses: Advanced Functions, Chemistry, Physics, and Calculus and Vectors, and one of or Biology, or Earth and Space Science. Although it is not an admission requirement, at least one 4U course in either English or French is recommended.

Applications for admission beyond 1st-year (*i.e.*, Advanced Standing) will be assessed on their merits. Successful applicants will have individual academic subjects, completed with grades of C- or higher, evaluated for academic standing, provided the academic work has been completed at another university or degree-granting college, or in another degree program at Carleton University.

All engineering programs come with a co-op option. Direct admission to the first year of the co-op option requires the applicant to meet the required overall admission cut-off average and prerequisite course average. These averages may be higher than the stated minimum

requirements; be registered as a full-time student in the Engineering degree; and be eligible for work in Canada (for off-campus work placements).

For international students, Carleton University has established procedures to determine equivalency on academic proficiency, as well as a need for proof of English competency for different countries.

E.2. Class sizes and course and program capacity

The expectation is that the students who enroll in Mechatronics will all be new students and thereby cause an increase in the total number of students in the Engineering Departments by approximately 15% once the steady state is reached eight years after starting. It is the Faculty's goal to keep the class sizes in the Mechatronics courses, as well as the courses which are shared with the other programs in Systems and Computer Engineering, Mechanical and Aerospace Engineering, and the Department of Electronics materially alike at today's levels. For the existing courses, it will be left to the Departments to determine if a course needs to be broken into more sections to preserve the quality of material delivery.

With respect to first year (1000-level) courses, many of these common core courses are based around large lecture sections, supported by scheduled smaller group problem solving sessions. It is expected that the addition of more students will trigger the need for more sections as the planned admissions increases (*i.e.*, with the annual ramping up of 30 – 60 – 90 – 120 – 150 – 150 – 150 - …).

Using data from 2022/23 for just the lecture component of a course, the number of section class sizes in each of the three engineering departments are shown in Table E.1 for the various program levels (*i.e.*, 2000, 3000, and 4000). These programs have some atypically large class sizes and more section offerings will be needed in future years. The resources needed for these sections are described in detail later, but they are part of the investment plan from the University and Faculty.

Table E.1: *2022/23 section class size for lecture component in the Department of Electronics (DOE), Mechanical and Aerospace Engineering (MAE), and Systems and Computer Engineering (SCE) for second (2000-level), third (3000-level) and fourth (4000-level) year courses.*

Level	Dept.	Class Size											
		1 – 10	11 – 20	21 – 30	31 – 40	41 – 60	61 – 80	81 – 100	101 – 120	121 – 140	141 – 160	161 - 180	181 +
2000	DOE					3	0	1	1	3	2	1	
	MAE			1	1	8	17	7					
	SCE			1	1	2	0	2	3	1	3	1	2
3000	DOE		4	0	4	5	2	3	1				
	MAE	1	0	6	1	7	10	1	1	2			
	SCE	2	0	0	5	3	0	2	4	4	2	1	1
4000	DOE	1	2	5	5	3	0	0	2	1			
	MAE	6	4	4	12	15	0	1	1				
	SCE	6	3	6	3	7	3	6	4	0	1	1	1

E.3. Projected enrolment

The proposed enrolment numbers are shown in Table E.2 and are taken directly from the revenue plan submitted to the Provost's Budget Working Group (PBWG), which is the body

responsible for addressing any institutional investments. The basic parameters of the model used to create the numbers in Table E.2 are:

- Undergraduate Retention - Undergraduate Engineering
  - One-Year retention: 90%
  - Two-Year retention: 82%
  - Three-year retention: 80%
- Fraction of Domestic and International Students
  - Domestic: ~84%
  - International: ~16%
- Admission Targets into First Year
  - Year 1: 30
  - Year 2: 60
  - Year 3: 90
  - Year 4: 120
  - Year 5 and beyond: 150

Table E.2: *Enrolment Projections.*

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
First year								
Domestic	25.0	50.0	76.0	101.0	126.0	126.0	126.0	126.0
International	5.0	10.0	14.0	19.0	24.0	24.0	24.0	24.0
subtotal	30.0	60.0	90.0	120.0	150.0	150.0	150.0	150.0
Second year								
Domestic		22.5	45.0	68.4	90.9	113.4	113.4	113.4
International		4.5	9.0	12.6	17.1	21.6	21.6	21.6
subtotal		27.0	54.0	81.0	108.0	135.0	135.0	135.0
Third year								
Domestic			20.4	40.8	61.9	82.3	102.7	102.7
International			4.1	8.2	11.4	15.5	19.6	19.6
subtotal			24.5	48.9	73.4	97.8	122.3	122.3
Fourth year								
Domestic				19.9	39.8	60.5	80.4	100.3
International				4.0	8.0	11.1	15.1	19.1
subtotal				23.9	47.8	71.6	95.5	119.4
Total								
Domestic	25.0	72.5	141.4	230.1	318.6	382.2	422.5	442.4
International	5.0	14.5	27.1	43.7	60.5	72.2	80.3	84.3
Total	**30.0**	**87.0**	**168.5**	**273.8**	**379.1**	**454.4**	**502.8**	**526.7**

F. Student Experience and Satisfaction

F.1. Student orientation, advising, and mentoring

Student orientation will be delivered through the Faculty of Engineering and Design and one member from each of the three participating departments will be involved in the orientation. The students enrolled in the B.Eng. Mechatronics Engineering program will have program coordinator in each of the three departments that will oversee the courses offered by that department. These program coordinators and the program director will serve as advisers for students in the program. General program advising will be carried out by the program director, and specific academic and course related advising will be done by the program coordinators. With respect to the capstone project, students have to register for a capstone project course (**MECT 4907**..

The students in the proposed new program will find a very active preexisting community to join, and will enrich it through their diverse interests, backgrounds, and through sheer numbers. The expectation is that students will form a subgroup in parallel to the existing societies in faculty of engineering and design. The assumption is that there may be a physical space, such as a lounge and labs, where students can congregate and work.

F.2. Career paths of graduates

Career paths of graduates of the programs are anticipated to be diverse, given the interdisciplinary nature of the program and research performed in the different academic departments. A trained mechatronics engineer will have the opportunity to design, build, and operate and maintain different machinery with mechanical, electronic, and computer systems parts. Such machinery parts include aeronautics, motor vehicles (e.g. green vehicles), mining, nuclear, and chemical plant machinery. These graduates will be able to work in information technology (IT), automotive, research and development, and manufacturing industries. A career in Mechatronics is worthwhile and is always in dem and in Canada because of important development in electric vehicles and other green engineering related tools. The new degree program will also prepare students for further study in related fields - mechanical engineering, electrical engineering, and systems and computer engineering. This further study could be a Master of Applied Science in engineering leading to a PhD or a terminal Master of Engineering degree.

G. Resources

G.1. Faculty

At the highest level of analysis, the ratio of undergraduate students to fulltime continuing teaching/research engineering faculty members in Canada is typically 22 for university programs. At Carleton, when our four engineering units are combined, this ratio is 28 with the minimum and maximum between Departments being 21 and 38, respectively.

Modeling of admissions targets and applying our current attrition rates, the steady state of student enrolment in Mechatronics is projected to be 527 students. Using the nominal target for an engineering program (i.e., 22 UGs/faculty) and our current ratio (i.e., 28 UGs/faculty), the first-order estimate for new faculty members if these were all new students would be between 24 and 19. These numbers will act as targets for the Faculty of Engineering and Design to work

towards over time, just as we have established enrolment targets, this would be over a period of eight years.

It is therefore proposed that each of the participating departments (Electronics, Mechanical and Aerospace, and Systems and Computer) will initially require two extra full-time faculty members for a total of six. Three of these positions would be expected to be hired in year two of the program's existence, with the next three being hired in the programs third year. The subsequent hires will be linked to meeting enrolment targets within Mechatronics, but also the total student numbers across all the programs in the Faculty of Engineering and Design over this period as a requirement of financial sustainability.

G.2. Support and technical staff

To support this program academically one new administrative assistant will need to be hired, as well as needing an additional administrative person being added to the Academic Support Office. As seen from the proposed curriculum, Mechatronics Engineering will be intensive in new hands-on laboratories, and as a result three new technicians will need to be hired one year prior to the first students entering second year.

G.3. Space

Within the Faculty of Engineering and Design these additional students, faculty members (as well as the consequential increase in research students and research labs), and administrators will continue to add to the pressure of a new building or transfer of space from other Units.

The total added space requirements, according to the Council of Ontario University "Building Blocks" Users' Guide for Space Standards Reporting, would be of the order of 1800 NASM (net-assignable square meters) of which 41% would be for research labs, 36% for offices/services, 20% for undergraduate labs, and 4% non-library student study space. The Faculty will receive additional space (one floor in Dunton Tower) beginning in 2024-25 to support the Mechatronics program. This space will be used for faculty/grad student offices with the vacated spaces in Mackenzie used for teaching and lab space. Additional space will be made available once the Faculty returns to pre-pandemic numbers and begins to grow beyond that level.

Currently, Carleton University has no active plans for new academic buildings, and therefore the Faculty of Engineering and Design will continue its pursuit of economies within the space issue.

G.4. Library Resources

The Library report is prepared by the librarian or subject specialist responsible for the subject area(s) covered by the program, using a common template developed from guidelines established by the Ontario Council of University Libraries. The main purpose of the report is to specify whether any new resources or services are necessary in order to support the program, for example, whether the Library needs to purchase new books or subscribe to new journals or electronic resources.

The librarians and subject specialists preparing the reports rely on their own professional experience with collecting resources in the subject areas in order to make assessments about whether there are gaps in the collection that need to be filled in order to provide the

appropriate teaching and research support for new, modified, or reviewed programs. They consult various sources for information about published resources in the subject area, including the database maintained by the Library's main monographs vendor, publishers' lists and websites, handbooks and guides to the literature, the library collections of universities that offer the program, various specialized sites relevant to the subject from professional societies and organizations, as well as basic information available in tools such as Google Scholar or generally on the web. They also generally consult faculty members (e.g., the Library representative or the department chair) to discuss their assessment of the strengths and gaps. The Library makes a clear distinction between those resources which are essential to the program and those which are simply "nice to have." Generally speaking, the reports list only the essential resources, with costing obtained from the vendors or agents from which the Library would obtain the materials: each item is listed and costed individually and the total amount is recorded in the report.

The report also provides context by providing information about the following, when possible or applicable: percentage of top-ranked journals which the Library subscribes to in the subject area(s); how much funds have been spent in the past fiscal year on e-resources, journals, and printed books in support of the subjects covered by the program; how much funds have been spent in the past 8 years on printed monographs for the program; specialized collections in archives, maps, data, and government information; instruction, teaching, and practicums carried out by Library staff in the classroom or in the Library; highlights from the Library website (e.g., links for subject and course guides and to online tutorials); research partnerships between the Library and the department or program; research consultations; help desk visits; and selected detailed statistical information about the Library.

G. Development of the Self-Study

The program committee consisting of the following developed the self-study.

- Larry Kostiuk, PhD., Dean, Faculty of Engineering and Desing (FED)
- Samantha Colasante, MBA, Engineering Accreditation and Quality Officer, FED
- Samuel A. Ajila, PhD., Associate Dean, Policy and Planning, FED

This document was authored by the above committee members.

The following provided advice, input, and feedback in the process of developing the self-study:

- Niall Tait, PhD., Chair, Department of Electronics
- Ron Miller, PhD., Chair Department of Mechanical and Aerospace Engineering
- Mohammad Biglar Begian, PhD.
- Yvan Labiche, PhD., Chair, Department of System and Computer Engineering
- Carlos Rossa, PhD.

Appendix 1. Proposed calendar copy – course descriptions

Year 1 Courses [5.0 credits plus three 0.0 credit engineering foundation courses) – This is a common year for all engineering programs at Carleton University. This year consists of the following courses:

MATH 1004 [0.5]
Calculus for Engineering Students
Limits. Differentiation of the elementary functions. Rules of differentiation. Inverse trigonometric functions. Applications of differentiation: max-min problems, curve sketching, approximations. Definite and indefinite integrals, techniques of integration. Applications to areas and volumes.

MATH 1104 [0.5]
Linear Algebra for Engineering Students
Systems of linear equations. Matrix algebra. Determinants. Invertible matrix theorem. Cramer's rule. Vector space R^n; subspaces, bases. Eigenvalues, diagonalization. Linear transformations, kernel, range. Complex numbers (including De Moivre's theorem). Inner product spaces and orthogonality. Applications.

CHEM 1101 [0.5]
Chemistry for Engineering Students
Topics include stoichiometry, atomic and molecular structure, thermodynamics and chemical equilibrium, acid-base chemistry, carbon dioxide in water, alkalinity, precipitation, electrochemistry, kinetics and basic organic chemistry. Laboratory components emphasize techniques and methods of basic experimental chemistry. Includes: Experiential Learning Activity

PHYS 1004 [0.5]
Introductory Electromagnetism & Wave Motion
This calculus-based course introduces potential energy, work, electricity, magnetism, oscillations and waves. Includes: Experiential Learning Activity

ECOR 1041 [0.25]
Computation and Programming
Software development as an engineering discipline, using a modern programming language. Language syntax and semantics. Tracing and visualizing program execution. Program style and documentation. Testing and debugging tools and techniques. Binary number system to represent data in a computer.

ECOR 1042 [0.25]
Data Management
Software development using container data types (sequences, sets, maps) for data management. Modules. Data files. Incremental, iterative development of programs. Introduction to designing and implementing numerical algorithms.

ECOR 1043 [0.25]
Circuits
Electrical Quantities (Voltage, Charge, Current, Power). Conservation of charge and energy. Mathematical models of simple devices. Elementary circuit theory for passive elements. Thévenin's and superposition theorem. Signal filtering and amplification. Time and frequency domain. Circuit design and simulation.

ECOR 1044 [0.25]

Mechatronics

Mechatronics applications. Analog to digital signal conversion. Control systems and PID controllers. Input devices, including sensors. Data collection and processing. Output devices, including displays, actuators, and motors. Project design and economics. Environmental Impact of Mechatronics Engineering. System failures and failsafe design.

ECOR 1045 [0.25]

Statics

Cartesian vector representation of forces. Components of forces. Particle equilibrium and free body diagrams. Moments and cross product. Centre of gravity and centroids. Rigid body equilibrium.

ECOR 1046 [0.25]

Mechanics

2D truss analysis (method of joints/sections). Normal stress/strain and shear stress/strain. 2D frames and machines. Internal loads - normal, shear and moment at a point. Shear and moment diagrams.

ECOR 1047 [0.25]

Visual Communication

Graphs and sketches, flow charts, block diagrams. Visual presentation, projection and perspectives of objects. 3D sketching. Free hand drawing. Reading engineering drawings and schematics. Introduction to scaling, dimensioning and tolerancing. Introduction to CAD.

ECOR 1048 [0.25]

Dynamics

Kinematics and kinetics of a particle. Principle of work and energy. Conservation of energy, conservative forces, potential energy. Principles of impulse and momentum, conservation of momentum for a system of particles.

Complementary Studies Elective [0.5] – This course must meet the following requirements -

(i) has 3 hours of lecture per week (can include up to 1 hour tutorial/discussion time)
(ii) deals with the “thought processes and methodologies of the arts and social sciences.”
(iii) includes an evaluation of written material, such as an essay or research paper (not part of an exam)
(iv) includes a proctored final exam scheduled within the examination period.
(v) is not a “language learning” course.

Basic Science Elective [0.5] – A 0.5 credit course in science (1000 or 2000 levels). A list of eligible courses from Faculty of Science is maintained by the FED office and updated periodically. https://carleton.ca/engineering-design/wp-content/uploads/FW_BSE_June5.pdf (Access August 19, 2023).

ECOR 1055 [0.0]

Introduction to Engineering Disciplines I

Overview of professional activities oriented to the student's discipline of study: Architectural Conservation and Sustainability. Civil and Environmental. Aerospace and Mechanical. Electrical.

Engineering Physics. Computer Systems, Communications and Software. Biomedical (Electrical and Mechanical). Sustainable and Renewable Energy. Graded SAT/UNS.

ECOR 1056 [0.0]
Introduction to Engineering Disciplines II
Selected lectures designed to provide students with exposure to the breadth of Engineering disciplines. Graded SAT/UNS.

ECOR 1057 [0.0]
Engineering Profession
Professional Engineers Act. Engineering documentation. History of the profession. Engineering practice: system life cycle, practice within the discipline, designing with others. Health and safety. Engineering Ethics, Equity and Diversity. Introduction to engineering law: Business, Entrepreneurship and Intellectual Property. Graded SAT/UNS.

Year 2 Courses [6.0 credits] – It consists of the following courses:

MATH 1005 [0.5]
Differential Equations & Infinite Series for Eng. Students
First-order differential equations. Second-order linear equations with constant coefficients, undetermined coefficients, variation of parameters. Sequences and series, convergence tests, estimation of sums. Power series, Taylor series, remainders. Fourier series.

MATH2004 [0.5]
Multivariable Calculus for Engineering Students
Curves and surfaces. Polar, cylindrical, and spherical coordinates. Partial derivatives, gradients, extrema and Lagrange multipliers. Exact differentials. Multiple integrals over rectangular and general regions. Integrals over surfaces. Line integrals. Vector differential operators. Green's Theorem, Stokes' theorem, Divergence Theorem. Applications.

CCDP 2100 [0.5]
Communication Skills for Engineering Students
Development of competence in professional written and oral communication in engineering. Focus on written documents (proposals, technical explanations, research reports, summaries) and oral presentations. Attendance is mandatory.
Includes: Experiential Learning Activity

ELEC 2501 [0.5]
Circuits and Signals
Properties of signals. Basic circuit elements: voltage and current sources. Kirchhoff's laws, linearity, superposition. Thevenin and Norton's theorems. Circuit simplification. AC steady-state analysis: impedance, admittance, phasors, frequency response. Transient response of RL and RC circuits: form of response, initial and final conditions. RLC circuits: resonance. Includes: Experiential Learning Activity

ELEC 2507 [0.5]
Electronics I
Qualitative semiconductor physics, leading to the diode equation. Diode applications. Operational amplifiers and their application in feedback configurations including active filters. Introduction to bipolar

transistors and MOSFETs, analysis of biasing circuits. Transistor applications including small signal amplifiers. Includes: Experiential Learning Activity

ELEC 2602 [0.5]
Electric Machine and Power
Modeling and analysis of basic electric power systems. Single-phase and three-phase circuits: real and reactive power, per-phase analysis, power factor correction. Electro-mechanical energy conversion: operation, characteristics and analysis of transformers, DC-, induction-, and synchronous electric machines. Motor and generator operation. Includes: Experiential Learning Activity

MAAE 2001 [0.5]
Engineering Graphical Design
Engineering drawing techniques; fits and tolerances; working drawings; fasteners. Elementary descriptive geometry; true length, true view, and intersection of geometric entities; developments. Assignments will make extensive use of Computer-Aided Design (CAD) and will include the production of detail and assembly drawings from actual physical models. Includes: Experiential Learning Activity

MAAE 2300 [0.5]
Fluid Mechanics I
Fluid properties. Units. Kinematics, dynamics of fluid motion: concepts of streamline, control volume, steady and one-dimensional flows; continuity, Euler, Bernoulli, steady flow energy, momentum, moment of momentum equations; applications. Fluid statics; pressure distribution in fluid at rest; hydrostatic forces on plane and curved surfaces; buoyancy. Includes: Experiential Learning Activity

MAAE 2401 [0.5]
Mechantronics Thermodynamics and Heat Transfer
Basics of thermodynamic and heat transfers, Fundamental concepts, Pure simple substances, Energy, Energy Conversion, Work, Energy Analysis, First Law of Thermodynamics, Energy Analysis of Closed Systems, Mass and Energy Analysis of Control Volume, Second Law of Thermodynamics, Entropy Heat transfer, one-dimensional conduction/lumped parameter analysis, Convection, Design of Heat Exchangers, Heat Sinks. Includes: Experiential Learning Activity

SYSC 2006 [0.5]
Foundation of Imperative Programming
The imperative programming paradigm: assignment and state, types and variables, static and dynamic typing. Memory management and object lifetimes: static allocation, automatic allocation in activation frames, dynamic allocation. Function argument passing. Recursion. Data structures: dynamic arrays, linked lists. Encapsulation and information hiding. Includes: Experiential Learning Activity

SYSC 2310 [0.5]
Digital Systems
Number systems: binary, decimal, hexadecimal. Digital representation of information. Computer arithmetic: integer, floating point, fixed point. Boolean logic, realization as basic digital circuits. Applications: simple memory circuits, synchronous sequential circuits for computer systems. Finite state machines, state graphs, counters, adders. Asynchronous sequential circuits. Races. Includes: Experiential Learning Activity

SYSC 2320 [0.5]

Intro to Comp Organization & Architecture
Computer organization: processor, memory, input/output, system bus. Microarchitecture. Instruction set architecture. Assembly language programming: addressing modes, instruction encoding, execution. Assembler. Simple digital I/O, programmable timer. Input/output methods: polling, hardware interrupts. Includes: Experiential Learning Activity

Year 3 Courses [5.5 credits plus one 0.0 credit in engineering portfolio] – It consists of the following courses:

ECOR 2050 [0.5]
Design and Analysis of Engineering Experiments
Statistics and the design of engineering experiments. Basic exploratory data analysis. Central limit theorem. Hypothesis testing: t-test, chi-square test, type-I and type-II errors, multiple-comparison problem. Statistical bias. Design of experiments: randomization, blocking and replication, randomized blocking designs, factorial design. Statistical software packages. Includes: Experiential Learning Activity

ECOR 2995 [0.0]
Engineering Portfolio
Students will be asked to reflect on their skills, strengths, and weaknesses as preparation for the professional practice course. Engineering students must submit samples of their writing and communications (including, for example, laboratory reports and professional memos).

ECOR 3800 [0.5]
Engineering Economics
Introduction to engineering economics; cash flow calculations; methods of comparison of alternatives; structural analysis; replacement analysis; public projects; depreciation and income tax; effects of inflation; sensitivity analysis; break-even analysis; decision making under risk and uncertainty.

ELEC 3508 [0.5]
Power Electronics
Power semiconductor devices: Thyristor, GTO, IGBT, SiC, GaN. Converter circuits: controlled AC to DC rectifiers, choppers, DC to AC inverters, AC voltage controllers. Protection of conversion circuits. Applications to high-efficiency control of electric machines and electromechanical energy conversion devices. Includes: Experiential Learning Activity

ELEC 4709 [0.5]
Integrated Sensors
Overview of sensor technologies with emphasis on devices suitable for integration with silicon integrated circuits. Sensor design and fabrication principles including signal conditioning; discussion of automotive, biomedical, and other instrumentation applications. Includes: Experiential Learning Activity

MAAE 2001 [0.5]
Engineering Graphical Design
Engineering drawing techniques; fits and tolerances; working drawings; fasteners. Elementary descriptive geometry; true length, true view, and intersection of geometric entities; developments. Assignments will make extensive use of Computer-Aided Design (CAD) and will include the production of detail and assembly drawings from actual physical models. Includes: Experiential Learning Activity

MECH 3002 [0.5]

Machine Design

The design of mechanical machine elements is studied from theoretical and practical points of view. Topics covered include design factors, fatigue, and discrete machine elements. Problem analysis emphasizes the application to practical mechanical engineering problems. Includes: Experiential Learning Activity

MAAE 3004 [0.5]

Dynamics of Machine

Kinematic and dynamic analysis of mechanisms and machines. Mechanism force analysis. Static and dynamic balancing. Kinematic and dynamic analysis of cams. Free and forced vibration of single-degree-of-freedom systems. Introduction to multibody dynamics. Includes: Experiential Learning Activity

MAAE 2203 [0.5]

Solids Mechanics for Machines

Covers the essentials of solids for machine design, with less emphasis on beams to make room for failure theories and stress concentrations. Includes: Experiential Learning Activity

SYSC 3310 [0.5]

Real Time Systems

Principles of event-driven systems. Microcontroller organization. Development of embedded applications. Programming external interfaces, programmable timer. Input/output methods: polling, interrupts. Real-time issues: concurrency, mutual exclusion, buffering. Introduction to concurrent processes. Includes: Experiential Learning Activity

SYSC 3600 [0.5]

Systems and Simulation

Properties of linear systems. Linear dynamic models of engineering systems. Applications of the Laplace transform. Transfer functions. Block diagrams. Frequency and time response. System simulation with digital computers. Includes: Experiential Learning Activity

SYSC 4505 [0.5]

Automatic Control Systems

Review of Laplace transform techniques. Effects of feedback: frequency response, pole-zero positions. Compensation: root locus, Bode plots. State variables: formulation, solution of linear systems, examples of simple second-order non-linear systems. Discrete time systems: z-transforms. Signal reconstruction. Includes: Experiential Learning Activity

Year 4 Courses [5.0 credits]

Complementary Studies Elective Course [0.5]

Engineering Elective Course [0.5] - 0.5 credit at 4000- or 3000-level in Mechanical (MECH) or Systems and Computer (SYSC) or Electronics (ELEC) or ECOR 2606

ECOR 4995 [0.5]

Professional Practice

Presentations by faculty and external lecturers on the Professional Engineers Act, professional ethics and responsibilities, practice within the discipline and its relationship with other disciplines and to society,

health and safety, environmental stewardship, principles and practice of sustainable development. Communication skills are emphasized.

MAAE 3505 [0.5]
Mechatronics I
This course is an introduction to Mechatronics System. The elements of the course contain lectures, labs, assignments, and a project. The project of the course is run throughout the whole semester and that's to ensure students are capable of developing a mechatronics system and program microcontrollers. Includes: Experiential Learning Activity

MAAE 4706 [0.5]
Mechatronics II
This course involves advanced topics in mechatronics, and students are expected to use those concepts in their project. Project is the main element of the course and developing a fully integrated mechatronic system is its requirement. The project of the course is run throughout the whole semester. Includes: Experiential Learning Activity

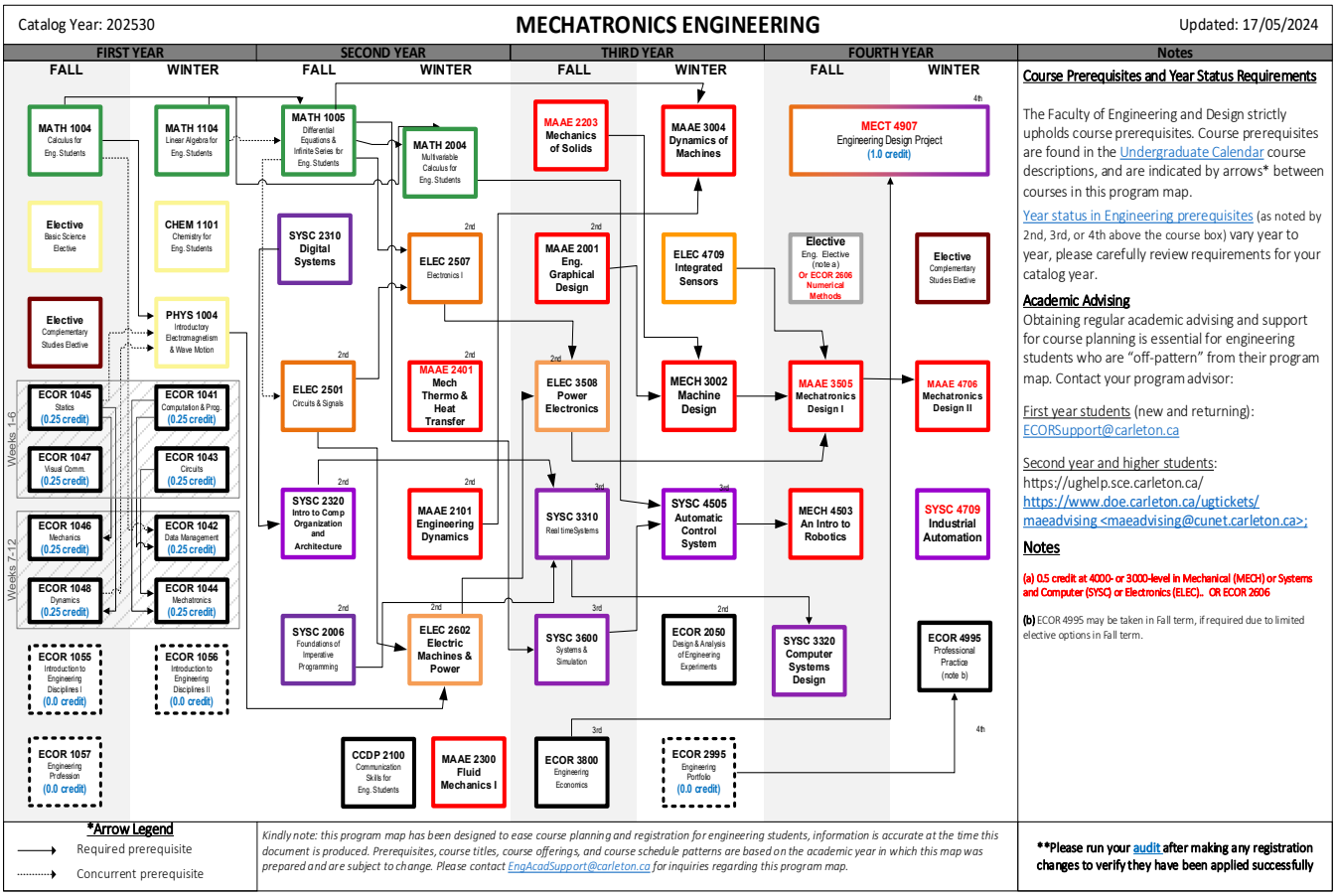
MECH 4503 [0.5]
An Introduction to Robotics
History of robotics and typical applications. Robotic actuators and sensors. Kinematics of manipulators, inverse kinematics, differential relationships, and the Jacobian. Manipulator dynamics. Trajectory generation and path planning. Robot control and performance evaluation. Force control and compliance. Applications in manufacturing and other industries.

SYSC 4709 [0.5]
Industrial Automation
Introduction to automation and digitalization, Ladder logic, PLC, Sensors and actuators (Monitor/measurement), Ladder Diagrams, Pneumatics, Fluid Power, Pumps and Actuators, Open and closed systems, accumulators, regeneration, counterbalancing, pilot-operated systems, Coolers and heat exchangers, reservoirs, and sequencing, Hydraulic diagrams and design, control, and implementation or full systems. Includes: Experiential Learning Activity

SYSC 3320 [0.5]
Computer Systems Design
System on Chip (SoC)-based computer system design. SoC internal organization. Cache memory. Interfacing: external memory, hardware subsystems. Direct memory access. Floating point units. Introduction to field programmable gate arrays. Includes: Experiential Learning Activity

New Course MECT 4907 [1.0]
Engineering Design Project
During the final year cap stone project - Student teams develop professional-level experience by applying previously acquired knowledge to a major design project. Lectures discuss project-related issues and student presentations. A project proposal, interim report, oral presentations, and a comprehensive final report are required. Includes: Experiential Learning Activity

Appendix 1.1 Program Tree



Appendix 2. Letters from supporting departments and library

Appendix 2.1 Letters of support

STATEMENT OF SUPPORT FROM SISTER UNIT

RE: New Mechatronics Program in FED – starting 2025 with 100 first year students rising to 150 over time.

[x] I support this change unconditionally.

[ ] I do not support this change.

[ ] I support this change, with the following reservations:

Signature:

Name: Seán Barry
Title: Professor and Chair
Academic unit: Chemistry
Date: 2023/09/19

Notes: This change will marginally increase enrollment in CHEM 1101, and so this needs to be noted going forward.

STATEMENT OF SUPPORT FROM SISTER UNIT

RE: New Mechatronics Program in FED – starting 2025 with 100 first year students rising to 150 over time.

[X] I support this change unconditionally. [ ] I

do not support this change.

[ ] I support this change, with the following reservations:

Signature: 

Name: Robert Burk

Title: Interim Director

Academic unit: School of Mathematics and Statistics

Date: 19/9/2023

Notes:

STATEMENT OF SUPPORT FROM SISTER UNIT

RE: New Mechatronics Program in FED – starting 2025 with 100 first year students rising to 150 over time.

[X] I support this change unconditionally.

[ ] I do not support this change.

[ ] I support this change, with the following reservations:

Signature: MRodgers

Name: Michael Rodgers

Title: Director

Academic unit: SLALS

Date: Tuesday, September 19, 2023

Notes:

STATEMENT OF SUPPORT FROM SISTER UNIT

RE: New Mechatronics Program in FED – starting 2025 with 100 first year students rising to 150 over time.

[x] I support this change unconditionally.

[ ] I do not support this change.

[ ] I support this change, with the following reservations:

Signature:  Name:

Thomas Gregoire

Title:Professor, Departmental Chair Academic

unit:

Physics

Date: Sept. 22,

2023

Notes:

Appendix 2.2 – Library Report for Mechatronics degree program

Carleton University | MacOdrum Library

Institutional Quality Assurance Process

Library Report for Mechatronics

New Program: Mechatronics

Date: January 22, 2024

Compiled by: George Duimovich, Collections Librarian, Science, Engineering & Design Team

Submitted to: Tiffany Douglas, Program Officer, Office of Academic Programs and Strategic Initiatives

cc Amber Lannon, University Librarian
Sarah Simpkin, Associate University Librarian, Academic Services
Alana Skwarok, Acting Head of Collections & Assessment
Sally Sax, Head of Electronic Resources & Acquisitions
Joel Rivard, Head of Research Support Services

Overview and Recommendations

An analysis of Carleton University Library's information resources and services in support of the program demonstrates that the Library does not require additional funds to support it.

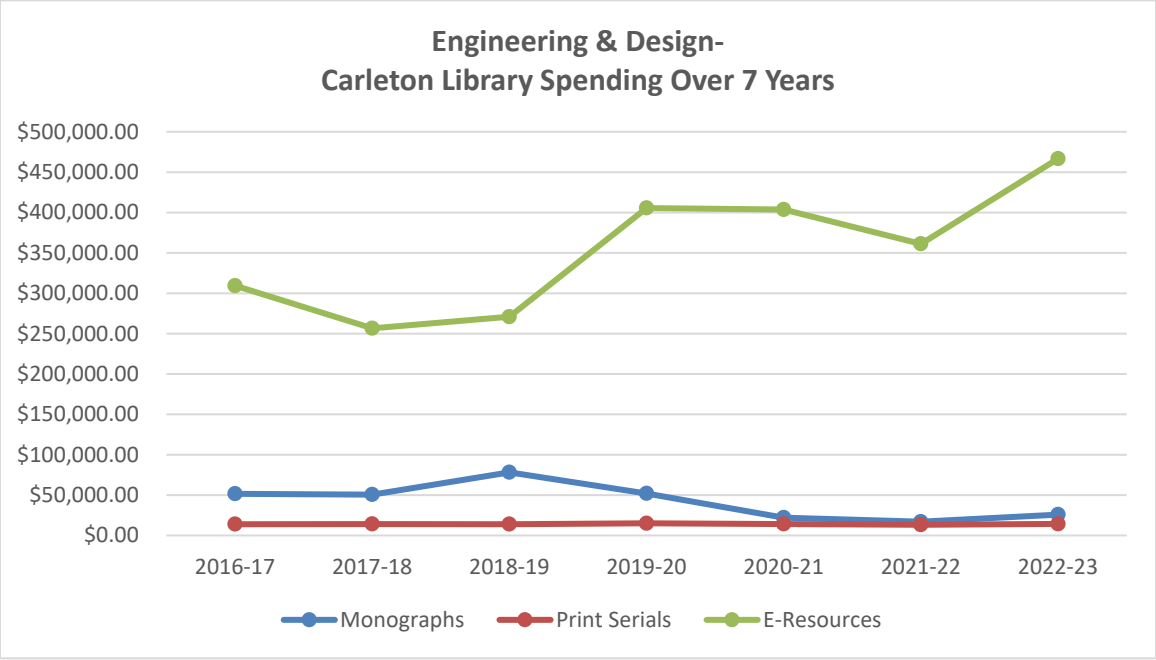
Library Collections

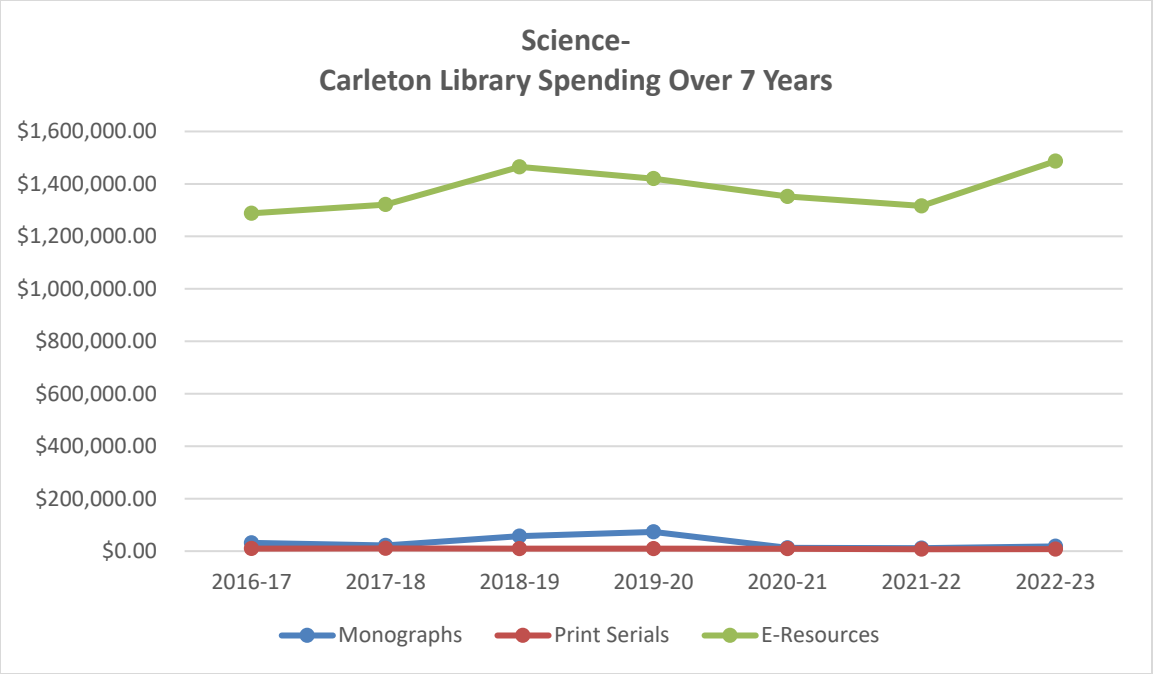
Subject Specific

The Library's collection includes specific resources to support Mechatronics. These include 25 of the top-ranked 25 journals in *Journal Citation Reports*, classified under the subject categories: Mechanical Engineering as well as Electrical Engineering. Holdings also include 20 of the top 20 journals ranked in Google Scholar for the category 'Mechatronics.' In addition, the Library's collections of journals in related programs are also strong in Physics, Math and Chemistry, as well as Software Engineering.

During the 2022-23 academic year, the Library's spending for collection in all areas was about $8.7 million. 88% of the entire collections budget is spent on electronic resources**.** Over $3.1 million was spent on general electronic resources which benefit all subject areas.

In addition to that amount, the following shows the amounts spent on electronic resources (databases, journals, eBook packages, indexes), print journals, and monographs (individual orders) related to *Faculty of Engineering and Design* and *Faculty of Science* for the past seven years***:***





The policy for materials that the Library collects for *Mechatronics* may be found at http://www.library.carleton.ca/about/policies/collection-development-subject-profiles, highlighting specifically:

- Electrical & Computer Engineering
- Engineering (General)
- Mechanical & Aerospace Engineering
- Systems & Computer Engineering

Teaching, Learning, and Research

Carleton Library is a vibrant and active partner in teaching, learning, and research across all disciplines of the university. Library staff take pride in supporting students to develop the skills required to locate, evaluate, use, and communicate information effectively and responsibly. Our programs and services are grounded in Ontario's Quality Assurance Framework.

The Librarian works collaboratively with faculty to address students' information competencies in several ways, including:

Instruction, Teaching, and Practicums

A total of 469 in-class instruction sessions were provided by Library staff in all subject areas during 2022-23, and a total of 12,542 students attended those sessions. These sessions were also supplemented by the creation of over 200 videos with over 31.000 total views. The Librarian designs and deliver instruction sessions and practicum opportunities to meet the needs of specific assignments and course requirements while addressing broad learning objectives.

Online Learning Support

The Library website (library.carleton.ca) guides students through each step of the research process: identifying, accessing, borrowing, evaluating, and citing resources. Google Analytics recorded almost 1 million visits to the Library website during 2022-23. Library users can conduct a comprehensive search of the entire collection using the Omni search interface. Recent enhancements to Omni allow Carleton users to easily request items from university libraries across Canada, the United States, and other countries.

Highlights of the *Mechatronics* related subject guides available on the Library's website include:

- Electronics Engineering ELEC
- Engineering (General)
- Engineering Physics ELEC
- Mathematics and Statistics
- Mechanical and Aerospace Engineering
- Software Engineering COMP/SYSC
- Robotics & Automation

Research Partnerships

Active research is the foundation of a strong academic program, and an increasingly important part of student learning and development. The Library provides resources, services, and expertise to facilitate the Carleton research community at all levels and through all stages of the research process. This research support is provided at key service points, and through individual consultations and more formal collaborations.

• Services

Individual Research Consultations

Library staff provided 2274 individual research consultations across all faculties in 2022-23. Consultations can be scheduled for discipline-based research support, as well as support for numeric and geospatial data, research data management, open access publishing, evidence synthesis, copyright, knowledge mobilization, and many related topics.

Research Help – Desks & Chat

Onsite research help is provided through two service points: a Research Help desk on the main floor of the Library and a help desk in Archives and Special Collections (ASC). These two service points had a total of 2685 visits in 2022-23. This service is supplemented by an extended online Ask a Librarian Chat service. A total of 1860 Carleton patron questions were answered via Ask a Librarian in 2022-23.

Results from recent user surveys show that the Library performs well in providing off-campus access to resources and services, and that these resources help people to be successful at university. It was noted that help is available from Library staff when needed. The Library also does well at providing accurate answers to questions and providing course reserves that help both faculty and students.

• General Information about the Library

Carleton Library consists of five stories, totaling over 214 thousand square feet. Two floors are dedicated to silent study, while three others allow for quiet conversation. As of the Fall of 2019, the Library had a total of 2400 seats for students. This included 179 public computers and 41 bookable group study rooms. User surveys show the need for more group and silent spaces with outlets for power, and so renovations throughout the Library in the past few years continue to focus on new study space for students.

Thanks to $1 million in funding from the Government of Ontario's Training Equipment and Renewal Fund and a matching contribution from the university, the fourth floor of Carleton Library has been transformed into a newly designed space called the Future Learning Lab. This multi-purpose space can be adapted to suit a wide range of needs. It is envisioned as both a physical space and a set of programs designed to foster innovation and incentivize student-centered ways of teaching.

The New Sun Joy Maclaren Adaptive Technology Centre (JMC) provides students access to assistive technologies and accessible individual and group study rooms. Rooms are equipped with a variety of adjustable furniture, desks, and assistive technologies and hardware.

The Library's collection includes approximately 1.2 million print monographs, 2.8 million e-books, and over 277,000 e-journals in a wide range of subjects and disciplines. In addition, the Library has substantial collections of government documents and other resources, maps, data, rare books and other special research collections, printed journals, archives, theses, multimedia resources (audio, DVD, streaming video), musical scores, as well as licensed access to full-text and indexing databases in a broad range of subjects.

Members of the Library's Collections & Assessment Department build and maintain the Library's collection by developing collection policies that guide the systematic selection of materials. The Library welcomes purchase suggestions from members of the Carleton community. A purchase suggestion form is available on the Library's website to gather suggestions.

In order to enhance its purchasing power (particularly for electronic resources), the Library is an active member of two major cooperative partnerships: the Ontario Council of University Libraries (OCUL), a consortium of the 21 academic libraries in the province; and the Canadian Research Knowledge Network (CRKN), a consortium of 75 academic libraries across the country. Carleton Library is also a member of HathiTrust, a not-for-profit collaborative of academic and research libraries which gives students, staff, and faculty access to a digital repository of millions of books, serials, and other materials from research institutions and libraries from around the world.

The Library's annual acquisitions budget for the 2023-24 fiscal year is $8.6 million, and its staffing and operating budget is $14.4 million.

The Library acquisitions budget is not protected from inflation, exchange rates, or cuts, which often challenges the Library's ability to provide all the necessary resources in support of teaching, learning, and research at Carleton. Consideration of the funds necessary for the Library's acquisitions budget is part of the academic planning and Quality Assurance processes for new programs. The Library is dedicated to regular assessment of its resources and services. Staff use an assortment of qualitative and quantitative techniques to evaluate collections and services in order to make sound decisions within budget parameters.

The Library strongly supports the principles and practices of open access (OA). The University's institutional repository was established in 2011 and is maintained by the Library. It includes a growing archive of the broad intellectual output of the University, as well as digitized versions of most of the theses accepted at Carleton since 1955. The Library contributes to CURIE, the University's program to provide funding for faculty and researchers who are publishing in open access journals, and has also entered into a number of agreements with publishers that offer no-charge open access publishing or discounts. The Library's journal hosting service allows Carleton-affiliated scholars to publish open access journals as a means of increasing availability of scholarly research and writing, as well as to increase involvement in disciplinary discourse. For more information about the Library's support for open access and research dissemination, please see our website.

AT A GLANCE: CARLETON UNIVERSITY LIBRARY

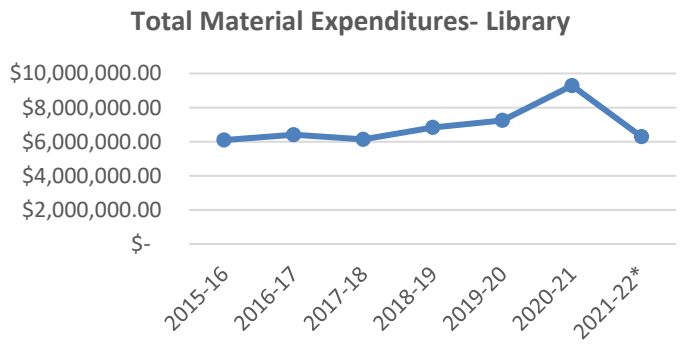
Statistics as of May 1, 2023 except where indicated. Labour disruption, new system implementation & effects of the pandemic** including an entire year online *** has affected some numbers*

Research Highlights

- Carleton's Institutional Repository
- Open Access- Funding for Faculty, Staff, & Students; Open Access Awards for Graduate Students
- Research Data Management Training
- Professional Skills Training for Graduate Students

Collection Spending:

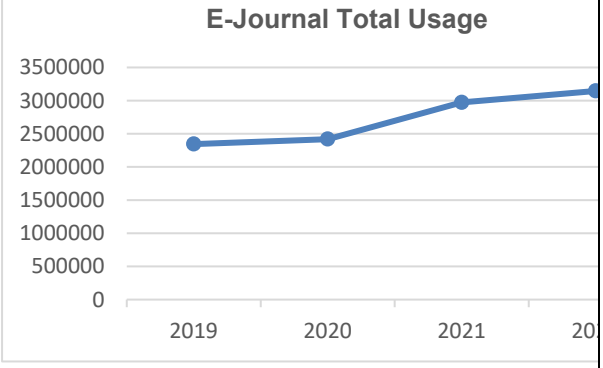
- $8.7 million; 88% of the entire collections budget spent on electronic resources
- $3.1 million spent on general electronic resources which benefit all subject areas

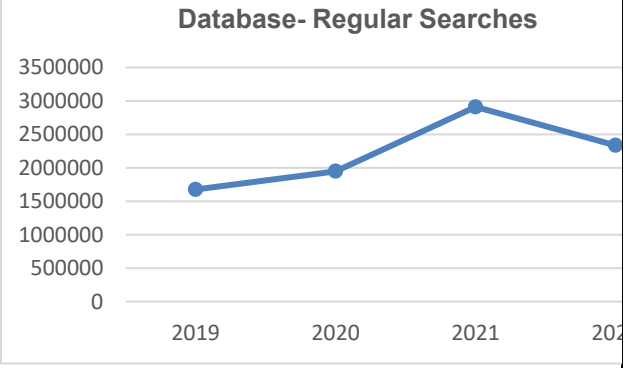


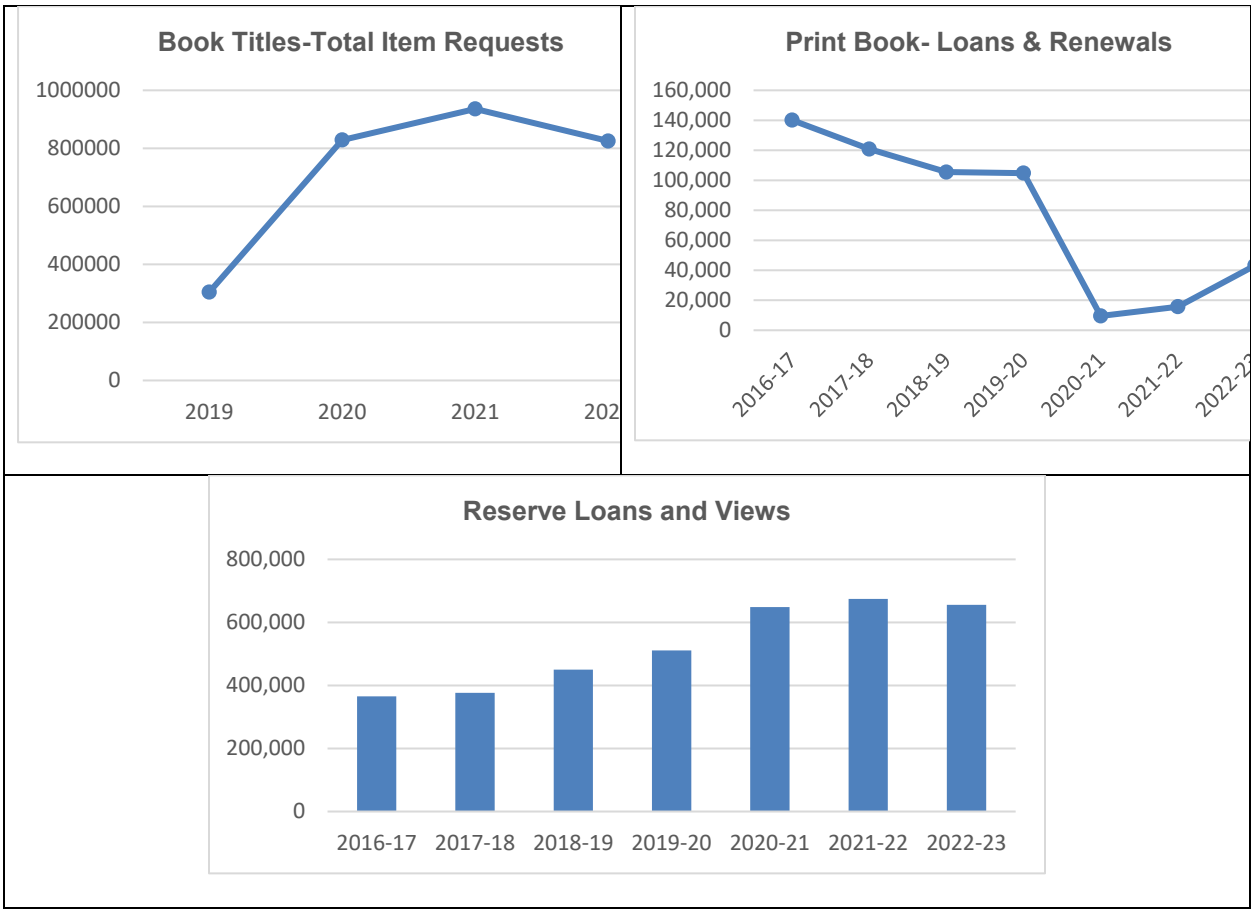
**2020-21- purchased a lot of one-time material to support the switch to online learning which did not have to be paid for again. Annual cost increases for subscriptions were lower than usual due to ongoing pandemic, & a favourable exchange rate lowered our overall spend as most of our invoices are paid in USD.*

Collections- Usage

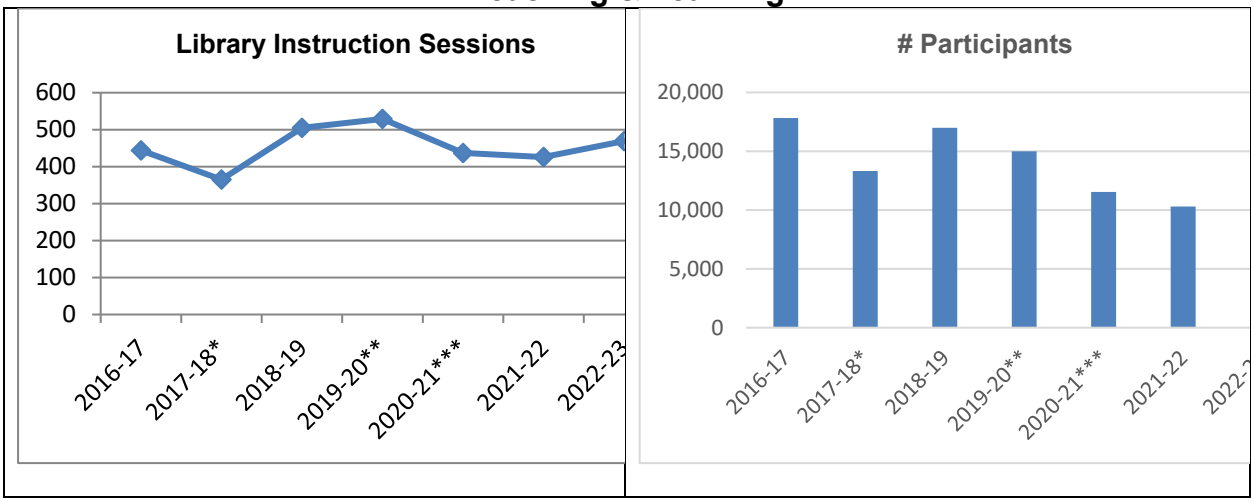
COUNTER 5-compliant data from a selection of major e-publishers/vendors (2019 onward only)







Teaching & Learning



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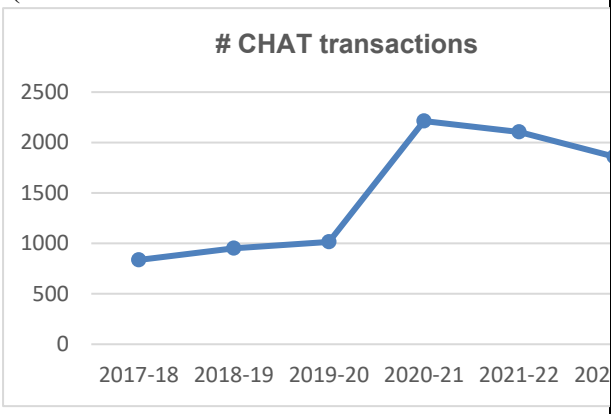


Highlights for 2022-23:

- 469 instruction sessions; 12,542 students attending
- 2274 individual research consultations in 2022-23 for all faculties
- 2685 research help questions answered on site
- 1860 Carleton patron questions answered (CHAT)
- Over 200 instruction videos created with over 31,000 total views

Space

Almost 1 million visits to Library website in a year
Future Learning Lab
Adaptive Technology Centre
Innovative Study areas
Group & graduate study rooms
Book Arts Lab, an experiential learning space

Discussant Report

New Program Review

Name: Hashmat Khan

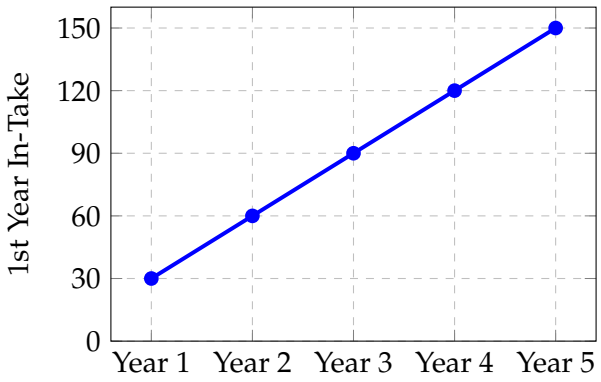
May 22nd, 2024

Program being reviewed

Mechatronics Engineering

Review of self-study (Volume I)

The self-study is well-written and clearly describes the new Mechatronics Engineering program. It is a multi-disciplinary 21.5 credit program that combines Mechanical & Aeronautical, Electronics, and System and Computer Science, with a 1.0 credit common capstone MECT 4907.[1] The program has ambitious enrolment targets as shown below:



The governance structure will consist of a Program Director and two faculty members from each of the three contributing units. It is not clear if the program committee is the same as the Interdisciplinary Academic Team (IAT) responsible for developing program learning outcomes.

Review of External Reviewers' Report

The External Reviewers have made 18 recommendations following their assessment of the program. Four are 'agreed to unconditionally,' nine are 'agreed to in principle,' and five are 'not agreed to.' In this last category, one recommendation (combining LOs 3 & 4) is noted as a 'concern' whereas the remaining four are noted as 'opportunities.'

[1] Item 7 (4th year) should be 1.0 credit but the correction is not yet reflected in Table A.2.

Review of Unit Response and Implementation Plan

Unit Response and Implementation Plan: Summary of Recommendations

Both the unit and the Dean responses to recommendations suggest that the 'tenet and the flavour' of the new program that is envisioned reflects a balance between the three units MECH, SYSC, and ELEC. In particular, for the recommendations that are not agreed to, the unit response suggests that (i) the matters of governance and (ii) the requirements of SYSC and ELEC courses have been an outcome of much discussion/debate. The Dean's responses indicate an openness to revisiting some of those recommendations in future years.

DISCUSSANT'S CONCERN:
I share the concern underlying Recommendation #7. If both Mechatronics I & II are offered in the 4th year, then the capstone is less likely to be Mechatronics focussed. The pre-reqs for Mechatronics are offered late in the 3rd year so Mechatronics I cannot easily be shifted to the third year. Will the 4th year students be adequately prepared to do a capstone in Mechatronics?

Recommendation #7 notes the different expectations of faculty members regarding the capstone project. Although the plan is for a common capstone MECT 4907 [1.0], it is not clear how those expectations will be managed through the delivery of this capstone.

DISCUSSANT RECOMMENDATION:
In the context noted above, to provide more clarification about MECT 4907 [1.0].

Recommendation of program categorization

Recommended to commence.

Carleton University Site Visit
New Undergraduate Program in Mechatronics
Date: May 1, 2024

External Reviewers: **Dr. Scott Nokleby,** Ontario Tech University
Dr. Mahdi Tavakoli, University of Alberta

Internal Reviewer: **Dr. Robyn Green,** Office of Academic Programs and Strategic Initiatives

Zoom:https://us06web.zoom.us/j/86059257789?pwd=C9vVUbU8aStePCqUKIQAj8f2FXBd8H.1

Est Time	May 1, 2024	Location	Mst Time
10:30 – 11:00	Meet and Greet (External and Internal Reviewers only)	Zoom	8:30 – 9:00
11:00 – 11:30	Meeting with Dr. Larry Kostiuk, Dean of the Faculty of Engineering and Design, Dr. Samuel Ajila, Associate Dean	Zoom	9:00 – 9:30
11:30 – 12:15	Meeting with Department Chairs: Dr. Ron Miller, Dr. Yvan Labiche, Dr. Niall Tait	Zoom	9:30 – 10:15
12:15 – 12:30	Department Tour Dr. Niall Tait (Department of Electronics) Dr. Don Russell (Department of Mechanical and Aerospace Engineering) Dr. Richard Dansereau (Department of Systems and Computer Engineering)	Zoom	10:15 – 10:30
12:30 – 1:30	LUNCH	Zoom	10:30 – 11:30
1:30 – 2:30	Meeting with Faculty	Zoom	11:30 – 12:30
2:30 – 3:00	Meeting with Dr. Pauline Rankin, Provost and Vice-President (Academic) and Dr. David Hornsby,Vice-Provost and Associate Vice-President (Academic)	Zoom	12:30 – 1:00
3:00 – 3:30	Break	Zoom	1:00 – 1:30
3:30 – 4:00	Meeting with Administrators: Blazenka Power (Department of Electronics) and Saundra Warmington (Department of Systems and Computer Engineering)	Zoom	1:30 – 2:00
4:00-4:30	Closing Meeting with Dr. Hashmat Khan, Associate Vice-President (Academic Programs and Strategic Initiatives)	Zoom	2:00 – 2:30
4:30 – 5:30	External Reviewers Report Preparation Meeting	Zoom	2:30 – 3:30

External Reviewers for the New Mechatronics Program

Dr. Scott Nokleby is a Professor and currently the Associate Dean, Academic in the Faculty of Engineering and Applied Science at **Ontario Tech University**. He is the Director of the Mechatronic and Robotic Systems Laboratory, which he established in January 2005. Dr. Nokleby's research areas include: Robotics; Mechatronics; Mechanisms; Automation; Advanced Kinematics of Robots and Mechanisms; Redundant Manipulator Systems; Mobile Robots; Mobile-Manipulator Systems; Autonomous Unmanned Aerial Vehicles; Mechanism and Robot Design; and Optimal Design. His particular focus is on the application of advanced kinematics for the control of redundant manipulator systems including joint redundant arms, redundantly-actuated parallel manipulators, and mobile-manipulator systems. Dr. Nokleby has attracted extensive funding for his research from both government and industry. His research group is involved in a number of industrial projects with Cameco Corporation through his past role as the Associate Cameco Research Chair in Nuclear Fuel at Ontario Tech. Dr. Nokleby has over 110 refereed journal and conference publications.

Dr. Mahdi Tavakoli is a Professor in the Electrical and Computer Engineering Department and the Biomedical Engineering Department and a Senior University of Alberta Engineering Research Chair in Healthcare Robotics. He is also Scientific Vice-Director for the Institute for Smart Augmentative and Restorative Technologies (iSMART) at the **University of Alberta.** He received his PhD degree in Electrical and Computer Engineering from the University of Western Ontario, Canada, in 2005. From 2006 to 2008, he was a post-doctoral researcher at Canadian Surgical Technologies and Advanced Robotics (CSTAR), Canada, and an NSERC Post-Doctoral Fellow at Harvard University, USA. Dr. Tavakoli's research interests involve medical robotics, image-guided surgery, and rehabilitation robotics. Dr. Tavakoli is the lead author of Haptics for Teleoperated Surgical Robotic Systems (World Scientific, 2008) and the Specialty Chief Editor for Frontiers in Robotics and AI (Robot Design Section). He is a Senior Member of IEEE and an Associate Editor for the International Journal of Robotics Research, IEEE Transactions on Medical Robotics and Bionics, IEEE/ASME Transactions on Mechatronics' Focused Section with Advanced Intelligent Mechatronics, and Journal of Medical Robotics Research

Carleton University | Office of the Vice-Provost and Associate Vice-President (Academic)

External Reviewer Report Template – New Programs

The external reviewer's joint report serves to inform the Senate Quality Assurance and Planning Committee and Carleton University Senate. This joint report can be brief on those criteria that reviewers feel are being met successfully and focus on 1) criteria that give rise to issues and on recommendations for the program and on 2) significant strengths, including any clearly innovative and creative aspects of the program. In the sections below you will find bullets, taken directly from the New Program Review Terms of Reference and Carleton University IQAP, these are items to consider and can be used as a guide but are not individual questions requiring specific responses. At the end of the document, we ask that you summarize your overall recommendations for the program.

Please note that the Internal Reviewer does not have a role in the writing of this joint report and that this document will be made public, we would ask that you please refrain from using specific names or identifiers as all comments are to be held anonymous on the report.

Recommendations

The most important part of the report from the point of view of the university will be the recommendations made for program improvement (a minimum of 3 are required). We therefore request that all recommendations be clearly listed under 3 main categories:

- **Weakness:** Remedial action is recommended to strengthen compliance with program quality standards.
- **Concern:** Potential risk to future quality that should be considered.
- **Opportunity:** Recommendation for future enhancements

Program(s) being reviewed:	Mechatronics Engineering
Date of review:	May 1, 2024
Names and Emails of External Reviewers:	Mahdi Tavakoli - mahdi.tavakoli@ualberta.ca Scott Nokleby - scott.nokleby@ontariotechu.ca
Date of Report:	May 15, 2024

Considerations for New Program Approval
Note: this document list criteria for both undergraduate and graduate programs, depending on the type of review being conducted not all will need to be considered

Program Objectives

- **Clarity of the program's objectives**

The proposed undergraduate program in Mechatronics Engineering at Carleton University is designed

with clear and targeted objectives. It aims to prepare graduates for leadership roles in the design, manufacture, and application of mechatronic devices, integrating mechanical, electrical, and software engineering disciplines. This program strives to offer a balanced synthesis of these disciplines as opposed to having it primarily centered around one discipline.

- **Appropriateness of degree nomenclature given the program's objectives**

The degree nomenclature 'Bachelor of Engineering in Mechatronics Engineering' is appropriate given the program's objectives. It accurately reflects the interdisciplinary nature of the curriculum that combines mechanical engineering, electronics, and computer science principles.

- **Consistency of the program's objective with the institution's mission and academic plans**

The program's objectives align with Carleton University's mission and strategic academic plans, particularly in fostering a spirit of innovation and interdisciplinary collaboration. The Mechatronics Engineering program has the potential to respond to the modern demands of tech industries and aims to position Carleton as a leader in this field in the Ottawa area. This supports the broader goal of meeting the evolving needs of society and the engineering profession.

Program Requirements

- **Appropriateness of the program's structure and requirements to meet its objects and program-level learning outcomes**

The structure of the program integrates the core principles of mechanical, electrical, and software engineering. The curriculum also includes a mix of foundational courses in math, science, and engineering principles, alongside specialized courses that focus on mechatronics-specific topics such as robotics, automation, and system integration. The learning outcomes, such as the ability to design, analyze, and implement mechatronic systems, are supported by this program structure.

In most engineering programs, especially in fields as broad as mechatronics, it is common to see a range of elective courses offered (3-5 electives). Seeing only one technical elective in the proposed Mechatronics Engineering program limits the ability of the students to specialize within certain areas of mechatronics, such as robotics or automation. Also, the field of mechatronics may rapidly evolve; having more electives allows the curriculum to be flexible and adaptive.

As far as program scalability and future growth go, one should consider the introduction of specializations. As the program establishes itself and expands, specializations could enhance the educational offerings and potentially increase the program's competitiveness and relevance in the rapidly evolving field of mechatronics engineering. Robotics and automation, automotive systems, manufacturing, wearables and healthcare technology, aerospace systems, energy systems, and IoT are examples.

Out of the 5 new courses to be developed specifically for this new program, three directly support the purposes of the program: Mechatronics I, Mechatronics II, and Industrial Automation. The other two, Thermodynamics and Heat Transfer and Mechanics of Solids, provide broad engineering foundations. While foundational knowledge is important, the curriculum could give more weight to courses that directly contribute to key mechatronic competencies like system integration, robotics, automation, and

intelligent systems design. The core focus of mechatronics lies in the integration of electronic, mechanical, and computational systems to create functional and autonomous machines. One idea is to use all new courses to more directly support systems design, control theory, sensor and actuator technology, and software development.

The courses Mechatronics I and II are not well-defined in terms of their course descriptions. The current course descriptions more describe the proposed structure of the courses than the actual content.

A dedicated course on actuators seems to be missing. As well, a course on mobile robots could be added as an elective. Further, a whole course on digital systems seems unnecessary. Necessary aspects of digital systems could be added to other courses.

One area of concern would be if all new courses were offered for the first time to the initial cohort of Mechatronics Engineering students. New courses sometimes experience a bit of ups and downs as instructors refine their content and delivery based on actual classroom experience and student feedback. One solution is to pilot some of them earlier as elective or special topics courses for students in related programs.

Within Complementary Studies Electives, is there any option for a course on the sustainability of technology or on technologies for a sustainable world? This could be interesting from a couple of angles: (1) how mechatronics and robotics can contribute to sustainability (e.g., precision agriculture, waste management, energy-efficient systems, and monitoring biodiversity), AND (2) how sustainability challenges and principles can influence mechatronics design and technology development (e.g., design with biodegradable components).

- **Appropriateness of the program's structure, requirements and program-level learning outcomes in meeting Carleton's undergraduate or graduate Degree Level expectations.**

Table B.2 has listed the degree level expectations (described to be provincial expectations rather than university-level expectations) and how they are supported by the program learning outcomes (similar to CEAB criteria) in Table B.1. However, the document lacks a detailed mapping that explicitly shows how each individual course contributes to these outcomes, making it difficult to assess the direct impact of specific courses on fulfilling the program's educational objectives. Such a detailed mapping would (1) allow for continuous improvement of the curriculum, (2) prepare the program for accreditation, and (3) improve student understanding and personalized learning paths (electives and potential specializations).

Given the concurrent nature of mechatronics, program learning outcomes 3 and 4 should be combined so that students consider aspects of mechanical, electrical, and software together.

It is good to see the multidisciplinary nature of the program through the delivery across three departments, but this also poses some challenges in terms of governance that have not been made clear in the proposal.

- **Appropriateness of the proposed mode(s) of delivery to facilitate students' successful completion of the program-level learning outcomes**

The delivery modes for the program include lectures, labs, tutorials, and project-based learning, which are suitable for the technical and interdisciplinary nature of the program. The inclusion of hands-on laboratory and design projects is key to ensuring that students can apply theoretical knowledge in

practical scenarios. The course An Introduction to Robotics should have a hands-on lab component. While the program includes some design-focused courses, there could be more. The most significant design-focused element is the Capstone Design Project, where students engage in a substantial project that spans the entire final year. Other than that, there are courses such as Mechatronics I and II that will teach aspects of engineering design. The focus on engineering design could be stronger for the benefit of students, especially given the inherently integrative and application-focused nature of mechatronics. Perhaps Mechatronics I and II can be developed such that they emphasize design more, if not go all the way to make them about open-ended design in mechatronics.

- **Ways in which the curriculum addresses the current state of the discipline or area of study**

The curriculum includes courses on emerging technologies such as intelligent systems, robotics, and digital manufacturing, so it does reflect the current trends and technological advancements in the field of mechatronics.

- **Identification of any unique curriculum or program innovations or creative components, or significant high impact practices**

One of the innovative learning strategies that the program introduces is integrated capstone projects that span multiple course numbers (either ELEC 4907, MAAE 4907, or SYSC 4907), giving students ample flexibility in terms of the nature of their projects. Supervisors for these projects are assigned by the department's final year project coordinator. For projects that span multiple disciplines, students can register under ECOR 4907, where they will be supervised jointly by faculty from the relevant departments involved in the interdisciplinary project.

- **Do the program's intellectual profile and learning outcomes match the teaching and research strengths of the academic unit(s)?**

Yes, the faculty involved in delivering the program include experts in core mechatronic areas such as robotics, control systems, and software engineering, who actively contribute to research in these fields. It seems that the program is grounded in strong existing scholarly activity.

Program Requirements for Graduate Programs Only

- Clear rationale for program length that ensures that students can complete the program-level learning outcomes and requirements within the proposed time period
- Evidence that each graduate student in the program is required to take a minimum of two-thirds of the course requirements from among graduate level courses
- For research-focused graduate programs, clear indication of the nature and suitability of the major research requirements for degree completion

Assessment of Teaching and Learning

- **Appropriateness of the methods for assessing student achievement of the program-level learning outcomes and degree level expectations**

The program will use usual assessment methods to measure student achievement of learning outcomes and degree level expectations. These include traditional exams, individual and group project work, lab experiments, and capstone projects.

- **Appropriateness of the plans to monitor and assess:**
  - **i. The overall quality of the program;**

The program plans to use ongoing evaluations, including student feedback, course evaluations, and external reviews, to monitor its quality.

  - **ii. Whether the program is achieving in practice its proposed objectives;**

Monitoring the achievement of the program's objectives is planned through annual reviews by the faculty to check for the alignment of course content with industry standards and educational goals.

  - **iii. Whether its students are achieving the program-level learning outcomes; and**

The achievement of learning outcomes is monitored through direct assessments like exams and projects, as well as indirect measures such as placement rates.

  - **iv. How the resulting information will be documented and subsequently used to inform continuous program improvement**

This is done by compiling reports and maintaining records of evaluations. This documented information is reviewed regularly to inform decisions on curriculum updates, teaching methods, and resource allocation.

- **Is there a clear indication of essential requirements?**

The document outlines essential requirements, which include academic prerequisites for entering the program, the core knowledge areas that students must master, and the competencies they are expected to develop by the end of their studies.

Admission Requirements

- **Appropriateness of the program's admission requirements given the program's objectives and program-level learning outcomes**

Prospective students are required to have a good foundation in mathematics and physics, which are essential for understanding the core concepts of mechatronics. High school topics such as chemistry or biology may be less relevant to mechatronics but it is still good to require them to be consistent with the rest of first-year engineering cohort. This ensures that incoming students are prepared to tackle the engineering challenges presented in the program.

MCV4U Calculus and Vectors is currently a recommended course for applicants to have. The course should be a required course for entry into the program. This will better prepare students for the program and align with entry requirements seen at other Ontario universities.

- **Sufficient explanation of alternative requirements, if applicable, for admission into a**

graduate, second-entry or undergraduate program, e.g., minimum grade point average, additional languages or portfolios, and how the program recognizes prior work or learning experience.

Students applying for second-year-entry or as transfer students from other post-secondary institutions are evaluated based on their previous academic performance, with a specific minimum grade point average required. It is not explicitly stated how students may pick the co-op option that will come with the mechatronics program if they are interested in it but in the interviews, it was clarified that co-op terms can happen during summers or by taking a gap year. It would be good to work on strategies for strengthening industry partnerships to enhance co-op training opportunities and employment prospects for mechatronics graduates.

Resources

Given the program's planned /anticipated class sizes and cohorts as well as its program-level learning outcomes:

- **Participation of a sufficient number and quality of core faculty who are competent to teach and/or supervise in the program and foster the appropriate academic environment**

There is a good number of core faculty members from the Departments of Electronics, Mechanical and Aerospace, and Systems and Computer Engineering who possess the requisite expertise to deliver the interdisciplinary curriculum and supervise mechatronics-focused capstone projects.

Given that new courses are to be developed, prior to their launch, faculty (especially new hires) could be invited to participate in workshops focused on course design, pedagogical strategies, and integration of technology such as simulation and software tools.

- **If applicable, discussion/explanation of the role and approximate percentage of adjunct and part-time faculty/limited term appointments used in the delivery of the program and the associated plans to ensure the sustainability of the program and quality of the student experience**

The program does utilize instructors and adjunct and part-time faculty. Sometimes, for specialized courses, professional industry experience can actually enrich the educational experience. The document and interviews outlined that the involvement of such faculty is going to be carefully managed to maintain educational continuity and quality, and also new faculty will be hired (6 in the first 2 years and up to around 20 in total if things go well, which is very good).

- **If required, provision of supervision of experiential learning opportunities**

The most important mandatory experiential learning opportunity is the capstone project. The program ensures that adequate faculty supervision is available for these activities.

- **Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, including implications for the impact on other existing programs at the university**

The program is designed to leverage existing resources first and foremost. For instance, most of the curriculum will rely on existing courses. Such a utilization of human, physical, and financial resources to support the new program should not adversely impact other programs at the university.

- **Evidence that there are adequate resources to sustain the quality of scholarship and research activities produced by students, including library support, information technology support, and laboratory access**

The document and interviews promised access to well-equipped labs, library resources, and information technology support. These resources are going to be crucial for supporting the research components of the program, particularly for upper-year students engaged in capstone projects and independent research.

Mechatronics labs, where students get hands-on experience working on projects, are often not like typical labs in other engineering programs that have fixed equipment that is used year after year. Mechatronics labs often require consumables and components (microprocessors, sensors, actuators, wire, etc.) that need to be replaced on a yearly basis. Considering the hands-on nature of mechatronics, what investments in laboratory infrastructure and technology updates are planned to ensure students have access to state-of-the-art tools and equipment?

- **If necessary, additional institutional resources commitments to support the program in step with its ongoing implementation**

The university's commitment is reflected in planned investments in faculty recruitment in the mechatronics area, space allocation (one floor in Dunton Tower), and the expansion of student services. It is important that the faculty recruitment targets those with substantial research AND teaching capacity in mechatronics, not just teaching capability.

Resources for graduate programs only

Given the program's planned /anticipated class sizes and cohorts as well as its program-level learning outcomes:

- Evidence that faculty have the recent research or professional/clinical expertise needed to sustain the program, promote innovation and foster and appropriate intellectual climate
- Where appropriate to the program, evidence that financial assistance for students will be sufficient to ensure adequate quality and numbers of students
- Evidence of how supervisory loads will be distributed, in light of qualifications and appointment status of faculty

Quality and other indicators

- **Evidence of the quality of the faculty (e.g., qualifications, funding, honours, awards, research,**

innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the program and commitment to student mentoring

The faculty involved in the Mechatronics Engineering program hold PhDs in relevant fields such as mechanical engineering, electronics, computer science, and systems engineering. They are actively involved in cutting-edge research and innovation and have their research well-supported by grants from tri-council agencies and more. Table D.3 (Distribution of thesis supervision) shows that some of the faculty are extremely committed to supervising undergraduate students, with several of them supervising over ten undergraduate students in the current year. This shows a great culture that places a strong emphasis on student mentoring, with faculty actively involved in advising students.

- **Any other evidence that the program and faculty will ensure the intellectual quality of the student experience**

Reflecting the interdisciplinary nature of mechatronics, the program encourages collaboration across different engineering disciplines. The program allows for internships and co-op placements (although it seems that the students need to take the initiative to use these opportunities and there is no specifically structured co-op pattern), which will enhance the students' readiness for their future careers.

Additional Comments:

The assumption that all the mechatronics students will be net new seems questionable. It would be expected that the program will impact enrolments in mechanical the most and to a lesser extent electrical and computer systems.

We would like to thank the administration, faculty, and staff for taking the time to meet with us. It is clear there is a lot of enthusiasm for this new program.

Summary of Recommendations

Use the chart below to summarize your overall recommendations for the program. If possible, it would be beneficial to the university for the recommendations to be prioritized.

Recommendation	**Category** *(Weakness, Concern, Opportunity)*
1) The course descriptions for Mechatronics I and Mechatronics II must be revised to reflect the content that will be taught in the courses.	Weakness
2) Develop a mapping of how the program learning outcomes will be achieved across the program. As well, develop a mapping of the Graduate Attributes for the program to meet the requirements for accreditation by the Canadian Engineering Accreditation Board (CEAB).	Weakness
3) Program learning outcomes 3 and 4 should be combined so that students consider aspects of	Concern

mechanical, electrical, and software simultaneously.	
4) Add one or two additional electives to the program. Space to achieve this could be made by implementing Recommendations 9, 10, and/or 11.	Concern
5) Consider adding MCV4U Calculus and Vectors as a mandatory entry requirement. This would ensure better preparation of the students entering the program.	Concern
6) Mechatronics I and II are offered in the 4th year, potentially precluding the capstone project to be mechatronics focused. If possible, at least one of them should be moved to the 3rd year.	Concern
7) The experience of students taking three different capstone courses (either ELEC 4907, MAAE 4907, or SYSC 4907) may not be uniform enough in terms of workload, demands, and level of difficulty. Also, the three Departments seemed to have different policies regarding expectations from their faculty members for capstone project supervision.	Concern
8) Add a list of approved technical electives for the program.	Concern
9) Add a dedicated course on actuators and power electronics that is more relevant to mechatronic students as opposed to taking ELEC 2602 and ELEC 3508.	Opportunity
10) Consider removing SYSC 2310 and adding any necessary content from the course to either SYSC 2320 and/or SYSC 3310, or consider a new course that combines aspects of SYSC 2310 with SYSC 2320.	Opportunity
11) Consider making SYSC 3320 an elective as the content is not absolutely necessary for mechatronics students.	Opportunity
12) Consider developing an elective on mobile robotics.	Opportunity
13) Consider defining a home Department for the program to minimize potential governance issues with the program (i.e., make a very clear administrative structure that still supports interdisciplinary integration).	Opportunity
14) Consider adding a hands-on lab for the course An Introduction to Robotics (MECH 4503).	Opportunity

15) Consider incorporating sustainability-focused content into the curriculum, possibly as a part of Complementary Studies.	Opportunity
16) Consider establishing systematic lab management that includes a regular update and replacement cycle for components and equipment, ensuring labs remain state-of-the-art and relevant to the needs of the program.	Opportunity
17) Ensure that the three Departments collaborate to provide a conflict-free schedule for students, facilitating smooth progress through the program without overlapping class times.	Opportunity
18) Work on enhancing industry partnerships to improve co-op and job placement opportunities. for students and to ensure the alignment of educational outcomes with market needs.	Opportunity

Mechatronics
Unit Response to External Reviewers' Report & Implementation Plan
Programs Being Reviewed: New Undergraduate Program

Note: This document is forwarded to Senate, the Quality Council and posted on the Vice- Provost's external website.

Introduction & General Comments
Please include any general comments regarding the External Reviewers' Report.

[Sample Text: The Department/School/Institute was pleased to receive the Reviewers' very positive External Reviewers' report on [date]. This report was shared with our faculty and staff, and we are committed to the continual improvement of our programs to enhance the student, staff, and faculty experience. This document contains both a response to the External Reviewers' Report and an Implementation Plan (Section B) which have been created in consultation with the Dean(s).

For each recommendation one of the following responses must be selected:

Agreed to unconditionally: used when the unit agrees to and is able to take action on the recommendation without further consultation with any other parties internal or external to the unit.
Agreed to **if additional resources permit:** used when the unit agrees with the recommendation, however action can only be taken if additional resources are made available. Units must describe the resources needed to implement the recommendation and provide an explanation demonstrating how they plan to obtain those resources. In these cases, discussions with the Deans will normally be required and therefore identified as an action item.
Agreed to in principle: used when the unit agrees with the recommendation, however action is dependent on something other than resources. Units must describe these dependencies and determine what actions, if any, will be taken.
Not agreed to: used when the unit does not agree with the recommendation and therefore will not be taking further action. A rationale must be provided to indicate why the unit does not agree (no action should be associated with this response).

Calendar Changes
If any of the action items you intend to implement will result in calendar changes, please describe what those changes will be. To submit a formal calendar change, please do so using the Courseleaf system.

UNIT RESPONSE AND IMPLEMENTATION PLAN **Programs Being Reviewed: Mechatronics Engineering** **Prepared by (name/position/unit/date): S. Ajila (Associate Dean) /R. Miller, Y. Labiche, N. Tait (Chairs) / May 16, 2024**					
External Reviewer Recommendation & Categorization	**Unit Response:** **1- Agreed to unconditionally** **2- Agreed to if additional resources permit (describe resources)** **3- Agreed to in principle** **4- Not agreed to** **Rationales are required for categories 2, 3 & 4**	**Action Item**	**Owner**	**Timeline**	**Will the action described require calendar changes? (Y or N)**
1) The course descriptions for Mechatronics I and Mechatronics II must be revised to reflect the content that will be taught in the courses. Weakness	*Agreed to unconditionally*	*Develop course outlines*	*Mechatronics (MECT) Curriculum Committee and course instructors*	*Immediate*	*Y*
2) Develop a mapping of how the program learning outcomes will be achieved across the program. As well, develop a mapping of the Graduate Attributes for the program to meet the requirements for accreditation by the Canadian Engineering Accreditation Board (CEAB). Weakness	*Agreed to unconditionally*	1. *Develop a mapping of program learning outcomes to courses.* 2. *The faculty is in the process of re-mapping GAs in different engineering degree programs. This action item will be added to the re-mapping process.*	1. *Acting Director for MECT* 2. *Academic planning Committee (APC)*	1. *Summer 2024* 2. *2025 – 2026 academic year*	*N*
3) Program learning outcomes 3 and 4 should be combined so that students consider aspects of mechanical, electrical, and software simultaneously. Concern	*Not agreed to*	*These two outcomes are unique, and the purpose is to make sure that the mechanical part of mechatronics and the systems part stay in balance by keeping the fulfillment of these outcomes independently required. Since the training of students will cover all the learning outcomes, they will have the opportunity to apply all aspects of the program in their*	1. *Acting Director for MECT* 2. *Academic planning Committee (APC)*	*N/A*	*N*

		capstone project and in the two dedicated Mechatronics courses.			
4) Add one or two additional electives to the program. Space to achieve this could be made by implementing Recommendations 9, 10, and/or 11. Concern	*Not agreed to*	*As it is, we have exceeded the normal 20 credits required in many engineering programs by 1.5 credits. However, the faculty will review the degree program from time to time to improve its contents as well as respond to comments from students and other stakeholders.*	*Acting Director for MECT*	*On going*	*Y*
5) Consider adding MCV4U Calculus and Vectors as a mandatory entry requirement. This would ensure better preparation of the students entering the program. Concern	*Agreed to unconditionally*	*Yes, we already have this condition in some of the Engineering programs.*	*Acting Director for MECT; and APC*	*Summer 2024*	*Y*
6) Mechatronics I and II are offered in the 4th year, potentially precluding the capstone project to be mechatronics focused. If possible, at least one of them should be moved to the 3rd year. Concern	*Not agreed to*	1. *Two of the pre-requisite courses for Mechatronics I are offered in the Winter term of the third year.* 2. *The students need solid background in Integrated Sensors, machine design, Dynamics of machines, and Control Systems before they can take Mechatronics I*	*Acting Director for MECT*	*N/A*	*N*
7) The experience of students taking three different capstone courses (either ELEC 4907, MAAE 4907, or SYSC 4907) may not be uniform enough in terms of workload, demands, and level of difficulty. Also, the three Departments seemed to have different policies regarding expectations from their faculty members for capstone project	*Agreed to unconditionally*	*A common capstone (MECT 4907) will be created for the new program so that the capstone experience will be appropriately controlled for these students.*	*Acting Director for MECT; and APC*	*2025 – 2026 academic year*	*Y*

supervision. Concern					
8) Add a list of approved technical electives for the program. Concern	*Agreed to unconditionally*	*This is already done, and it was included as a comment (0.5 credit at 4000- or 3000-level in Mechanical (MECH) or Systems and Computer (SYSC) or Electronics (ELEC) OR ECOR 2606) in the degree program tree – appendix to Volume I*	*Done*	*Immediate*	*Y*
9) Add a dedicated course on actuators and power electronics that is more relevant to mechatronic students as opposed to taking ELEC 2602 and ELEC 3508. Opportunity	*Not agreed to*	*There is merit in this opportunity, but we need to consider the main goal of our mechatronics program and the targeted application area. This may be considered by APC after implementing the program and receiving feedback from stakeholders.*	*N/A*	*N/A*	*N*
10) Consider removing SYSC 2310 and adding any necessary content from the course to either SYSC 2320 and/or SYSC 3310, or consider a new course that combines aspects of SYSC 2310 with SYSC 2320. Opportunity	*Not agreed to*	*This will change the tenant and the flavor of the type of Mechatronics degree program we want to create. We want our students to be able to work with programmable devices that range from smaller limited-mass to larger heavy industrial-scale mechatronics devices.*	*N/A*	*N/A*	*N*
11) Consider making SYSC 3320 an elective as the content is not absolutely necessary for mechatronics students. Opportunity	*Not agreed to*	*This will change the tenet and the flavor of the type of Mechatronics degree program we want to create.*	*N/A*	*N/A*	*N*

12) Consider developing an elective on mobile robotics. Opportunity	*Agreed to in principle*	*This suggestion is a very good application area to strive for in this program.*	*Acting Director for MECT; and APC*	*2026 – 2027 academic year*	*Y, once such a course is developed*
13) Consider defining a home Department for the program to minimize potential governance issues with the program (i.e., make a very clear administrative structure that still supports interdisciplinary integration). Opportunity	*Not Agreed to*	*The teaching Units have been operating on the principle that the governance of the program will be around a cooperative model headed by a Director. All teaching responsibilities have been assigned to established teaching Units. The Director will be responsible for working with all Units to achieve a balanced continual improvement of the curriculum. There are positives and negatives associated with all governance structures, so we will be providing feedback to the Dean as the program is launched.*	*Dean, FED*	*N/A*	*N*
14) Consider adding a hands-on lab for the course An Introduction to Robotics (MECH 4503). Opportunity	*Agreed to in principle*	*This suggestion has merit and will be taken back to the program committee for proposing a physical lab, the required space, and a budget to accomplish.*	*Acting Director for MECT; and APC*	*2027 – 28 academic year*	*Y, if lab is introduced*
15) Consider incorporating sustainability-focused content into the curriculum, possibly as a part of Complementary Studies. Opportunity	*Not Agreed to*	*This is a curriculum topic that is far broader than mechatronics as all engineering disciplines are adapting to this societal imperative.*	*APC*	*On going*	*Y*

16) Consider establishing systematic lab management that includes a regular update and replacement cycle for components and equipment, ensuring labs remain state-of-the-art and relevant to the needs of the program. Opportunity	Agreed to unconditionally	*The engineering departments at Carleton are fortunate to have an established and growing endowment for this very purpose. The Carleton Undergraduate Engineering Students' Equipment Fund (CUESEF) was derived from a student fee dating back to 1993. This fund makes ~200k/year available for such purchases.*	*Dean, FED*	*N/A*	*N*
17) Ensure that the three Departments collaborate to provide a conflict-free schedule for students, facilitating smooth progress through the program without overlapping class times. Opportunity	Agreed to unconditionally	*A conflict-free schedule committee with be setup*	*Acting Director of MECT, Faculty APC, and the Registrar office*	*Ongoing*	*N*
18) Work on enhancing industry partnerships to improve co-op and job placement opportunities. for students and to ensure the alignment of educational outcomes with market needs. Opportunity	*Agreed to in principle*	*This is a topic that is far broader than mechatronics as all engineering disciplines need to maintain positive relationship with local, regional, and national employers of our students.*	*FED and University's Co-op office*	*On going*	*N*

Mechatronics

Dean's Response

Programs Being Reviewed: Mechatronics Engineering

Date: May 17, 2024

Version:

Instruction

The table below has been pre-populated with the external reviewer recommendations. Please complete the Dean's Response column by providing a separate response to each of the external reviewers' recommendations, as required by the QAF (5.3.1).

Dean's Response **Programs Being Reviewed: Mechatronics Engineering** **Prepared by: L. Kostiuk**	
External Reviewer Recommendation & Categorization	**Dean's response** **A response is required for each recommendation listed.**
1) The course descriptions for Mechatronics I and Mechatronics II must be revised to reflect the content that will be taught in the courses. Weakness	*The Faculty agrees unconditionally and supports the idea that these course descriptions be created and expanded to be close to a syllabus in structure by the Department of Mechanical and Aerospace Engineering (the instructing department) as soon as possible.*
2) Develop a mapping of how the program learning outcomes will be achieved across the program. As well, develop a mapping of the Graduate Attributes for the program to meet the requirements for accreditation by the Canadian Engineering Accreditation Board (CEAB). Weakness	*It is my understanding that preliminary efforts were made in the design of the Mechatronics program to ensure that the accreditation standards would be met both in terms of the Accreditation Units in Math, Natural Sciences, Engineering Sciences, Complementary Studies, and Engineering Design, as well as all 12 Graduate Attributes (GAs). Since most of the courses offered in Mechatronics are derived from existing courses that have been vetted by the CEAB in 2023, we are confident that the programmatic accreditation outcome will be positive, especially since there are more courses and academic credits in this program than any other BEng.*

	The Faculty agrees with the Unit response that the work on the learning outcome mapping and the Graduate Attributes should begin in this and subsequent years, respectively.
3) Program learning outcomes 3 and 4 should be combined so that students consider aspects of mechanical, electrical, and software simultaneously. Concern	*The written structure of learning outcomes 3 and 4 are so similar that a more compact form could be achieved by combining them together with the same result. This point was debated, and the Units' response reflects the internal concern such that it was felt important that the Mechatronics program be explicitly held to each of these learning outcome separately so that any modifications to the program in the future would have to consider both.*
4) Add one or two additional electives to the program. Space to achieve this could be made by implementing Recommendations 9, 10, and/or 11. Concern	*The current program structure has very few electives overall, and only one technical elective. This low number of electives arises in programs where more than one engineering discipline contributes to the requirements associated with the program name. (Another example of this reduced elective situation occurs in Biomedical engineering programs.). Meeting the requirement of prescribed breadth and staying close to the normal number of academic units for graduation invariably results in a low number of electives. As we launch this program, we are more comfortable with the quality of the graduates in staying with this initial structure and make this electives issues a point of review for the program director and APC in the future.*
5) Consider adding MCV4U Calculus and Vectors as a mandatory entry requirement. This would ensure better preparation of the students entering the program. Concern	*Agreed to unconditionally.*
6) Mechatronics I and II are offered in the 4th year, potentially precluding the capstone project to be mechatronics focused. If possible, at least one of them should be moved to the 3rd year. Concern	*Capstone courses are always taken at the same time as some technical courses resulting in which courses should be either a pre- or co- requisite. Mechatronics I and II ended up as co-requisites because of their background and preparation needs. If Mechatronics I were moved to year 3 of the program, then another important course would have to become a co-requisite to the Capstone. No solution is perfect in this regard.*

7) The experience of students taking three different capstone courses (either ELEC 4907, MAAE 4907, or SYSC 4907) may not be uniform enough in terms of workload, demands, and level of difficulty. Also, the three Departments seemed to have different policies regarding expectations from their faculty members for capstone project supervision. Concern	*It was my understanding that these courses were inadvertently used as placeholders and that the intent was always to have a Mechatronics Capstone with projects tailored to the expectations of their program. The calendar will need to be amended.*
8) Add a list of approved technical electives for the program. Concern	*This information was in the Brief.*
9) Add a dedicated course on actuators and power electronics that is more relevant to mechatronic students as opposed to taking ELEC 2602 and ELEC 3508. Opportunity	*Mechatronics programs can emphasize many different things. Changing from two ELEC courses to one to an actuators course would shift that emphasis. This suggestion will need to be put in front of APC for their consideration in future years.*
10) Consider removing SYSC 2310 and adding any necessary content from the course to either SYSC 2320 and/or SYSC 3310, or consider a new course that combines aspects of SYSC 2310 with SYSC 2320. Opportunity	*Mechatronics programs can emphasize many different things. Changing from two SYSC courses to one SYSC course would shift that emphasis. This suggestion will need to be put in front of APC for their consideration in future years.*
11) Consider making SYSC 3320 an elective as the content is not absolutely necessary for mechatronics students. Opportunity	*Mechatronics programs can emphasize many different things. Changing SYSC 3320 course to an elective would shift that emphasis. This suggestion will need to be put in front of APC for their consideration in future years.*
12) Consider developing an elective on mobile robotics. Opportunity	*This is a very good suggestion that will need to be put in front of APC for their consideration in future years.*

13) Consider defining a home Department for the program to minimize potential governance issues with the program (i.e., make a very clear administrative structure that still supports interdisciplinary integration). Opportunity	*A few governance models were considered in the conception stage of developing this program, and certainly placing Mechatronics in an existing or new department was considered. The expectation is that Mechatronics will be a hugely successful program that would be a highly desirable entity for any department to have as part of their portfolio. There was considerable concern that the battle over ownership could poison the collaboration we so much wanted in sincerely bringing mechanical, electrical, and computer engineering together. The idea of creating a new department which took so much from mechanical, electrical, and computer engineering who would not get credit for their investments also seemed too stressful of a path. For now, the appointment of the Director and Associate Directors to develop the up to a steady state operation was chosen as the best option. Departmental status from Mechatronics will be worthy of consideration once the flow of students is established.*
14) Consider adding a hands-on lab for the course An Introduction to Robotics (MECH 4503). Opportunity	*This is a very good suggestion that will need to be put in front of APC for their consideration in future years.*
15) Consider incorporating sustainability-focused content into the curriculum, possibly as a part of Complementary Studies. Opportunity	*Mechatronics programs can emphasize many different things. Incorporating more sustainability elements in the program would shift that emphasis. This suggestion will need to be put in front of APC for their consideration in future years.*
16) Consider establishing systematic lab management that includes a regular update and replacement cycle for components and equipment, ensuring labs remain state-of-the-art and relevant to the needs of the program. Opportunity	*As identified by the Units, Mechatronics will be a full participant in the equipment renewal opportunities of CUESEF*

17) Ensure that the three Departments collaborate to provide a conflict-free schedule for students, facilitating smooth progress through the program without overlapping class times. Opportunity	*We transfer a great deal of this responsibility to Central Timetabling.*
18) Work on enhancing industry partnerships to improve co-op and job placement opportunities. for students and to ensure the alignment of educational outcomes with market needs. Opportunity	*As Dean, I spend every Wednesday in Canada's largest technolgy park (Kanata) meeting with and sharing ideas with industry there. They are aware of the likely emergence of a Mechatronics program at Carleton. Initial feedback is very positive.*

Date: May 23, 2024

To: Dr. Larry Kostiuk, Dean, Faculty of Engineering and Design
Dr. Samuel Ajila, Associate Dean (Policy & Planning), Faculty of Engineering and Design

From: Dr. David Hornsby, Vice-Provost and Associate Vice-President (Academic);
Chair, Senate Quality Assurance and Planning Committee

Cc: Dr. Hashmat Khan, Associate Vice-President (Academic Programs and Strategic Initiatives)
Christina Noja, Director, Office of Academic Programs and Strategic Initiatives
Dr. Eileen Harris, Program Assessment Specialist, Office of Academic Programs and Strategic Initiatives

RE: Outcome of New Program Proposal

The Senate Quality Assurance and Planning Committee (SQAPC) met on **May 23, 2024,** to consider the unit's response to the External Reviewers' report for the following new program proposal:

- **Bachelor of Engineering - Mechatronics**

In accordance with article 3.5.8 of Carleton's Institutional Quality Assurance Process, SQAPC has determined the outcome of the programs as "**Recommended to commence**".

The committee did however request the following updates to the unit response and Volume I:

1) The unit should consider revising their responses to better align with the Actions listed in the following recommendations:
    a. #4 consider changing to "not agreed to"
    b. #6 consider changing to "not agreed to" and providing a more fulsome explanation
    c. #7 consider changing to "agreed to unconditionally"
    d. #15 consider changing to "not agreed to" or providing additional information on what will be done
    e. #16 consider changing to "agreed to unconditionally" or indicating further information on how the current funding is used
    f. #17 consider changing to "agreed to unconditionally"
2) The unit should provide additional information on the action, owner and timeline for

Office of the Vice-Provost & Associate Vice-President (Academic)

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1125 Colonel By Drive
Ottawa, ON K1S 5B6 Canada

T (613) 520-4027
david.hornsby@carleton.ca
www.carleton.ca/viceprovost

recommendation #14

3) Any actions relating to program or course changes should have a “Y” in the last column (Will the action described required calendar changes (Y or N)) of the Unit response
4) The Governance section in Volume I section C should be adjusted to:
    a. clarify the role the units have in making course and program changes
    b. clarify the role of the role of the program committee and how the program will be managed

In addition, the unit should work on clarifying the program curriculum mapping in Section B. Assistance with this can be provided by Eileen Harris.

If you could please forward your updated unit response and Volume (using track changes) to Christina Noja by Tuesday May 28, 2024. The file will then be updated and forwarded to Senate for consideration.

Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,

Professor David J Hornsby, BA (Hons), MA, PhD (Cantab)
Vice-Provost and Associate Vice-President (Academic)
Professor of International Affairs

Office of the Dean
Faculty of Engineering and Design
3010 Minto Centre
1125 Colonel By Drive
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Fax: (613) 520-7481

Carleton University

May 12, 2024

BEng Mechatronics Engineering
Program Organizing Committee
Faculty of Engineering and Design

Dear Colleagues,

Re: Letter of Support for BEng Mechatronics Engineering

I am very pleased to provide a letter of support for the proposed BEng Mechatronics Engineering program. This program is an exceptional response to the convergence of mechanical, electrical, computer and systems engineering in our modern technical world. Giving students an enhanced and guided insights into how all these disciplines need to come together to address society's needs bodes well for the future of engineering.

The demand for such a program is immense. So many young talented people ask about whether we offer such a program and I look forward to being able to answer 'yes', instead of seeing their disappointment.

An element that is very much appreciated with respect to this program is the sincere and balanced blending of the root disciplines where we already have strength. So many of our professors identify in their research programs with the hybrid space between mechanical and electrical engineering systems that function under the control of software. Allowing students and professors to operate outside the artificial constraints of engineering's classical disciplines will be very good for appropriately addressing problems that have these characteristics.

The Faculty of Engineering and Design strongly supports the BEng Mechatronics Engineering, and how it will provide students with an exceptional learning experience.

Sincerely yours,

Larry Kostiuk
Dean

New Program Proposal

Date Submitted: 05/11/24 10:30 am

Viewing: TBD-2266 : Mechatronics Engineering Bachelor of Engineering

Last edit: 05/11/24 10:30 am

Last modified by: samuelajila

Changes proposed by: samuelajila

In Workflow

1. **FED ChairDir UG**
2. **ENG Dean**
3. **ENG FCC**
4. **ENG FBoard**
5. **PRE SCCASP**
6. SCCASP
7. SQAPC
8. Senate
9. PRE CalEditor
10. CalEditor

Approval Path

1. 05/11/24 10:32 am Samuel Ajila (samuelajila): Approved for FED ChairDir UG
2. 05/11/24 10:32 am Samuel Ajila (samuelajila): Approved for ENG Dean
3. 05/11/24 2:03 pm Samuel Ajila (samuelajila): Approved for ENG FCC
4. 05/11/24 2:12 pm Samuel Ajila (samuelajila): Approved for ENG FBoard

Effective Date	2025-26
Workflow	majormod
Program Code	TBD-2266
Level	Undergraduate
Faculty	Faculty of Engineering and Design
Academic Unit	Engineering & Design (Faculty of)
Degree	Bachelor of Engineering
Title	Mechatronics Engineering Bachelor of Engineering

Program Requirements

Mechatronics Engineering
Bachelor of Engineering (21.5 credits)

First year

1. a) 4.0 credits in:		4.0
CHEM 1101 [0.5]	Chemistry for Engineering Students	
ECOR 1041 [0.25]	Computation and Programming	
ECOR 1042 [0.25]	Data Management	
ECOR 1043 [0.25]	Circuits	
ECOR 1044 [0.25]	Mechatronics	
ECOR 1045 [0.25]	Statics	
ECOR 1046 [0.25]	Mechanics	
ECOR 1047 [0.25]	Visual Communication	
ECOR 1048 [0.25]	Dynamics	
MATH 1004 [0.5]	Calculus for Engineering or Physics	
MATH 1104 [0.5]	Linear Algebra for Engineering or Science	
PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion	
b) The Introduction to Engineering Disciplines requirement must be met through the successful completion of:		
ECOR 1055 [0.0]	Introduction to Engineering Disciplines I	
ECOR 1056 [0.0]	Introduction to Engineering Disciplines II	
ECOR 1057 [0.0]	Engineering Profession	
2. 0.5 credit in Complementary Studies Electives		0.5
3. 0.5 credit in Basic Science Electives		0.5

Second year

4. a) 6.0 credits in:		6.0
CCDP 2100 [0.5]	Communication Skills for Engineering Students	
ELEC 2501 [0.5]	Circuits and Signals	
ELEC 2507 [0.5]	Electronics I	
ELEC 2602 [0.5]	Electric Machines and Power	
MATH 1005 [0.5]	Differential Equations and Infinite Series for Engineering or Physics	
MATH 2004 [0.5]	Multivariable Calculus for Engineering or Physics	
MAAE 2101 [0.5]	Engineering Dynamics	
MAAE 2300 [0.5]	Fluid Mechanics I	
MAAE 2401 [0.0]	Course MAAE 2401 Not Found (New Course)	
SYSC 2310 [0.5]	Introduction to Digital Systems	
SYSC 2320 [0.5]	Introduction to Computer Organization and Architecture	
SYSC 2006 [0.5]	Foundations of Imperative Programming	

Third year

5. 5.5 credits in:		5.5
ECOR 2050 [0.5]	Design and Analysis of Engineering Experiments	
ECOR 3800 [0.5]	Engineering Economics	
ELEC 3508 [0.5]	Power Electronics	
ELEC 4709 [0.5]	Integrated Sensors	

MAAE 2001 [0.5]	Engineering Graphical Design	
MAAE 3004 [0.5]	Dynamics of Machinery	
MAAE 2203 [0.0]	Course MAAE 2203 Not Found (New Course)	
MECH 3002 [0.5]	Machine Design and Practice	
SYSC 3600 [0.5]	Systems and Simulation	
SYSC 3310 [0.5]	Introduction to Real-Time Systems	
SYSC 4505 [0.5]	Automatic Control Systems I	
b) Successful completion of		
ECOR 2995 [0.0]	Engineering Portfolio	
Fourth year		
6. 3.0 credits in:		3.0
ECOR 4995 [0.5]	Professional Practice	
MAAE 3505 [0.0]	Course MAAE 3505 Not Found (New Course)	
MAAE 4706 [0.0]	Course MAAE 4706 Not Found (New Course)	
MECH 4503 [0.5]	An Introduction to Robotics	
SYSC 3320 [0.5]	Computer Systems Design	
SYSC 4709 [0.0]	Course SYSC 4709 Not Found (New Course)	
7.0 1.0 credit from		1.0
MAAE 4907 [1.0]	Engineering Design Project	
OR		
SYSC 4907 [1.0]	Engineering Project	
OR		
ELEC 4907 [1.0]	Engineering Project	
OR		
ECOR 4907 [1.0]	Multidisciplinary Engineering Project	
8. 0.5 credit in Complementary Studies Electives		0.5
9. 0.5 credit in Engineering Elective or ECOR 2606		0.5
Total Credits		21.5

New Resources	No New Resources
Summary	New program Bachelor of Engineering in Mechatronics Engineering.
Rationale	The world today is a small village thanks to different technologies around us. We now have tools such as brain implant smart systems, electric vehicles (EVs), 3D wearable devices, etc. that use intelligence and allow us to operate dynamically in our environment fully connected and active. These “intelligent” systems or devices may be referred to as “Mechatronics” devices. To manage these devices effectively and efficiently, and innovate further, we need experts that can understand the intersection between mechanical, electronics, and computer systems parts. The complexity involves maintaining the balance between these intelligent devices necessitating the need to train young (and old) people in the art of designing and developing these new technologies. Since the demand for these new technologies is increasing daily, there is demand for more experts in the domain, and Carleton University Faculty of Engineering and Design will fill the gap by starting a new degree program in Mechatronics Engineering.
Transition/Implementation	New degree program

Program reviewer comments	**samuelajila (05/11/24 2:11 pm):** 1. The EFB gave a conditional approval for the new program on March 25, 2024. 2. The EFB gave a complete and unconditional approval for the new program was given at its meeting on April 25, 2024.

Key: 2266

Mechatronics associate Minor modifications

MAAE 2401	Mechatronics Thermodynamics and Heat
MAAE 2203	Mechatronics of Solids
MAAE 3505	Mechatronics I
MAAE 4706	Mechatronics II
SYSC 4709	Industrial Automation

Cyclical Program Review Volume II:

Faculty Curricula Vitarum

Mechatronics Engineering

March 2024

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Professor Mojtaba Ahmadi

Correspondence language: English

Contact Information

The primary information is denoted by (*)

Address

Courier

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Carleton University
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Ottawa Ontario K1S 5B6
Canada

Primary Affiliation (*)

Mechanical & Aerospace Engineering Dept.
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Professor Mojtaba Ahmadi

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes

Degrees

- 2000/5 Post-doctorate, Robotics and Teleoperation, École Polytechnique de Montréal
  Supervisors: Paul Cohen and Richard Hurteau, 1998/11 - 2000/6
- 1998/10 Doctorate, Mechanical Engineering (robotics), McGill University
  Supervisors: Martin Buehler, 1993/2 - 1998/10
- 1992/1 Master's Thesis, Mechanical Engineering (Controls), University of Tehran
  Supervisors: Ali Ghaffari, 1989/2 - 1992/1
- 1988/9 Bachelor's, Mechanical Engineering, Sharif University of Technology
  Supervisors: Ali Meghdari, 1984/2 - 1988/9

Recognitions

2023/3 Outstanding Faculty Graduate Mentor Award
Carleton University
Prize / Award
Nominated by Graduate Students

2023/2 Entrepreneurship Award, PEO Ottawa Chapter
Professional Engineers Ontario (PEO)
Prize / Award
Award given to an engineering entrepreneur in Ottawa: Startup MAE Robotics Inc.

2022/10 Best Paper Award: Modelling, Estimation, and Controls Conference (MECC)
IFAC
Prize / Award
My PhD student paper received the best conference award

2019/6 Best Paper Award
ASET (International Academy of Science and Technology)
Prize / Award
6th International Conference of Control Dynamic Systems and Robotics. Decided by session chairs.

2018/5	Faculty Research Achievement Award. Carleton University Prize / Award few awards given annually to faculty members with high research achievements

User Profile

Research Specialization Keywords: Robotics, Biomechatronics, Assistive Devices, Rehabilitation robotics, Mechatronics, Medical devices, Control systems, Optimization

Employment

2018/7	Cross-Appointed Professor Systems and Computer Engineering, Faculty of Engineering and Desing, Carleton University Full-time Tenure Status: Tenure
2017/7	Full Professor Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University Full-time Tenure Status: Tenure
2010/7 - 2017/6	Associate Professor Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University Full-time Tenure Status: Tenure
2005/7 - 2010/6	Assistant Professor Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University Full-time Tenure Status: Tenure Track
2002/6 - 2005/6	Research Council Officer Institute for Aerospace Research, National Research Council Canada Lead robotic activities related to the design of a new wind tunnel robotic system.
2001/11 - 2002/5	Research Associate Génie électrique et génie informatique, Faculty of Engineering, École Polytechnique de Montréal Full-time Tenure Status: Non Tenure Track
2002/1 - 2002/4	Part-time faculty member Mechanical Engineering, Faculty of Engineering, Concordia University Part-time, Lecturer Tenure Status: Non Tenure Track
2001/4 - 2001/8	Senior Servo Engineer Maxtor Corporation
2001/2 - 2001/4	Senior Servo Engineer Quantum Corporation

2000/5 - 2001/2
Manager
Advanced Robotics and Controls Group, Opal-RT Technologies Inc.
Led the Advanced Robotics and Controls Group

1998/3 - 1998/11
Research Engineer
Centre for Intelligent Machines, Faculty of Engineering, McGill University
Full-time
Tenure Status: Non Tenure Track

1993/2 - 1998/3
Research Assistant
Centre for Intelligent Machines, Faculty of Engineering, McGill University
Full-time
Tenure Status: Non Tenure Track

Leaves of Absence and Impact on Research

2018/7 - 2019/6
Sabbatical, Carleton University
During Sabbatical i spent significant time dealing with sever health issues of parents of mine and of my spouse's and losing one. Impact has not been too significant, but these caused delays in preparation and submission of articles.

Research Funding History

Awarded [n=9]

2020/9 - 2026/8
Co-applicant
Building Trust in Connected and Autonomous Vehicles, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
CREATE
Total Funding - 1,650,000
Portion of Funding Received - 165,000
Funding Competitive?: Yes

2021/5 - 2026/4
Principal Investigator
Intelligent Human-Interactive, Assistive, and Rehabilitation Systems and Robots, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 195,000
Portion of Funding Received - 195,000
Funding Competitive?: Yes

2023/7 - 2025/7
Principal Investigator
Real-time Control Software, Calibration, and Assessment of a Redundant Robotic System Operating in a Supersonic Wind-Tunnel, Grant

Funding Sources:
Mathematics of Information Technology and Complex Systems (MITACS)
Postdoc funds (Accelerate)
Total Funding - 120,000
Portion of Funding Received - 120,000
Funding Competitive?: Yes

Co-applicant : Nafiseh Kahani

2021/1 - 2024/4
Co-applicant
Abilities Living Lab (ALL), Grant

Funding Sources:
Canada Foundation for Innovation (CFI)

CFI-IF, a Major Infrastructure Grant
Total Funding - 4,500,000
Portion of Funding Received - 1,500,000
Funding Competitive?: Yes

2017/9 - 2023/8
Co-applicant

Research and Education in Accessibility Design and Innovation (READi) Training Program, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
CREATE
Total Funding - 1,650,000
Portion of Funding Received - 165,000
Funding Competitive?: Yes

2020/5 - 2022/4
Principal Investigator

Industrial Robotic Deburring for Aerospace Structures, Grant

Funding Sources:
Ontario Center of Excellence (OCE)
VIP-II
Total Funding - 150,000
Portion of Funding Received - 150,000
Funding Competitive?: Yes

2020/7 - 2021/6
Principal Investigator

Semi-Autonomous Mobile Robotic Systems for Remote Assessments of CoVID-19 Patients, Grant

Funding Sources:
Carleton University
Total Funding - 18,000
Portion of Funding Received - 18,000
Funding Competitive?: Yes

Co-applicant : Dr. Anna McCormick - Children Hospital

2018/5 - 2021/4
Principal Investigator

Sensor-based Robotic Deburring for Aerospace Structures, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Collaborative Research and Development
Total Funding - 600,000
Portion of Funding Received - 600,000
Funding Competitive?: Yes

2015/4 - 2020/3
Principal Investigator

Interactive Robotic and Rehabilitation Systems, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 110,000
Portion of Funding Received - 11,000
Funding Competitive?: Yes

Completed [n=5]

2018/1 - 2020/6
Principal Investigator

Universal Intelligent Assistive Devices for Media Content Accessibility, Grant

Funding Sources:
Broadcast Accessibility Funds
Research Grants
Total Funding - 83,600

Portion of Funding Received - 83,600
Funding Competitive?: Yes

2019/5 - 2019/9
Principal Investigator

Early Stroke Robotic Intervention

Funding Sources:
Ottawa Hospital Research Institute (OHRI)
Research Contract
Total Funding - 5,000
Portion of Funding Received - 5,000
Funding Competitive?: No

2018/7 - 2019/7
Principal Applicant

Faculty Research Award, Grant

Funding Sources:
Carleton University
(award competition with cash prize)
Total Funding - 10,000
Portion of Funding Received - 100
Funding Competitive?: Yes

2018/1 - 2018/6
Principal Investigator

Master-Slave Camera System for Sporting Events, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Engage
Total Funding - 25,000
Portion of Funding Received - 25,000
Funding Competitive?: Yes

2017/5 - 2017/9
Principal Investigator

Multimodal Passenger Interfaces for Next Generation Business Jets, Grant

Funding Sources:
Mathematics of Information Technology and Complex Systems (MITACS)
Accelerate
Total Funding - 15,000
Portion of Funding Received - 50
Funding Competitive?: Yes

Student/Postdoctoral Supervision

Bachelor's [n=5]

2022/5 - 2022/9
Principal Supervisor

Kai Houston (Completed) , Carleton University
Thesis/Project Title: Robotic and Mechatronic Systems Design and Implementation.
Present Position: Student, Carleton University

2021/9 - 2022/9
Principal Supervisor

Nourjehan Faris (In Progress) , Carleton University
Thesis/Project Title: Software for Interactive Robot Manipulators
Present Position: Student, Carleton University

2019/9 - 2020/12
Principal Supervisor

Keyanna Coughlan (In Progress) , Carleton University
Thesis/Project Title: Telepresence Robotics for CoVID-19 Remote Patient Assessment: Design (to start Masters Jan 2021)
Present Position: Undergrad Researcher

2019/9 - 2020/12
Principal Supervisor
Max Polzin (In Progress) , Carleton University
Thesis/Project Title: Telepresence Robotics for CoVID-19 Remote Patient Assessment: Software (To start Masters Jan 2021)
Present Position: Undergrad Researcher

2018/5 - 2018/12
Co-Supervisor
Devin Wang, Carleton University
Thesis/Project Title: Development and integration of the Robotic Deburring Cell.
Present Position: Coop Student, Carleton University

Master's Thesis [n=9]

2021/1 - 2022/1
Principal Supervisor
Sami Nassif-LaChappelle (In Progress) , Carleton University
Thesis/Project Title: Reconfigurable Robotic Arms
Present Position: Student, Carleton University

2020/9 - 2022/6
Principal Supervisor
Mauricio Ledon (In Progress) , Carleton University
Student Degree Expected Date: 2022/9
Thesis/Project Title: Intelligent Interfaces for Persons with Disability
Present Position: Student

2020/6 - 2022/9
Principal Supervisor
Wade McMillan (Completed) , Carleton University
Thesis/Project Title: Optimal Process Planning for Robotic Precision Machining
Present Position: Student

2019/1 - 2021/1
Principal Supervisor
Mahdokht Golmohammadi (Completed) , Carleton University
Thesis/Project Title: Development and On-site Experiments of an Early Stroke Rehabilitation Robotic System
Present Position: student, Carleton University

2018/9 - 2020/8
Principal Supervisor
Hasti Kkiabani (Completed) , Carleton University
Thesis/Project Title: Controllers for Assisted Walking and Biomechanics of Walking for People with Disability using an Intelligent Walker
Present Position: student, Carleton University

2018/9 - 2020/9
Co-Supervisor
Grael Miller (Completed) , Carleton University
Thesis/Project Title: Robotic Deburring Process Modelling and Implentaion
Present Position: student

2018/1 - 2019/9
Principal Supervisor
Steffan Lloyd (Completed) , Carleton University
Thesis/Project Title: Sensor-based Precision Deburring
Present Position: PhD student, Fast- Tracked to PhD

2017/9 - 2019/9
Principal Supervisor
Nicholas Berezny (Completed) , Carleton University
Thesis/Project Title: Light weight robotic system for virtual gait rehabilitation
Present Position: student

2016/9 - 2018/9
Principal Supervisor
Stephanie Eng (Completed) , Carleton University
Thesis/Project Title: Dynamic Balance Measures and Sensing for Humans in Fall Detection and Prevention, nominated for Senate Medal
Present Position: Research Engineer, MD Robotics, Toronto

Doctorate [n=6]

2022/5 - 2026/5
Principal Supervisor
Hossein Sadat Hosseini (In Progress) , Carleton University
Thesis/Project Title: Advanced Intention Detection and Human-Robot Interaction for Assistive Robotic Systems
Present Position: Student, Carleton University

2021/9 - 2025/9 Principal Supervisor	Arash Abarghooei (In Progress) , Carleton University Student Degree Expected Date: 2025/9 Thesis/Project Title: Learning Controllers for Assisted Driving Present Position: Student, Carleton University
2020/1 - 2024/9 Principal Supervisor	Masoud Karimi (In Progress) , Carleton University Student Degree Expected Date: 2024/9 Thesis/Project Title: Behaviour Based Learning Control in Robotics Present Position: Student
2020/1 - 2024/1 Principal Supervisor	Nicholas Berezny (In Progress) , Carleton University Student Degree Expected Date: 2024/1 Thesis/Project Title: Robotic Platforms for Virtual Gait Rehabilitation for Early Stroke Present Position: Research Associate, Carleton University - ABL lab
2019/9 - 2023/10 Principal Supervisor	Steffan Lloyd (Completed) , Carleton University Thesis/Project Title: Sensor-based Feedback Control of Robotic Precision Machining Present Position: PhD Student, ABL Lab, Carleton University
2015/5 - 2019/10 Principal Supervisor	Osama Al-Mai (Completed) , Carleton University Thesis/Project Title: Design, Development and Calibration of Compliant, Multi-Axis, Fiber-Optic Force/Torque Sensors for Biomechanical Measurements, Nominated for Senate Medal Present Position: Faculty Member, Department of Electronics, Institute of Technology, Mizdah, Lybia

Post-doctorate [n=2]

2023/7 - 2025/6 Principal Supervisor	Mohammadreza Dehghani Tafti, Carleton University Thesis/Project Title: Real-time control of robotic systems in supersonic wind tunnel. Present Position: Postdoctoral Fellow, Carleton University
2019/9 - 2023/4 Principal Supervisor	Mohammadreza Dehghani Tafti (Completed) , Carleton University Thesis/Project Title: Control of Robotic Systems in Precision Machining Present Position: Postdoctoral Fellow, ABL-Lab, Carleton University

Research Associate [n=3]

2020/1 - 2022/12 Principal Supervisor	Ryan Mackenzie, Carleton University Thesis/Project Title: Sensor-based Precision Robotic Deburring Present Position: Research Associate
2019/12 - 2020/5 Principal Supervisor	Narges Zarei, Carleton University Thesis/Project Title: Gesture-based User Interface for Individuals with CP Present Position: Phd Student, Carleton University
2019/9 - 2019/12 Principal Supervisor	Nick Berezny (Completed) , Carleton University Thesis/Project Title: Robotic Software for Virtual Gait Rehabilitation Present Position: Research Associate, ABL- Lab, Carleton University

Event Administration

2017/9 - 2023/9	Symposium Organizer, Research and Education in Accessibility, Design, and Innovation (READi): The Annual Symposium., Seminar, 2017/9 - 2023/9
2019/11 - 2020/6	Organizer and Panel Moderator, Enable Ottawa: Panel Discussion on Activities on Technologies Related to Healthcare and Rehabilitation, Conference, 2020/6 - 2020/6

2016/5 - 2020/6 Planning Committee Member, Enable Ottawa (member of the planning committee for the last 4 years, from the event's inception)., Conference, 2016/5 - 2020/6

2016/5 - 2019/6 Chair, International Conference on Control Dynamic Systems and Robotics (acted as the conference chair for 4 years), Conference, 2016/5 - 2019/6

Knowledge and Technology Translation

2018/10 - 2028/10 Founder, Involvement in/Creation of Start-up
Group/Organization/Business Serviced: MAE Robotics Inc
Target Stakeholder: Industry/Business-Small (<100 employees)
Outcome / Deliverable: The company was established and still operating
Activity Description: A startup was founded that is taking on the development of complex robotic systems as well as a novel force sensor for robotics that will enter the market in 2023. The company employs

2024/1 - 2026/1 PI, Business Innovation
Group/Organization/Business Serviced: Arnprior Aerospace Inc.
Target Stakeholder: Industry/Business-Medium (100 to 500 employees)
Outcome / Deliverable: Technology being patented and licensed through school to the inudstrial partner.
Activity Description: A technology that was developed in our lab after 5 years of research was transferred to the industrial partner through an agreement.

2012/9 - 2020/9 Co-founder, Involvement in/Creation of Start-up
Group/Organization/Business Serviced: GaitTronics
Target Stakeholder: Private Not-for-Profit Organization
Outcome / Deliverable: GaitEnable: A robotic patient mobility system.
Evidence of Uptake/Impact: Tech Transfer to GaiTronics startup, Ottawa. Robot commercialized already. Acquisition and research expected from Bloorview and Ottawa Hospitals.
References / Citations / Web Sites: www.gaittronics.com
Activity Description: One of my research projects on robotics for rehabilitation and early mobilization led to a novel robot called GaitEnable (3 papers and one patent). This activity led to co-founding GaitTronics Inc. in Ottawa together with two of my PhD students. The project students received two awards Ontario Brain Institute and Ontario Centers of Excellence (Walmsley awards) amounting more than $300,000 as well as other commercialization funds. The system is now commercialized as Solowalk. A unit is purchased by Children Hospital (CHEO) and is currently being tested for rehabilitation of teenage children with Cerebral Palsy.

2018/1 - 2018/6 PI, R&D Collaboration with Industry
Group/Organization/Business Serviced: Ross Video
Target Stakeholder: Industry/Business (>500 employees)
Outcome / Deliverable: A Master-slave Camera Based Tracking System for Sport Event Broadcasting.
Evidence of Uptake/Impact: Upon completion, PhD student moved on to work for the company and a new product is being developed based on this technology.
Activity Description: Collaborative research on concept development and prototyping a self-calibrating master slave tracking camera system for horse-racing events. Funded via an Engage Grant.

2017/5 - 2017/9 PI, R&D Collaboration with Industry
Group/Organization/Business Serviced: Bombardier
Target Stakeholder: Industry/Business (>500 employees)
Outcome / Deliverable: Prototype and designs
Evidence of Uptake/Impact: Patent filed. Application # 20200130838 16/665710
References / Citations / Web Sites: https://uspto.report/patent/app/20200130838
Activity Description: A novel projection-based (touchless) user interface using hand gesture and vision cameras was designed and developed for future business aircrafts. The technology was prototyped and demonstrated to Bombardier and identified as a priority for future developments. A patent was filed.

Committee Memberships

2020/4 Committee Member, Advisory Committee to the Vice President Research and International on Technology Transfer, Carleton University
Work with the Vice President Research on the University's technology transfer guidelines development and monitoring and advising faculty members.

2019/7 Committee Member, IEEE Rehabilitation and Assistive Robotics Technical Committee, IEEE

2017/1 Committee Member, Professional Engineers Ontario (PEO) Entrepreneurial Competition Committee (and Judge), Professional Engineers Ontario
Students and Engineers are challenged each year to bring forward and present ideas in solving large scale societal and environmental problems (such as CO2 reduction, water purification in Africa, etc.).

2012/5 Committee Member, Advisory Board, READ Initiative, Carleton University
Research, Education, Accessibility, and Design is a new initiative at Carleton U. aiming at solving problems related to accessibility for people with disability.

2019/7 - 2020/6 Committee Member, Research Ethics Board (REB), Carleton University
The committee evaluates and authorizes any research projects that will involve human participants at Carleton University.

2014/6 - 2017/6 Committee Member, Standards Council Canada Mirror Committee for ISO (CAC/ISO/TC266), Standards Council Canada
Evaluating the new ISO Biomimetic stadndard (currently being developed) and assisting in forming Canada's position on ISO 18457, 18458.

Other Memberships

2020/7 Mentor, Ottawa Community Immigration Services Organization
Will assist/mentor newcomers / vulnerable populations with regards to career, adjusting to the new environment and culture or any other concerns they may have.

Presentations

1. Mr. Arash Abarghooei (my PhD students). (2024). Intelligent and Learning Assistive Devices and Robotic Systems. Professional Engineers Ontario (PEO) Annual General Meeting, Ottawa, Canada
Invited?: Yes, Keynote?: Yes

2. Dr. Hana Alazam (MD, Children Hospital). (2022). Design and Control in Biorobotics and Rehabilitation Systems. Global Perspectives on Medicine, Rehabilitation and Robotics Webinar Series, IEEE Robotics and Automation Society, Philadelphia, United States of America
   Main Audience: Researcher
   Invited?: Yes, Keynote?: No
3. Masoud Karimi. (2022). A Reinforcement Learning Approach in Assignment of Task Priorities in Kinematic Control of Redundant Robots. IEEE International Conference on Robotics and Automation, Philadelphia, United States of America
   Invited?: No, Keynote?: No
4. Co-presenters: Mojtaba Ahmadi, Adrian Chan, Bjarki Halgrimsson. (2018). Innovation and Accessibility. Invited talk and Panel Discussion: Federal Government Launch Event for Innovative Design and Accessibility Program, Ottawa, Canada
   Main Audience: Knowledge User
   Invited?: Yes, Keynote?: No
5. Co-presenters: Mojtaba Ahmadi, Heidi Sveistrup. (2018). Mobility, Balance, and Rehabilitation: Principles and Emerging Technologies. Enable Ottawa, Ottawa, Canada
   Main Audience: Knowledge User
   Invited?: Yes, Keynote?: No

Broadcast Interviews

2011/07/22 - 2011/07/22	Robots Help Patients Walk Again, Ottawa Morning, CBC Radio
2010/05/06 - 2010/05/06	Biomedical Robot Development, Daily Planet, Discovery Channel

Publications

Journal Articles

1. Steffan Lloyd, Rishad Irani, Mojtaba Ahmadi. (2024). Precision robotic deburring with Simultaneous Registration and Machining for improved accuracy, quality, and efficiency. Robotics and Computer-Integrated Manufacturing. 88
   Published
   Refereed?: Yes, Open Access?: Yes
2. Steffan Lloyd, Rishad Irani, Mojtaba Ahmadi. (2023). Improved Accuracy andContact Stability in Robotic Contouring with Simultaneous Registration and Machining. IEEE Transactions on Control Systems Technology.
   Accepted
   Refereed?: Yes
3. Mohammadreza Dehghani*, Ryan A McKenzie*, Rishad A Irani, Mojtaba Ahmadi. (2023). Robot-mounted sensing and local calibration for high-accuracy manufacturing. Robotics and Computer-Integrated Manufacturing. 79: 1-14.
   Published
   Refereed?: Yes

4. Wade R MacMillan*, Rishad A Irani, Mojtaba Ahmadi. (2023). Planar image-space trajectory planning algorithm for contour following in robotic machining. CIRP Journal of Manufacturing Science and Technology. 42: 1-11.
   Published
   Refereed?: Yes

5. Steffan Lloyd*, Rishad Irani, Mojtaba Ahmadi. (2023). Precision Robotic Deburring with Simultaneous Registration and Machining for Improved Accuracy, Quality, and E?>ciency. Robotics and Computer-Integrated Manufacturing.
   Revision Requested
   Refereed?: Yes

6. Masoud Karimi, Mojtaba Ahmadi. (2023). Intelligent Learning Assistive Devices (iLeAD) Framework: Adaptive Shared Control in Exoskeletons via Deep Reinforcement Learning. IEEE Transactions on Robotics.
   Submitted
   Refereed?: Yes

7. Nicholas Berezny, Mojtaba Ahmadi. (2023). Interpolating across the impedance/admittance spectrum with Unified Interaction Control. Discover Mechanical Engineering (Springer). : 1-24.
   In Press
   Refereed?: Yes, Open Access?: Yes

8. Lloyd, Steffan, Irani, Rishad , Ahmadi Mojtaba. (2022). Fast and Robust Inverse Kinematics of Serial Robotsusing Halley’s Method. IEEE Transactions on Robotics (T-RO). 38(5): 2768 - 2780.
   Published
   Refereed?: Yes

9. O. Al-Mai*, M. Ahmadi,. (2022). Novel Calibration Methodologies for Compliant, Multi-Axis, Fiber-Optic Based Force/Torque Sensors. IEEE Transactions on Instrumentation and Measurement. 22(22): 21727-21734.
   Published
   Refereed?: Yes

10. Masoud Karimi and Mojtaba Ahmadi. (2022). A Reinforcement Learning Approach in Assignment ofTask Priorities in Kinematic Control of Redundant. IEEE Robotics and Automation Letters. 7(2): 850 - 857.
    Published
    Refereed?: Yes

11. Richard Beranek*, Masoud Karimi*, Mojtaba Ahmadi. (2021). A Behavior-Based Reinforcement Learning Approach to Control Walking Bipedal Robots under Unknown Disturbances. IEEE/ASME Transactions on Mechatronics. : 1-11.
    Published
    Refereed?: Yes

12. Grael Miller*, Rishad A Irani, Mojtaba Ahmadi. (2021). Application of mechanistic force models to features of arbitrary geometry at low material removal rate. The International Journal of Advanced Manufacturing Technology. 117(9): 2741-2754.
    Published
    Refereed?: Yes

13. O. Al-Mai*, J. Albert, M. Ahmadi. (2020). Development and Characterization of Compliant FBG-Based, Shear and Normal Force Sensing Elements for Biomechanical Applications. IEEE Sensors. 20(10): 5176 - 5186.
    Published
    Refereed?: Yes

14. Steffan Lloyd*, Rishad Irani, Mojtaba Ahmadi. (2020). Using neural networks for fast numerical integration and optimization. IEEE Access. 8: 84519 - 84531.
    Published
    Refereed?: Yes, Open Access?: Yes
15. N. Berezny*, D. Dowlatshahi, M. Ahmadi. (2020). Feasibility of a 1-DOF Linear Robot for Bed-bound Stroke Rehabilitation. ASME Journal of Medical Devices.
    Revision Requested
    Refereed?: Yes
16. Grael Miller*, Rishad Irani, Mojtaba Ahmadi. (2020). The Application of Mechanistic Cutting Force Models for Deburring. International Journal of Advanced Manufacturing Technology. 115(1-2): 199-212.
    Published
    Refereed?: Yes
17. Steffan Lloyd*, Rishad Irani, Mojtaba Ahmadi. (2020). A Numeric Derivation for Fast Regressive Modeling of Manipulator Dynamics. Mechanisms and Machine Theory Journal.
    In Press
    Refereed?: Yes
18. O. Al-Mai*, M. Ahmadi, J. Albert,. (2018). Design, Development and Calibration of A Lightweight,Compliant 6-Axis Optical Force/Torque Sensor. IEEE Sensors. 18(17): 7005-7014.
    Published
    Refereed?: Yes, Open Access?: No
19. Stephanie Eng*, O. Al-Mai*, M. Ahmadi,. (2018). A 6-DoF, Wearable, Compliant Shoe Sensor for Gait Analysis. IEEE Transactions on Instrumentation and Measurement. 67(11): 2714-272.
    Published
    Refereed?: Yes, Open Access?: No

Conference Publications

1. Steffan Lloyd, Rishad Irani, Mojtaba Ahmadi. (2023). A Framework for Simultaneous Workpiece Registration in Robotic Machining Applications. IEEE International Conference on Robotics and Automation (ICRA), (5249-5255)
    Paper
    Published
    Refereed?: Yes, Invited?: No
2. Arash Abarghooei, Mojtaba Ahmadi. (2023). Driving Behaviour Detection using Smart Steering Wheel: Supervised and Unsupervised Classification*. IEEE Sensor Application Symposium,
    Paper
    Published
    Refereed?: Yes, Invited?: No
3. Steffan Lloyd*, Rishad Irani, Mojtaba Ahmadi. (2022). The application of mechanistic cutting force models for robotic deburring. Modeling, Estimation and Control Conference,
    Paper
    Accepted
    Refereed?: Yes, Invited?: No
4. Hasti Khiabani, Mojtaba AHmadi. (2021). Classical MachineLearning Approach For EMG-Based Lower Limb Intention Detection For Human-Robot InteractionSystems. IEEE International Conference on Autonomous Systems,
    Paper
    Published
    Refereed?: Yes, Invited?: No

5. Colin Miyata, Mojtaba Ahmadi. (2019). Compliant Limb Sensing and Control for Safe Human Robot Interactions. Proceedings. IEEE International Conference on Robotics and Automation (ICRA 2019), (7484-7490)
   Paper
   Published
   Refereed?: Yes, Invited?: No

6. A. Zreiba, M. Ahmadi, A. Etemad,. (2019). Simulation of Human Balance Impairment on a Biped Robot, paper #139. proceedings. Int. Conf. on Control, Dynamic System, and Robotics,
   Abstract
   Published
   Refereed?: No, Invited?: Yes

7. N. Berezny, Dar Dowlatshahi, Mojtaba Ahmadi. (2019). Interaction Control and Haptic Feedback for a Lower-limb RehabilitationRobot with Virtual Environments (received Best Paper/PresentationAward). International Conference on Control, Dynamic Systems. and Robotics,
   Abstract
   Published
   Refereed?: No, Invited?: Yes

8. O. Al-Mai. (2019). Fiber-Optic Based, Force and Torque Compliant Sensing Calibration Strategies, paper #144. Int. Conf. on Control, Dynamic System, and Robotics (CDSR),
   Abstract
   Published
   Refereed?: No, Invited?: Yes

9. C. Miyata, M. Ahmadi. (2019). On the Development of a Compliant Sensor Shell for use in Robot Safety, paper #143. Int. Conf. on Control, Dynamic System, and Robotics,
   Abstract
   Published
   Refereed?: No, Invited?: Yes

10. N. Berezney, D. Dowlatshahi, M. Ahmadi,. (2019). Novel Concept of a Lower-limb Rehabilitation RobotTargeting Bed-bound Acute Stroke Patients. Proceedings. Canadian Medical and Biomedical Engineering Society Conference,
    Conference Date: 2019/5
    Paper
    Published
    Refereed?: Yes, Invited?: No

11. Ahmadi M, Chan ADC, Davies C, Frankel L, Girouard A, Graham T.C., Labiche Y, Lemaire E, Stewart J, Trudel C. (2018). Research and Educationin Accessibility, Design, and Innovation: Integrating Post-Secondary Training in Accessibility. Accessibility Canadian Engineering Education Conference, Vancouver, Canada
    Paper
    Published
    Refereed?: Yes, Invited?: No

Intellectual Property

Patents

1. System and Method for Providing Passenger Interfaces. United States of America. U.S. 16/665710. 2018/10/30.
   Patent Status: Pending
   Inventors: Mojtaba Ahmadi Soon Jung Bang Nikolas Beaudin Thomas Fikhelstein Louis Gagnon Seguin Omar Masaud Darren O'Neil Chantal Trudel
   A novel projection-based user interface for future business jets developed for Bombardier. This was the result of a short MITACS collaborative project.
2. Control System and Device for Patient Assist. United States of America. US9907721B2. 2018/03/06.
   Patent Status: Granted/Issued
   Year Issued: 2018
   Inventors: Ali Morbi, Mojtaba Ahmadi, Richard Beranek
   This PCT international patent covers a novel device (GaitEnable) design for fall prevention and its control system which guarantees human-robot interaction stability.

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Academic Appointments

Department of Systems and Computer Engineering — **Associate Professor**
Carleton University, Ottawa, Ontario — Jul. 2021 – present

Department of Systems and Computer Engineering — **Assistant Professor**
Carleton University, Ottawa, Ontario — Jan. 2019 – Jun.2021

Department of Electronics — **Assistant Professor**
Carleton University, Ottawa, Ontario — Aug. 2016 – Dec. 2018

Department of Mechanical and Mechatronics — **NSERC Postdoctoral Fellows**
University of Waterloo, Waterloo, Ontario — Jan. 2016 – Aug. 2018

Department of Electrical and Computer Engineering — **Adjunct Professor**
Queen's University, Kingston, Ontario — Jan. 2016 – May. 2016

Department of Electrical and Computer Engineering — **Adjunct Professor**
Royal Military College of Canada, Kingston, Ontario — Jan. 2015 – Dec. 2015

Department of Electrical and Computer Engineering — **MiTACS Postdoctoral Fellow**
Queen's University, Kingston, Ontario — Jan. 2015 – Dec. 2015

Department of Electrical and Computer Engineering — **Postdoctoral Fellow**
Queen's University, Kingston, Ontario — May. 2013 – Dec. 2014

Department of Electrical and Computer Engineering — **Ph.D. Candidate**
Queen's University, Kingston, Ontario — Sept. 2009 – April. 2013

Industry Experience

Intelligent Mechatronics Systems (IMS) — **Systems Engineer (R&D)**
Waterloo, Ontario — Jan. 2015 – Dec. 2015

Trusted Positioning Inc. — **Software Development Manager**
Calgary, Alberta — Jan. 2011 – Feb. 2013

Asset Technology Group — **Project Leader, R&D**
Cairo, Egypt — Jan. 2008- Sept. 2009

Sakhr Software Company — **Team Leader, R&D**
Cairo, Egypt — Sept. 2003- Dec. 2007

Sakhr Software Company — **Software Engineer, R&D**
Cairo, Egypt — Sept. 2000- Aug. 2003

Funding Record

Agency/Program/Project	Role	Amount	Year
Provectus Robotics Solutions Inc. Radar/Vision-Aided Navigation in GNSS-denied Environments	Principal Investigator Granted	$81K	2022-2023
General Dynamics Automated Human Audio Intelligibility Assessment using Machine Learning	Principal Investigator Granted	$25K	2022
DND/IDEaS 2 Advanced Situational Awareness Framework for Ships using BLE and IMU Fusion	Principal Investigator Granted	$219K	2022
DND/IDEaS Phase B Navigation and Timing in GPS-denied Environments using Hybrid Natural-SLAM Approach integrated with UWB self-configurable networks	Principal Investigator Granted	$817K	2019-2021
Ericsson Fellowship ($40K/year) 5G Network Applications in Sensors and Context Awareness Systems	Student Supervisor Granted	$40K	2020-2021
DND/IDEaS Phase A Navigation and Timing in GPS-denied Environments using Hybrid Natural-SLAM Approach integrated with UWB self-configurable networks	Principal Investigator Granted	$164K	2018-2019
NSERC/Engage Occupancy-based Adaptive HVAC Control for Energy Efficient Residential Buildings	Principal Investigator Granted	$25K	2018-2019
NSERC/Discovery (DG) Real-time Onboard Multi-Sensor Navigation Systems for Unmanned Aerial Vehicles in GPS-challenging	Principal Investigator Granted	$145K	2017-2023
NSERC/PDF Map-aided Navigation in Urban Environments	Applicant Granted	$90K	2016-2018
MITACS/PDF Lane-determination for Automotive Vehicles	Applicant Granted	$115K	2015-2016
Carleton/I- CUREUS Indoor Positioning using UWB networks	Student Supervisor Granted	$2.5K	2017-2018
Carleton/I- CUREUS	Student Supervisor	$2.5K	2017-2018

Indoor Positioning using ZigBee networks	Granted		
Alberta/AIF (Alberta Innovate Fund) Multi-sensor Navigation Systems	Applicant Granted	$147K	2011-2012
Carleton/Start-up Grant Start-up fund for new faculty	Applicant Granted	$30K	2016-2023
(Total Funding)		**$2 M**	

Graduate Students Supervision/Co-supervision Record

Student	Program	Start Date	Status
Mai Abourobea Official Main Supervision	PHD	W2023	In-progress
Jonathan Plangger Official Main Supervision	MAS	F2021	In-progress
Divyam Sharma Official co-supervision	MAS	W2023	In-progress
Petar Mitrev Official Sole Supervision	MAS	F2022	In-progress
Amirhossein Asgharnia Official co-supervision	PHD	F2019	Completed W2023.
Hongzhao Zheng Official co-supervision	PHD	F2019	Passed Comp. Exam W2020.
Tariq Maksoud Official co-supervision	MAS	F2021	Completed S2023
Rohan Kumar Reddy Damagatla Official Main Supervision	MAS	F2021	Completed F2023
Sarat Rodin Official Main Supervision	MAS	F2021	Completed F2023
Junwen Fu Official Sole Supervision	MAS	F2020	Completed S2022
Vishnu Priya Official Sole Supervision	MAS	F2020	Completed W2022
Ahmed Mahmoud Official Sole Supervision	PHD	W2019	Completed S2022
Soroush Sheikhpour Official Primary Supervision	PHD	F2017	Completed S2021
Alan Zhang Official Sole Supervision	MAS	F2018	Completed S2020
Hamza Sadruddin Official Sole Supervision	MAS	F2018	Completed S2020
Meron Gessesse Official Sole Supervision	MAS	F2016	Completed S2018
Raj Ramani	MEng	F2016	Completed S2018

Official Sole Supervision

Shifei Liu	PHD	F2014	Completed S2016
Informal co-supervision			
Jianzhong Xia	MAS	F2014	Completed S2016
Informal co-supervision			
Basem Amer	PHD	F2014	Completed S2018
Informal co-supervision			
Malek Karaim	PHD	F2013	Completed S2019
Informal co-supervision			
Tashfeen Karamat	PHD	F2009	Completed W2014
Informal co-supervision			

Undergraduate Students Supervision/Co-supervision Record

Summer/Internship Students

Student	Program/Project	Year	Project
Ifiok Udoh	Summer/Co-op internship	2023	BLE-based Wireless Positioning
Frank Xu	Summer/Co-op internship	2020	Indoor Map Visualization
Junwen Fu	Summer/Co-op internship	2020	3D SLAM Visualization
Islam Ibrahim	I-CUREUS	2019	UWB Wireless Positioning
Ghada Mustafa	I-CUREUS	2018	ZigBee Wireless Positioning
Shane Macisaac	Summer/Co-op internship	2017	IMU sensor calibration
Stefan Marinov	Summer/Co-op internship	2017	IMU sensor calibration

4th year undergraduate projects

Students	Role	Year	Project
Nicholas Fejes, Hari Saravanan, Michael Purcell, Weihong Shen	Co-supervisor	2022-2023	SLAM Based Navigation for Robotics
Neethan Sriranganathan; Idir Zerrouk; Mohammad Issa; Andy Lau; Solan Siva	Sole Supervisor	2021-2022	Drone Power Management System
Huzaifa Mazhar; Dominique Giguere Samson; Harshil Verma; Samy Aljamal; Akkash Anton Amalarajah	Sole Supervisor	2021-2022	Non-GPS Navigation and Guidance System
Loulia Massarani; Shady Eloraby; Ryan Gaudreault; Ruqaya Almalki	Sole Supervisor	2020-2021	Remote Control of Drone using Hand Gestures
James Desrosiers; Abdul-Rahmaan Rufai; Cameron McFadden	Sole Supervisor	2020-2021	Covid-19 Vanguard

Zoya Mushtaq; Dare Balogun Emad Arid; Gregory Koloniaris; Anannya Bhatia	Sole Supervisor	2019-2020	IndoorView: An Indoor mobile Mapping System for Carleton Campus
Zubaer Ahmed; Birat Dhungana; Ilham Rahman; Muaz Almalki	Sole Supervisor	2019-2020	Ultra-Wideband Camera Tracking System
John Turner; Alden Wang; Aaron Vuong	Co-supervisor	2019-2020	Differential Power Analysis Hardware Validation Station
Sebastien Cook; Maveric Garde; Fatima Hashi; Nour Rei; Kevin Sun	Co-supervisor	2019-2020	From 3D space-modeling to autonomous robotic item handling
Mujaheed Khan; Shamoon Irshad Junwen Fu; Youssef Al Sabbagh; Adam Fillion	Sole Supervisor	2018-2019	ADAS Pedestrian Detection using Fusion of Radar, LiDAR, and Camera
Jacob Godin; Ryan McDonell; Alex Rochefort; Islam Ibrahim	Sole Supervisor	2018-2019	UWB-enabled UAV that can navigate indoors without GPS
Matthew Bovolotto; Alec Sanderson; Rigved Abhang; Khalid Alharthi; Althaf Ahamed	Sole Supervisor	2017-2018	Indoor Navigation using smartphone Sensors

Teaching Record

Course	Institution	Term	Evaluation
SYSC3310: Introduction to Real-time Systems	Carleton University	F2022	4.8/5
SYSC3320: Computer Systems Design (SoC Approach)	Carleton University	W2022	4.27/5
SYSC 5807- W: Sensor Fusion for Autonomous Systems	Carleton University	W2022	4.08/5
SYSC3310: Introduction to Real-time Systems	Carleton University	F2021	NA due to COVID
SYSC3320: Computer Systems Design (SoC Approach)	Carleton University	W2021	NA due to COVID
SYSC2310: Introduction to Digital Systems	Carleton University	W2021	4.33/5
SYSC 5807- W: Sensor Fusion for Autonomous Systems	Carleton University	W2021	4.08/5
SYSC3320: Computer Systems Design (SoC Approach)	Carleton University	W2020	4.53/5
SYSC 5807- W: Sensor Fusion for Autonomous Systems	Carleton University	W2020	4.65/5
SYSC3320: Computer Systems Design (SoC Approach)	Carleton University	W2019	4.91/5
EACJ5300O: Sensor Fusion for Autonomous Systems	Carleton University	W2019	4.82/5
ELEC4601: Microprocessor Systems	Carleton University	F2018	4.51/5
ELEC4706: Digital Integrated Electronics	Carleton University	W2018	4.60/5
EACJ5300O: Sensor Fusion for Autonomous Systems	Carleton University	W2018	4.55/5
ELEC4601: Microprocessor Systems	Carleton University	F2017	4.51/5
ELEC4601: Microprocessor Systems	Carleton University	F2016	4.68/5
ELEC273: Numerical Methods and Optimization	Queen's University	W2016	4.40/5

APSC100: Engineering Practice	Queen's University	W2014	
EEE 435: Operating Systems	RMC	W2015	
EEE523: Integrated Navigation Systems	RMC	F2014	
ESU Mini course for SEEDS program	Queen's University	F2013	

Seminars

ECOR1055: System on Chip Computer Systems	Carleton University	F2022
ECOR1055: Autonomous Navigation Systems	Carleton University	F2022
ECOR1055: Self-driving cars	Carleton University	F2019/F2020
ECOR1055: The Smart Coder	Queen's University	F2019/F2020

New Course Development

Course	Institution	Level	Year
SYSC 5807- W: Sensor Fusion for Autonomous Systems	Carleton	Graduate	2018
SYSC3320: Computer Systems Design (SoC Approach)	Carleton	Undergraduate	2019

Teaching Training and Certificates

Certificate/Workshops	Institution	Year
Certificate in Practical Experience	Queen's	2015
Certificate in Foundation	Queen's	2015
Certificate in Teaching and Learning Scholarship	Queen's	2015
SGS 901: Teaching and Learning in higher education	Queen's	2015

Teaching Awards/Recognitions

Award/Recognition	Institution	Year
Raving Ravens for teaching excellence	Carleton	2019
Teaching Award, Professor of the Year	Queen's	2016

Service Record

Department Level	Year
Program Coordinator – CSE	2021-2022
Hiring Committee Member – Visual Servoing Position	2020-2021
Comprehensive Exam Coordinator – Comp. Organization and Architecture	2020-2021
Committee Member in FED Space Committee	2019-2020
Committee Member in 4th year Project Process Development Committee	2019-2020
Committee Member in Embedded Systems Course Development Committee	2019-2020
Committee Member in 19 Ph.D./MAS defence/exams Committee	2016-2020
Ericson Scholarship Review Committee Member	2019
Ontario Graduate Scholarship Reviewer	2019
Hiring Committee Member – Communication Position	2018
sWall Coordinator	2019-2020
Students Call Campaign	2016-2017

Faculty/University Level	**Year**
FED Space Committee Member	2019-Present
Hiring Committee Member (School of Information Technology – Optical Sensor)	2022
Hiring Committee Chair (Systems and Computer Eng. Dept. – Embedded Systems)	2022
Carleton Representative in the OCE Discovery Conference, Toronto	2018
Carleton Representative in Convergex 2018 conference in Calgary	2018
Carleton Representative in the OCE Discovery Conference, Toronto	2017
Carleton Representative in the GTA hiring event in Mississauga	2017
IEEE Secretary Kingston Section	2014
Committee Member in Queen's Graduate Project Competition 2013	2013

Community Level	**Year**
NSERC Discovery Grant Reviewer Committee Member	2023-2024
Organizer and Speaker at Autonomous Navigation Similar at Carleton University SCE	2022
Speaker at Kanata Business Centre Opening Event	2021
Invited Speaker at IEEE AESS Chapter	2020
Committee Member for the Ontario Research Fund - Large Infrastructure Fund	2020
External Reviewer for NSERC CRD Program	2019
Committee Member in the European Research Council, Consolidator Grant	2018
Associate Editor with the IEEE Transactions on Vehicular Technology	2012-2019
Associate Editor with the IET Electronic Letters	2013-2018
Associate Editor with IROS Conference	2019-2020
Reviewer for several international journals, IEEE transactions, letters, and periodicals	2012-2020
Technical Committee member in several international conferences (WCNC 2013-2014, IEEE ICCVE 2012-2015, ICC'15 (02) WC, IEEE SysCon 2015-2017, IEEE ISSE 2016, VTC2017)	2013-2020
Session Chair in IEEE SysCon, The International Systems Conference, Ottawa, Canada	2014-2015
Invited Speaker in IEEE GlobalSIP Conference in Ottawa in September 2019.	2019
IEEE Secretary, Kinston Section	2014
Invited Speaker in IEEE MTT AP Kingston Section in October 2014.	2014

Professional Membership

- Professional Engineering Ontario (license # 100222475).
- Senior IEEE member.
- Member in the Institute of Navigation (ION).
- Member in the Egyptian Engineering Association.

List of Publications/Patents/Software

In all papers, supervised/co-supervised student name is underlined, and the candidate's name is bold. Fund is mentioned whenever the paper is an independent outcome from the candidate own's funds. First author is identified if the first author is one of my solely supervised or co-supervised students.

Journal Articles

#	Contribution/Paper	Remarks
[1]	H. Zheng, **M. Atia**, H. Yanikomeroglu "Analysis of a HAPS-Aided GNSS in Urban Areas using a RAIM Algorithm", IEEE Open Journal of the Communications Society, 4 (2023), pp: 226 – 238, Jan. 2023.	Status **Published** First Author **Co-supervised PhD Student** Fund **NSERC**
[2]	H. Zheng, **M. Atia**, H. Yanikomeroglu "A Positioning System in an Urban Vertical Heterogeneous Network (VHetNet)", EEE Journal of Radio Frequency Identification, Vol. 7, pp: 352 – 363, April 2023.	Status **Published** First Author **Co-supervised PhD Student** Fund **NSERC** Peer-reviewed ✓
[3]	J. Plangger, **M. Atia**, H. Chaoui "FCIoU: A Targeted Approach for Improving Minority Class Detection in Semantic Segmentation Systems", Machine Learning and Knowledge Extraction 5 (4), 1746-1759, 2023.	Status **Accepted** First Author **Supervised MAS Student** Fund **Industry** Peer-reviewed ✓
[4]	H. Zheng, **M. Atia**, H. Yanikomeroglu, "Implementation of a RAIM Algorithm on the HAPS-Aided GNSS for Urban Areas", IEEE Open Journal of the Communications Society, paper # OJCOMS-01093-2022, October 2022.	Status **Published** First Author **Co-supervised PhD Student** Fund **NSERC** Peer-reviewed ✓
[5]	A. Mahmoud, **M. Atia** " Improved Visual SLAM Using Semantic Segmentation and Layout Estimation", MDPI-Robotics, Vol. 11 (5), 91, September 2022.	Status **Published** First Author **My PhD Student** Fund **NSERC DG** Peer-reviewed ✓
[6]	S. Kourabbaslou, **M. Atia** "A Real-Time CPU-GPU Embedded Implementation of a Tightly-Coupled Visual-Inertial Navigation System", IEEE Access Journal, Vol (10), pp: 86384 – 86394, August 2022.	Status **Published** First Author **My PhD Student** Fund **NSERC DG** Peer-reviewed ✓
[7]	A. Asgharnia, H. Schwartz, and **M.M. Atia**, "Multi-Objective Fuzzy Q-Learning to Solve Continuous State-Action Problems," Neurocomputing, 2022	Status **Accepted** First Author **My Co-supervised PhD Student** Fund **NSERC DG** Peer-reviewed ✓
[8]	A. Asgharnia, H. Schwartz, **M.M. Atia**. "Learning Deception Using a Fuzzy Multi-Level Reinforcement Learning in a Multi-Defender One-Invader Differential Game", Accepted in the International Journal of Fuzzy Systems (2022). Manuscript ID: IJFS-D-22-00200R1.	Status **Accepted** First Author **My Co-supervised PhD Student** Fund **NSERC DG** Peer-reviewed ✓

[9]	A. Asgharnia, H. Schwartz, and **M.M. Atia**, "Learning Multi-Objective Deception In a Two-Player Differential Game Using Reinforcement Learning and Multi-Objective Genetic Algorithm," International Journal of Innovative Computing, Information, Control (IJICIC), August 2022.	Status First Author Fund Peer-reviewed	**Accepted** **My Co-supervised PhD Student** **NSERC DG** ✓
[10]	A. Mahmoud, H. Sadruddin, P. Coser, **M. Atia** "Integration of Wearable Sensors Measurements for Indoor Pedestrian Tracking", IEEE Instrumentation & Measurement Magazine, 25 (1), 46-54, Feb. 2022	Status First Author Fund Peer-reviewed	**Published** **My PhD Student** **IDEaS Program** ✓
[11]	A. Zhang and **M.A. Atia** "An Efficient Tuning Framework for Kalman Filter Parameter Optimization using Design of Experiments and Genetic Algorithms", Navigation, Journal of the Institute of Navigation, Vol (67), Issue (4), https://doi.org/10.1002/navi.399, Winter 2020.	Status First Author Fund Peer-reviewed	**Published** **My MAS Student** **NSERC DG** ✓
[12]	S. Kourabbaslou, A. Zhang ; **M. M. Atia** "A Novel Design Framework for Tightly-coupled IMU/GNSS Sensor Fusion using Inverse-Kinematics, Symbolic Engines and Genetic Algorithms", IEEE Sensors Journal, Vol(19), no(23), pp: 11424 – 11436, Dec. 2019.	Status First Author Fund Peer-reviewed	**Published** **My PhD Student** **NSERC DG** ✓
[13]	H. Sadruddin, **M. M. Atia**, "Fusion of Digital Road Maps with Inertial Sensors and Satellite Navigation Systems using Kalman Filter and Hidden Markov Models", Sensors and Transducers Vol(237), no(9-10),pp:129-136, December 2019.	Status First Author Fund Peer-reviewed	**Published** **My MAS Student** **NSERC DG** ✓
[14]	**M.M.Atia** "Design and Simulation of Sensor Fusion using Symbolic Engines", Mathematical and Computer Modelling of Dynamical Systems(MCMD), Vol(25), no(1), pp: 40-62, Feb. 2019.	Status Fund Peer-reviewed	**Published** **NSERC DG** ✓
[15]	**M.M.Atia** and S. Waslander "Map-aided Adaptive GNSS/IMU Sensor Fusion Scheme for Robust Urban Navigation", Elsevier, Measurement Journal, Vol (131), pp: 615-627, Jan 2019.	Status Fund Peer-reviewed	**Published** **NSERC PDF** ✓
[16]	**M. M. Atia**, A.R. Hilal, "Lane-level positioning with low-cost map-aided GNSS/MEMS IMU integration", GPS World Magazine, Vol (29), no(5), p:18, May 2018. FRONT COVER of the GPS World Magazine in May issue https://www.gpsworld.com/lane-level-positioning-with-low-cost-map-aided-gnss-mems-imu-integration/	Status Fund Peer-reviewed	**Published** **MITACS/PDF**
[17]	**M. M. Atia**, A.R. Hilal, C. Stellings, E. Hartwell, J. Toonstra, W. B. Miners, and O.A. Basir. (2017). A Low-Cost Lane-Determination System Using GNSS/IMU Fusion and HMM-Based Multistage Map Matching. IEEE Transactions on Intelligent Transportation Systems, Volume (18), Issue (11), PP: 3027 – 3037, DOI: 10.1109/TITS.2017.2672541, Nov. 2017.	Status Fund Peer-reviewed	**Published** **MITACS/PDF** ✓

[18] Y. Gao, S. Liu, **M.M. Atia**, A. Noureldin, "INS/GPS/LiDAR Integrated Navigation System for Urban and Indoor Environments Using Hybrid Scan Matching Algorithm", Sensors 2015, 15(9), 23286-23302; doi:10.3390/s150923286.

Status **Published**
Second Author **My co-supervised PhD Student**
Peer-reviewed ✓

[19] T.B. Karamat, **M. M. Atia**, A. Noureldin, "An Enhanced Error Model for EKF-based Tightly-coupled Integration of GPS and Land Vehicle's Motion Sensors", Sensors (Basel). 2015 Sep 22; 15(9):24269-96. doi: 10.3390/s150924269.

Status **Published**
First Author **My co-supervised PhD Student**
Peer-reviewed ✓

[20] S. Liu, **M.M. Atia**, Y. Gao, A.Noureldin "Adaptive Covariance Estimation Method for LiDAR-aided Multi-sensor Integrated Navigation Systems", Journal of Micromachines, Vol(6), pp: 196-215, doi:10.3390/mi6020196, January 2015.

Status **Published**
First Author **My co-supervised PhD Student**
Peer-reviewed ✓

[21] **M.M. Atia**; S. Liu, H. Nematallah, T.Karamat, A.Noureldin, "Integrated Indoor Navigation System for Ground Vehicles with Automatic 3D Alignment and Position Initialization", IEEE Transaction on Vehicular Technology, Vol. 64, no. 4, January 2015.

Status **Published**
Second Author **My co-supervised PhD Student**
Peer-reviewed ✓

[22] **M.M. Atia**, T.Karamat, A. Noureldin, "An Enhanced 3D Multi-Sensor Integrated Navigation System for Land-Vehicles", Journal of Navigation, Vol.67, no. 04, pp. 651-671, Cambridge, July 2014.

Status **Published**
Second Author **My co-supervised PhD Student**
Peer-reviewed ✓

[23] T.Karamat, M.M. Atia, A.Noureldin, "Performance Analysis of Code-phase Based Relative GPS Positioning and its Integration with Land Vehicle's Motion Sensors", IEEE Sensors Journal, Vol.14, No.9, pp. 3084 – 3100, May 2014.

Status **Published**
First Author **My co-supervised PhD Student**
Peer-reviewed ✓

[24] M.O. Karaim, T. Karamat, A.Noureldin, M. Tamazin, and **M.M. Atia** , "Cycle Slips, Detection and Correction Using Inertial Aiding", GPS World, Innovation Column, January 2014.

Status **Published**
First Author **My co-supervised PhD Student**
Peer-reviewed ✓

[25] **M.M. Atia**, M. Korenberg, A. Noureldin, "Dynamic Online-Calibrated Radio Maps for Indoor Positioning In Wireless Local Area Networks", IEEE Transactions on Mobile Computing, Vol.12, no.9, pp. 1774 - 1787, 2013.

Status **Published**
Peer-reviewed ✓

[26] S. Lui, **M.M.Atia**, T.Karamat, A. Noureldin, "A LiDAR-Aided Indoor Navigation System for UGVs", Journal of Navigation, Vol.68, no.2, pp: 253-273, March 2015.

Status **Published**
First Author **My co-supervised PhD Student**
Peer-reviewed ✓

[27] **M.M. Atia**, A. Noureldin, M. Korenberg, "Dynamic Propagation Modeling For Mobile Users' Position and Heading Estimation in Wireless Local Area Networks", IEEE Wireless Communication Letters, vol.1, no.2, pp. 101-104, April 2012.

Status **Published**
Peer-reviewed ✓

[28] **M.M. Atia**, M. Korenberg, A. Noureldin, "Particle Filter-based WiFi-Aided Reduced Inertial Sensors Navigation System for Indoor and GPS-denied Environments", International Journal of Navigation and Observation vol.2012, Article ID. 753206, doi:10.1155/2012/753206. 2012.

Status **Published**
Peer-reviewed ✓

[29]	**M.M. Atia**, A. Noureldin "Recursive Genetic Algorithm for Robot Manipulator Motion Planning in the existence of obstacles", Springer, Recent Advances in Computer Science and Information Engineering. Lecture Notes in Electrical Engineering, vol.124, pp.571-581, 2012.	Status Peer-reviewed	**Published** ✓
[30]	**M.M. Atia**, A. Noureldin, J. Georgy, M. Korenberg, "Bayesian Filtering Based WiFi/INS Integrated Navigation Solution for GPS-denied Environments", NAVIGATION Journal, vol. 58, no. 2, pp. 111-125. Summer 2011.	Status Peer-reviewed	**Published** ✓
[31]	**M.M. Atia**, A. Noureldin, and M. Korenberg, "Gaussian process regression approach for bridging GPS outages in integrated navigation systems", Electronic Letters, vol.47, no. 1, pp.52–53, January 2011.	Status Peer-reviewed	**Published** ✓
[32]	**M.M. Atia**, M. Korenberg, A. Noureldin, "Fast Features Reduction of Radio Maps for Real-time Fingerprint-based Wireless Positioning Systems", Electronic Letters, vol.47, no.20. pp. 1151-1153, September 2011.	Status Peer-reviewed	**Published** ✓
[33]	**M.M.Atia**, J.Georgy, M. Korenberg, A. Noureldin, "A Quicker Route", featured article in the Institution of Engineering and Technology, Edited by Dr. H. Dyball, 2010.	Status Peer-reviewed	**Published** ✓
[34]	**M.M.Atia**, J.Georgy, M. Korenberg, A.Noureldin, "Real Time Implementation of Mixture Particle Filter for 3D RISS/GPS Integrated Navigation Solution", Electronic Letters, vol. 46, no. 15, July 2010.	Status Peer-reviewed	**Published** ✓
[35]	T. Karamat, M.M.Atia, A. Noureldin "An Enhanced Error Model for EKF-based Tightly-coupled Integration of GPS and Land Vehicle's Motion Sensors", IEEE Sensors Journal, ISSN 1424-8220, Sensors 2015.	Status First Author Peer-reviewed	**Published** **My co-supervised PhD Student** ✓

Conference Papers

#	Contribution/Paper	Remarks	
[1]	H. Zheng, **M. Atia**, H. Yanikomeroglu " Synthetic Waveform Generation for Satellite, HAPS, and 5G Base Station Positioning Reference Signal Using QuaDRiGa", arXiv preprint arXiv:2401.13791, 2024.	Status First Author Fund Peer-reviewed	**Submitted** **Co-supervised PhD Student** **NSERC** ✓
[2]	RKR Damagatla, **M Atia**, "A Novel Approach for IMU Denoising using Machine Learning", 2023 IEEE Sensors Applications Symposium (SAS), pp: 1-6, July 2023	Status First Author Fund Peer-reviewed	**Published** **MAS Student** **NSERC** ✓

[3] T. Maksoud, **M. Atia**, F. Khouli " Inner-Loop Controller Stability of a Generic Urban Air Taxi in Various Spatial Locations of a Representative Urban Airflow Environment in the Presence of IMU Sensor Noise", The Vertical Flight Society's 79th Annual Forum & Technology Display, Pam Beach, FL, USA, March 2023.

Status **Published**
First Author **MAS Student**
Fund **NSERC**
Peer-reviewed ✓

[4] T. Maksoud, F. Khouli, and **M. Atia** "Analysis of an Urban Air Taxi Inner Loop Controller with Noisy IMUs in an Urban Airflow Environment", 2023th International IEEE Aerospace Conference, Big Sky, Montana, March 2023

Status **Published**
First Author **MAS Student**
Fund **NSERC**
Peer-reviewed ✓

[5] J. Plangger, H. Ravichandran, S. Rodin, **M. Atia** "System Design and Performance Analysis of Indoor Real-time Localization using UWB Infrastructure", 2023 IEEE International Systems Conference (SysCon) , pp: 1-8, 2023

Status **Published**
First Author **MAS Student**
Fund **DND**
Peer-reviewed ✓

[6] A. Asgharnia, HM. Schwartz, **M. Atia** "Hierarchical Reinforcement Learning With Multi Discount Factors In A Differential Game, 2022 IEEE Symposium Series on Computational Intelligence (SSCI), 686-693, 2022.

Status **Published**
First Author **Co-supervised PhD Student**
Fund **NSERC DG**

[7] H. Zheng, **M. Atia**, H. Yanikomeroglu "High Altitude Platform Station (HAPS)-Aided GNSS for Urban Areas", ***Best Paper Award*** in the IEEE International Conference on Wireless for Space and Extreme Environments (WiSEE 2022), Oct. 2022, Winnipeg, Manitoba, Canada

Status **Published**
First Author **Co-supervised PhD Student**
Fund **NSERC**
Peer-reviewed ✓

[8] A. Mahmoud, P. Coser, H. Sadruddin, **M. Atia**, "Ultra-Wideband Automatic Anchor's Localization for Indoor Path Tracking", Accepted in IEEE Sensors 2022, Nov. 2022, Dallas, Texas, USA

Status **Accepted**
First Author **Supervised MAS Student**
Fund **IDEaS B**
Peer-reviewed ✓

[9] J.Fu, X. Zhang, W. Yu, J. Li, **M. Atia**, H. Wang, C. Li, Z. Hao "Decoding Passenger's EEG Signals From Encountering Emergency Road Events", Accepted in The 25th IEEE International Conference on Intelligent Transportation Systems, Macau, China, October 8-12, 2022

Status **Accepted**
First Author **Co-supervised MAS Student**
Fund **NSERC DG**
Peer-reviewed ✓

[10] A. Asgharnia, H. Schwartz, and **M.M. Atia**, "Multi-Invader Multi-Defender Differential Game Using Reinforcement Learning," in WCCI2022 IEEE World Congress on Computational Intelligence, 2022

Status **Published**
First Author **Co-supervised PhD Student**
Fund **NSERC DG**
Peer-reviewed ✓

[11] A. Asgharnia, H. Schwartz, **M.M. Atia** "Deception in A Multi-agent Adversarial Game: The Game of Guarding Several Territories", 2020 IEEE Symposium Series on Computational Intelligence SSCI 2020, pp. 1321–1327, 2020, doi: 10.1109/SSCI47803.2020.9308211.

Status **Published**
First Author **Co-supervised PhD Student**
Fund **NSERC DG**
Peer-reviewed ✓

[12]	H. Sadruddin, A. Mahmoud, **M. M. Atia** "Enhancing Body-Mounted Lidar Slam Using IMU-based Pedestrian Dead Reckoning (PDR) Model", IEEE 63rd International Midwest Symposium on Circuits and Systems (MWSCAS) 2020, Springfield, MA, US. DOI: 10.1109/MWSCAS48704.2020.9184561	Status **Published** First Author **My MAS Student** Fund **IDEaS B** Peer-reviewed ✓
[13]	A. Zhang, **M.M. Atia**, "Comparison of 2D Localization Using Radar and Lidar in Long Corridors", IEEE SENSORS 2020 Conference, October 25-28, 2020. DOI: 10.1109/SENSORS47125.2020.9278684.	Status **Published** First Author **My MAS Student** Fund **IDEaS B** Peer-reviewed ✓
[14]	Y. Farajpour, F. Nadon, S.B. Toosi, N. Iliaee, S. Qu, **M. M. Atia**, "A Modified NLLS Algorithm for UWB Positioning Systems with Experimental Validation", The Australian and New Zealand Control Conference (ANZCC), Gold Coast, Australia, 26-27 November 2020. DOI: 10.1109/ANZCC50923.2020.9318382.	Status **Published** First Author **G. Course Student** Fund **IDEaS B** Peer-reviewed ✓
[15]	S. Sheikhpour, **M. M. Atia** "An Enhanced Visual-Inertial Navigation System Based on Multi-State Constraint Kalman Filter", IEEE 63rd International Midwest Symposium on Circuits and Systems, MWSCAS 2020. Springfield, MA, USA. DOI: 10.1109/MWSCAS48704.2020.9184501.	Status **Accepted** First Author **My PhD Student** Fund **NSERC DG** Peer-reviewed ✓
[16]	A. Asgharnia, H. Schwartz, **M.M. Atia** "Deception In The Game of Guarding Multiple Territories; A Machine Learning Approach", 2020 IEEE Int. Conf. System, Man, Cybernetics, pp. 381–388, 2020, doi: 10.1109/SSCI47803.2020.9308211.	Status **Published** First Author **My Co-supervised PhD Student** Peer-reviewed ✓
[17]	A. Mahmoud and **M.M. Atia** "Hybrid IMU-aided approach for optimized visual odometry", 2019 IEEE Global Conference on Signal and Information Processing (GlobalSIP), Ottawa, November 2019. INSPEC Accession Number: 19299612	Status **Published** First Author **My PhD Student** Fund **IDEaS B** Peer-reviewed ✓
[18]	H. Sadruddin, A. Mahmoud and **M.M. Atia** "An Indoor Navigation System using Stereo Vision, IMU and UWB Sensor Fusion", 2019 IEEE Sensors Conference, Montreal, ON, Canada, 2019. INSPEC Accession Number: 19261621	Status **Published** First Author **My MAS Student** Fund **IDEaS B** Peer-reviewed ✓
[19]	H. Sadruddin, and **M.M. Atia** "Real-time Fusion of MEMS Accelerometers/Gyroscopes with Global Navigation Satellite Systems and Road Networks for Enhanced Urban Localization", SEIA'2019 Conference Proceedings, pp: 153, Canary Island, Spain, September 2019.	Status **Published** First Author **My MAS Student** Fund **IDEaS B** Peer-reviewed

[20] A. Zhang, **M. M. Atia** "An Efficient Tuning Framework for Kalman Filter Parameter Optimization using Design of Experiments and Genetic Algorithms", Proceedings of the 32nd International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2019), Miami, Florida, September 2019, pp. 1641-1652.
(BEST PRESENTATION AWARD)

Status **Published**
First Author **My MAS Student**
Fund **NSERC DG**
Peer-reviewed ✓

[21] S. Sheikhpour, **M. M. Atia** "Calibration-free Visual-Inertial fusion with Deep Convolutional Recurrent Neural Networks", Proceedings of the 32nd International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2019), Miami, Florida, September 2019, pp. 2198-2209.

Status **Published**
First Author **My PhD Student**
Fund **NSERC DG**
Peer-reviewed ✓

[22] M. Gessesse, **M. M. Atia**, "Multi-sensor Attitude and Heading Reference System using Genetically Optimized Kalman Filter", In the proceedings of IEEE 61st International Midwest Symposium on Circuits and Systems, MWSCAS 2018, pp: 460-463, Windsor, August 2018.

Status **Published**
First Author **My MAS Student**
Fund **NSERC DG**
Peer-reviewed ✓

[23] M. Gessesse, **M. M. Atia**, "Enhancing UAV 3D Orientation Estimation using Design of Experiment and Genetically Optimized Kalman Filter", the 3rd Virtual Geoscience Conference (VGC), Kingston, Canada, August 22-24, 2018.

Status **Published**
First Author **My MAS Student**
Fund **NSERC DG**
Peer-reviewed

[24] S. Sheikhpour, **M. M. Atia**, S. Waslander, "A Flexible Simulation and Design Environment for INS/GNSS Integration", In the proceedings of IEEE 61st International Midwest Symposium on Circuits and Systems, MWSCAS 2018, pp: 472-475, Windsor, August 2018.

Status **Published**
First Author **My PhD Student**
Fund **NSERC DG**
Peer-reviewed ✓

[25] **M. M. Atia**, A. Hilal, "Vehicular Lane-Level Positioning using Low-Cost Map-Aided GNSS/MEMS IMU Sensors Integration," in the Proceedings of the 2018 International Technical Meeting of The Institute of Navigation, Reston, Virginia, January 2018, pp. 483-494.

Status **Published**
Peer-reviewed ✓

[26] J. Xia, U. Iqbal, **M.M.Atia**, F. Sun, A. Noureldin "Adaptive square-root CKF based SLAM algorithm for indoor UGVs", 2017 IEEE International Conference on Mechatronics and Automation (ICMA), Takamatsu, Japan, INSPEC Accession Number: 17137170

Status **Published**
First Author **My Co-supervised MAS Student**
Peer-reviewed ✓

[27] J. Xia, U. Iqbal, **M.M.Atia**, F. Sun, A. Noureldin "Adaptive Square-Root Cubature KF based SLAM Algorithm for Indoor Unmanned Ground Vehicles", April 2016 · IEEE/ION PLANS 2016, Savannah, Georgia; 04/2016.

Status **Published**
First Author **My Co-supervised MAS Student**
Peer-reviewed ✓

[28] S. Liu, **M.M. Atia**, T.B. Karamat, A. Noureldin, S. Givigi "LiDAR-aided Integrated INS/GPS Navigation System for Unmanned Ground Vehicles in Urban and Indoor Environments Using Hybrid Adaptive Scan Matching Algorithm", in the proceedings of the 28th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2015), Tampa, Florida, September 2015.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[29] T.B. Karamat, **M.M. Atia**, M. Karaim, A. Noureldin "Aided GPS Integer Ambiguity Resolution Using Low-cost Motion Sensors", in the proceedings of the 28th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2015), Tampa, Florida, September 2015.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[30] **M.M.Atia**, U. Iqbal, A. Noureldin, M. Korenberg "Adaptive Integrated Indoor Pedestrian Tracking System Using MEMS sensors and Hybrid WiFi/Bluetooth-Beacons With Nonlinear Grid-based Bayesian Filtering Algorithm", Accepted for publication in the International Technical Meeting (ITM) of the Institute of Navigation (ION), ITM 2014, Held in Dana Point, California, USA, January 2015.

Status **Published**
Peer-reviewed ✓

[31] B. Amer, **M.M. Atia**, M. Hefnawi, A. Noureldin "An Adaptive Positioning System for Smartphones in Zigbee Networks Using Channel Decomposition and Particle Swarm Optimization", Proceedings of the 2015 International Technical Meeting of The Institute of Navigation, Dana Point, California, January 2015, pp. 445-454.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[32] H. Nematallah, S. Liu, **M.M. Atia**, S. Givigi, and A.Noureldin, "A Fast LiDAR-based Features Extraction/Tracking Using Hough Transforms and Fuzzy C-means Clustering for LiDAR-aided Multisensor Navigation Systems", Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014), pp. 3184-3193, Tampa, Florida, September 2014.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[33] S. Liu, **M.M.Atia**, Y. Gao, A.Noureldin, S. Givigi, "An Inertial-Aided LiDAR Scan Matching Algorithm for Multisensor Land-Based Navigation", Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014), pp. 2089-2096, Tampa, Florida, September 2014.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[34] T.Karamat, **M.M.Atia**, A.Noureldin, S. Givigi, "Performance Comparison Analysis of FOGS and MEMS IMUs Under An Enhanced GPS/Reduced INS Land Vehicles Navigation System", Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014), pp. 141-153, Tampa, Florida, September 2014.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[35] **M.M.Atia**, A.Noureldin, S. Givigi "A Smart Reconfigurable Multi-sensor Multi-filter Navigation Engine with Modular Architecture Design for Plug-and-Play Navigation", Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014), pp. 2034-2042, Tampa, Florida, September 2014.

Status **Published**
Peer-reviewed ✓

[36] H. Nematallah, M. Korenberg, A.Noureldin, **M.M.Atia** "Enhancing Vision-Aided GNSS/INS Navigation Systems Using Nonlinear Modeling Techniques Based on Fast Orthogonal Search with Double-Filtering Mechanism", In the Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014), pp. 627-634, Tampa, Florida, September 2014.

Status **Published**
Peer-reviewed ✓

[37] C. Donnelly, **M.M.Atia**, M. Korenberg, A.Noureldin, "Hardware-Independent Automatic Crowdsourcing-Based Hybrid WLAN-RFID Adaptive Indoor Tracking System Using Fast Orthogonal Search and Multiple Particle Filters", Proceedings of ION International Technical Meeting, pp. 377 – 383, San Diego, California, USA, 2014.

Status **Published**
Peer-reviewed ✓

[38] **M.M.Atia**, C.Donnelly, M. Korenberg, "A Novel Systems Integration Approach for Multi-sensor Integrated Navigation Systems", 8th Annual IEEE Systems Conference (SysCon), pp. 554 – 558, April 3 2014.

Status **Published**
Peer-reviewed ✓

[39] S. Liu, **M.M. Atia**, T. Karamat, S. Givigi, A. Noureldin "A Dual-Rate Multi-filter Algorithm for LiDAR-Aided Indoor Navigation Systems", under print in the proceedings of IEEE/ION PLANS, Monterey, California, 2014.

Status **Published**
First Author **My Co-supervised PhD Student**
Peer-reviewed ✓

[40] M. Hassan, **M.M.Atia**, A. Noureldin, "A Prediction Scheme for VBR Video Traffic Using A Fast Orthogonal Search Algorithm", In the Proceedings of the 16th International Conference on Computer Modelling and Simulation (UKSim), United Kingdom, 2014.

Status **Published**
Peer-reviewed ✓

[41] **M.M.Atia**, A. Noureldin, M. Korenberg, "Nonlinear Error Modeling of Reduced GPS/INS Vehicular Tracking Systems Using Fast Orthogonal Search", In the Proceedings of The Third International Conference on Advances in Vehicular Systems, Technologies and Applications, VEHICULAR 2014, June 22 - 26, 2014 - Seville, Spain.

Status **Published**
Peer-reviewed ✓

[42] **M.M. Atia**, J. Georgy, A. Noureldin , "An Enterprise Service Oriented Architecture-Based High Resolution WiFi Indoor Positioning System", Proceedings of the International Technical Meeting of The Institute of Navigation, pp.752 - 757, Catamaran Resort Hotel, San Diego, California, January 29 - 27, 2013.

Status **Published**
Peer-reviewed ✓

[43] M. Karaim, T. Karamat, M.Tamazeen, **M.M. Atia**, A. Noureldin, "Real-time Cycle-slip Detection and Correction for Land Vehicle Navigation Using Inertial Aiding", In the Proceedings of ION GNSS 2013, pp. 1290 – 1298, Nashville, Tennessee 2013.

Status **Published**
First Author **My Co-supervised PhD Students**
Peer-reviewed ✓

[44] **M.M. Atia**, A. Noureldin, M. Korenberg, "Enhanced Kalman Filter for RISS/GPS Integrated Navigation using Gaussian Process Regression", In the Proceedings of the 2012 International Technical Meeting of Institute of Navigation, pp:1148–1156, Newport Beach,CA, Jan. 2012.

Status **Published**
Peer-reviewed ✓

[45] **M.M. Atia**, A. Noureldin, M. Korenberg, "A Consistent Zero-Configuration GPS-Like Indoor Positioning System Based on Signal Strength in IEEE 802.11 Networks", In the Proceedings of IEEE/ION PLANS 2012, Myrtle Beach Marriott Resort & Spa, Myrtle Beach, South Carolina, pp. 1068 - 1073, April 2012.

Status **Published**
Peer-reviewed ✓

[46] **M.M. Atia**, A. Noureldin, M. Korenberg, "A WiFi-Aided Reduced Inertial Sensors-Based Navigation System with Fast Embedded Implementation of Particle Filtering", 8th International Symposium on Mechatronics and its Applications (ISMA), pp.1-5, April 2012.

Status **Published**
Peer-reviewed ✓

[47] H. Nematallah, **M.M. Atia**, C. Goodall, A. Noureldin, N. El-Sheimy, "Assessment of Time Delays and Synchronization Errors in Real-time INS/GNSS Systems and its impact on the Navigation Performance", Proceedings of the 25th International Technical Meeting of The Satellite Division of the Institute of Navigation, pp.3192 – 3197, Nashville, TN 2012.

Status **Published**
Peer-reviewed ✓

[48] Z. Syed, J. Georgy, **M.M. Atia**, C. Goodall, A. Noureldin, N. El-Sheimy, "Real-time, Continuous and Reliable Consumer Indoor/Outdoor Localization for Smartphones", Proceedings of the 25th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS 2012), pp. 3147 – 3153, Nashville, TN 2012.
Status **Published**
Peer-reviewed ✓

[49] El-Sheimy, C. Goodall, W. Abdelfatah, **M.M. Atia**, B. Scannell, "MEMS versus FOG's for Machine Control and Guidance", In the Proceedings of the 25th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS 2012), pp.1634 - 1640, Nashville Convention Center, Nashville, Tennessee, September 17 - 21, 2012.
Status **Published**
Peer-reviewed ✓

[50] **M.M. Atia**., J. Georgy, M. Korenberg and A. Noureldin, "Optimized Embedded Real-Time Realization of Mixture Particle Filter for 3D RISS/GPS Land-Vehicles Navigation", In the Proceedings of the Institute Of Navigation (ION) conference, International Technical Meeting (ITM'11), pp. 850 – 857, January 2011.
Status **Published**
Peer-reviewed ✓

[51] **M.M. Atia**, A. Noureldin, M. Korenberg, "Bayesian Machine Learning in INS/WiFi Integrated Navigation Systems for Indoor and GNSS-denied Environments", In the Proceedings of the Institute Of Navigation (ION) conference(ION GNSS'11), pp.3444-3450, Portland, USA, 2011.
Status **Published**
Peer-reviewed ✓

Patents

[1] (**US11598638B2 Granted 2023**): Methods of attitude and misalignment estimation for constraint free portable navigation. Inventors: **Mohamed Atia**, Zainab Syed, Jacques Georgy, Christopher Goodall, Aboelmagd Noureldin, Naser El-Sheimy.

[2] (**US10203207B2 Granted 2019**): Methods of Attitude and Misalignment Estimation for Constraint Free Portable Navigation. Inventors: **Mohamed Atia**, Zainab Syed, Jacques Georgy, Christopher Goodall, Aboelmagd Noureldin, Naser El-Sheimy.

[3] (**US10349286B2 Granted 2019**): System and method for wireless positioning in wireless network-enabled environments. Inventors: **Mohamed Atia** and Aboelmagd Noureldin.

[4] (**EP2503288B1 Granted 2016**): Methods of Attitude and Misalignment Estimation for Constraint Free Portable Navigation. Inventors: **Mohamed Atia**, Zainab Syed, Jacques Georgy, Christopher Goodall, Aboelmagd Noureldin, Naser El-Sheimy.

[5] (**US10082583B2 Granted 2018**): Method and apparatus for real-time positioning and navigation of a moving platform. Inventors: Jacques Georgy, Christopher Goodall, **Mohamed Atia**, Walid Abdelfattah, Zhi Shen, Aboelmagd Noureldin, Husain Syed.

Book Chapters

[1] **M.M. Atia**. (2018). LiDAR-Aided Multisensor Integrated Navigation in Urban and Indoor Areas. Book chapter in "Positioning and Navigation in Complex Environments". Publisher: Idea Group Inc, DOI: 10.4018/978-1-5225-3528-7.ch010. pp.46, Editor: Kegen Yu, Jan. 2018.

[2] **M.M. Atia** "Location Estimation in Modern Mobile Computing Environments", book chapter in "Horizons in Computer Science Research. Volume 9", Nova Publishers, 2014.

Software

[1] **M. M. Atia**, "EMS EMS-SymINSGNSS, demonstration of multi-sensor INS/GNSS EKF using MATLAB symbolic engine", DOI: 10.5281/zenodo.1183569, open source project, Feb. 2018.

[2] **M. M. Atia**, "ZigNav DEMO, a calibration-free cooperative wireless indoor positioning system" DOI:10.5281/zenodo.1147144, Open source project, January 2018.

[3] **M. M. Atia**, "A sample usage of EMS Symbolic Engine for sensor fusion with application on Attitude and Heading Reference Systems (AHRS)," DOI:10.5281/zenodo.1135234, Open source project, January 2018.

Projects DEMOs

https://www.youtube.com/channel/UCKutAclUPh6qXi4Mmwj7DxA

Mohammad Biglarbegian, Ph.D., P.Eng.

Director of Advanced & Intelligent Controls and Sensing for Mechatronics (AICSM) Research Lab

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RESEARCH INTERESTS

- Advanced Control (theoretical and practical)
- Intelligent control, data-driven control
- Robust motion control methods for autonomous mobile robots
- Soft robotics & control
- Collaborative robotics: autonomous mobile robots, human-robot collaboration
- Soft robotics
- Artificial intelligence and Machine learning applications for robotics & mechatronics
- Modeling, control, optimization of mechatronics and thermal systems

EDUCATION

University of Waterloo, Waterloo, Canada

PhD, Mechanical Engineering, 2010

University of Toronto, Toronto, Canada

M.A.Sc., Mechanical Engineering, 2005 (received A+ in all courses)

University of Tehran, Tehran, Iran

B.A.Sc., Mechanical Engineering, 2002 (ranked first out of 74 graduates)

PROFESSIONAL EXPERIENCE

- **Associate Professor:** Carleton University, Department of Mechanical and Aerospace Engineering, May 2023 - present
- **Associate Professor:** University of Guelph, School of Engineering, July 2016 - April 2023
- **Assistant Professor:** University of Guelph, School of Engineering, August 2011- 2016
- **Visiting Professor:** Karlsruhe Institute of Technology (KIT), Germany, Fall 2017 and Winter 2018.
- **Postdoctoral Fellow:** University of Waterloo & Ryerson University, July 2010-July 2011.
- **Visiting Researcher:** Electrical Engineering Department, University of Southern California (USC), Fall 2009
- **Mechanical Engineer**: (part-time) Simulent Inc., Toronto, 2003-2005
- **Mechanical Engineer**: Research and Development Center of Iran Khodro company (largest automotive company in Iran), summer 2001

LICENSE

- Licensed Engineer of Professional Engineers Ontario (PEO), 2012-present

Honors and Awards

- University of Guelph Research Excellence Award, 2018
- Best Student Paper Award for "Robustness of Interval Type-2 Fuzzy Logic Systems", NAFIPS conference, Toronto, July 2010
- National Sciences and Engineering Research Council of Canada (NSERC) Scholarship, CGS-D2, 2007-2009
- Arthur F. Church Scholarship, University of Waterloo, 2009-2010
- Ontario Graduate Scholarship (OGS), 2007-2008, and 2009-2010
- Student Travel Grant Award, IEEE Computational Intelligence Society, WCCI conference, Hong Kong, June 2008
- President's Graduate Scholarship, University of Waterloo, 2006-2010
- Ontario Graduate Scholarship (OGS), *International Student*, 2006-2007
- Best TA awards (two times), Mechanical & Mechatronics Engineering Department, University of Waterloo, Winter 2008 and Winter 2009
- Faculty of Engineering Award, University of Waterloo: 2005-2009 (8 times)
- International Doctoral Student Award, University of Waterloo, 2005-2006
- University of Toronto Fellowship, 2003-2005
- Ranked first among Mechanical Engineering students (ranked first out of 74 graduates), University of Tehran, 2002

Patent

- H. Simha, M. Biglarbegian, B. Deavy, B. Sicard, E. Darcel, S. Weaver, "Auxetic-Structured-Based Soft Grippers for Gripping Surfaces with Multiple Curvatures", Pending US Patent #US20210016452A1

Publications

Journal papers

Currently under review

- Z. Xu, T. Yan, S. X. Yang, S. A, Gadsden, M. Biglarbegian, "Distributed Robust Learning based Formation Control of Mobile Robots based on Bioinspired Neural Dynamics", *IEEE Transactions on Intelligent Vehicles*, under review (submitted Fe. 2024).

Accepted & Published journals

1. R. Bustos, S. A. Gadsden, M. Biglarbegian, M. AlShabi, S. Mahmud, "Battery State of Health Estimation Using the Sliding Interacting Multiple Model Strategy", *Energies*, accepted Jan. 2024,
2. E. Hill, A. Newton, A. Gadsden, M. Biglarbegian, "Tube-based Robust Model Predictive Control for Fault Tolerance", *Mechatronics (Elsevier)* , vol. 95, November 2023, 103051.
3. C. Wen Zhu, E. Hill, M. Biglarbegian, S. A. Gadsden, J. A. Cline,"Development of A Skid-Steer Autonomous Robot with Advanced Model Predictive Controllers for Agricultural Applications", *Journal of Robotics and Autonomous Systems*, vol. 162, 104364, 2023.
4. J. Lee, S. A. Gadsden, M. Biglarbegian, J. A. Cline, "Smart Agriculture: A Fruit Flower Cluster Detection Strategy in Apple Orchards using Machine Vision and Learning", *Applied Sciences*, vol. 12, no. 22, pp. 11420, 2022.
5. D. Zhou, S. Yang, M. Biglarbegian, "A Fuzzy Logic-based Cascade Control without Driving Saturation for the Unmanned Underwater Vehicle Trajectory Tracking", *Journal of Intelligent & Robotic Systems*, vol. 106., no.2, 2022.

6. C. H. M. Simha, M. Biglarbegian, "A Note on the Use of Dynamic Mode Decomposition in Mechanics", *Mechanics Research Communications*, vol. 120, 2022.

7. M. Shahriari, M. Biglarbegian, "A Novel Predictive Safety Criteria for Robust Collision Avoidance of Autonomous Robots", *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 5, pp. 3773-3783, 2022.

8. E. Hill, A. Gadsden, M. Biglarbegian, "Robust Nonlinear Model Predictive Control with Model Predictive Sliding Mode for Continuous-time Systems", *ASME Journal of Dynamic Systems, Measurement and Control*, vol. 144, no. 3., 2022.

9. M. Shahriari, M. Biglarbegian, "Toward Safer Navigation of Heterogeneous Mobile Robots in Distributed Schemes: A novel Time-to-Collision based Method", *IEEE Transactions on Cybernetics*, vol. 52, no. 9, pp. 9302-9315, 2022.

10. B. Dyer, M. Biglarbegian, A. A. Aliabadi, "The autonomous robotic environmental sensor (ARES)", *Science and Technology for the Built Environment*, vol. 27, no. 10, pp. 1461-1472, 2021.

11. E. Hill, A. Gadsden, M. Biglarbegian, "Explicit Nonlinear MPC for Fault Tolerance Using Interacting Multiple Models", *IEEE Transactions on Aerospace and Electronic Systems*, vol. 57, no. 5, pp. 2784–2794, 2021.

12. B. Sahoo, M. Biglarbegian, W. Melek, "Monocular Visual Inertial Direct SLAM with Robust Scale Estimation", *Robotics*, vol. 10, no.1, 2021.

13. C. H. M. Simha, M. Biglarbegian, "An Assessment of Shallow Neural Networks for Stress Updates in Computational Solid Mechanics", *International Journal for Computational Methods in Engineering Science and Mechanics*, vol. 21, no. 6, pp. 277-291, 2020.

14. N. Lashkari, M. Biglarbegian, S. X. Yang, "Development of a Novel Robust Control Method for Formation of Heterogeneous Multiple Mobile Robots with Autonomous Docking Capability" *IEEE Transactions on Automation Science and Engineering*, vol. 17, no. 4, pp. 1759–1776, 2020.

15. R. Byerlay, M. K. Nambiar, A. Nazem, M. Nahian, M. Biglarbegian, A. A. Aliabadi, "Measurement of Land Surface Temperature from Oblique Angle Airborne Thermal Camera Observations", *International Journal of Remote Sensing*, vol. 41, no. 8, pp. 3119–3146, 2020.

16. M. Hajyian, S. Mahmud, M. Biglarbegian, H. Abdullah, "Electric Vehicle Battery thermal Management System with Thermoelectric Cooling", *Energy Reports*, vol. 5, pp. 822-827, 2019.

17. N. Lashkari, M. Biglarbegian, S. X. Yang, "Development of Novel Motion Planning and Controls for a Series of Physically Connected Robots in Dynamic Environments", *Journal of Intelligent & Robotic Systems*, vol. 95, no. 2, pp. 291-310, 2019.

18. M. Hajyian, S. Mahmud, M. Biglarbegian, H. Abdullah, A. Chamkha, "Effect of Magnetic Field-Dependent Thermal Conductivity on Natural Convection of Magnetic Nanofluid Inside Square Enclosure", *International Journal of Numerical Method for Heat & Fluid Flow*, vol. 29, no. 4, pp. 1466-1489, 2019.

19. M. Hajyian, S. Ebadi, S. Mahmud, M. Biglarbegian, H. Abdullah, "Experimental investigation of the effect of an external magnetic field on the thermal conductivity and viscosity of Fe3O4-glycerol, *Journal of Thermal Analysis and Calorimetry*, vol. 135, no. 2, pp. 1451-1464, 2019.

20. M. Shahriari, M. Biglarbegian, "Development of a New Conflict Resolution Method for Multi-Mobile Robots in Cluttered Environments with Guaranteed Motion-Liveness", *IEEE Transaction on Cybernetics*, vol. 48, no. 1, pp. 300-311, 2018.

21. Y. Wang, Y. Tuo, S. X. Yang, M. Biglarbegian, M. Fu, "Reliability-based Robust Dynamic Positioning for a Turret-moored Floating Production Storage and Offloading Vessel with Unknown Time-varying Disturbances and Input Saturation", *ISA Transactions*, vol. 78, pp. 66-79, 2018.

22. Y. Wang, Y. Tou, S. X. Yang, M. Biglarbegian, M. Fu, "Robust Adaptive Dynamic Surface Control based on Structural Reliability for a Turret-moored Floating Production Storage and Offloading Vessel", *International Journal of Control, Automation, and Systems*, vol. 16, pp. 1648–1659, 2018.

23. M. Hajyian, S. Mahmud, M. Biglarbegian, H. Abdullah, "Natural Convection in an Annular Enclosure: Effect of Magnetic Field-dependent Thermal Conductivity, *Journal of Fluid Flow, Heat and Mass Transfer*, vol. 5, pp. 1-9, 2018.

24. N. Lashkari, M. Biglarbegian, S. X. Yang, "Development of a New Robust Controller with Velocity Estimator for Docked Mobile Robots: theory and experiments", *IEEE Transactions on Mechatronics*, vol. 22, no. 3, pp. 1287-1298, 2017.

25. M. Islam, S. Mahmud, M. Biglarbegian, S. H. Tasnim, "Influence of a Magnetic Field on the Energy, Work, and Heat Flux of a Multi-Plate Thermoacoustic System", *International Communications in Heat and Mass Transfer*, vol. 86, pp. 150-158, 2017.

26. S. Tabandeh, W. Melek, M. Biglarbegian, P. Won, C. Clark, "A Memetic Algorithm Approach for Solving the Task-based Configuration Optimization Problem in Serial Modular and Reconfigurable Robots", *Robotica*, vol. 48, no. 1, pp. 300–311, 2017.

27. K. Tai, A. El-Sayed, M. Shahriari, M. Biglarbegian, S. Mahmud, "State of the Art Robotic Grippers and Applications", *Robotics*, vol. 5, no. 2, pp. 1–20, 2016.

28. K. Tai, A. El-Sayed, M. Biglarbegian, C. Gonzalles, O. Castillo, S. Mahmud, "Review of Recent Type-2 Fuzzy Controller Applications", *Algorithms*, vol. 9, no. 2, pp. 1–39, 2016.

29. Z. Najjary, H. Saremi, M. Biglarbegian, A. Najari, "Identification of Deprivation Degrees Using Two Models of Fuzzy-Clustering and Fuzzy Logic Based on Regional Indices: A Case Study of Fars Province", *Elsevier: Journal of Cities*, vol. 58, pp. 115-123, 2016.

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31. Md. Sharif Islam, M. Biglarbegian, S. Mahmud, "Influence of Magnetic Field on the Periodically Oscillating Fluid inside a Porous Medium Attached to a Thick Solid Plate", *International Journal of Heat and Mass Transfer, vol. 96, pp. 602–613, 2016.*

32. M. Hajyian, S. Mahmud, M. Biglarbegian, H. Abdullah, "A New Design of Magnetorheological Fluid based Braking System using Genetic Algorithm Optimization", *Springer: International Journal of Mechanics and Materials in Design*, vol. 12, no. 4, pp. 1–14, 2015.

33. A. Rajvanshi, Md. Sharif, H. Majid, I. Atawi, M. Biglarbegian, S. Mahmud, "An Efficient Potential-Function Based Path-Planning Algorithm for Mobile Robots in Dynamic Environments with Moving Targets", *British Journal of Applied Science & Technology*, vol.9, no. 6, pp. 534–550, 2015.

34. R. Rabari, S. Mahmud, A. Dutta, M. Biglarbegian, "Analytical and Numerical Studies of Heat Transfer in Nanocomposite Thermoelectric Cooler", *Journal of Electronic Materials*, vol. 44, no. 8, pp. 2915–2929, 2015.

35. R. Rabari, S. Mahmud, A. Dutta, M. Biglarbegian, "Effect of Convection Heat Transfer on Performance of Waste Heat Thermoelectric Generator", *Journal of Journal of Heat Transfer Engineering: Taylor & Francis*, vol. 36, no. 17, pp. 1458–1471, 2015.

36. M. Schrieber, M. Biglarbegian, "Hardware Implementation and Performance Comparison of Interval Type-2 Fuzzy Logic Controllers for Real-time Applications", *Elsevier: Applied Soft Computing*, vol. 32, pp. 175–188, 2015.

37. P. Won, M. Biglarbegian, W. Melek, "Development of Intelligent Docking System for Self-Reconfigurable Robots Using Extended Kalman Filter", *Robotics*, vol. 4, no. 1, pp. 25–49, 2015.

38. T. Lambert, M. Biglarbegian, S. Mahmud, "A Novel Approach to the Design of Axial-Flux Switched-Reluctance Motors", *Journal of Machines*, vol. 3, no. 1, pp. 27–54, 2015.

39. M. Biglarbegian, J. Mendel, "On the Justification to Use a Novel Simplified Interval Type-2 Fuzzy Logic System for Modeling and Control Applications", *Journal of Fuzzy and Intelligent Systems*, vol. 28, no. 3, pp. 1071–1079, 2015.

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41. H. Chaoui, W. Gueaieb, M. Biglarbegian, M. Yagoub, "Computationally Efficient Adaptive Type-2 Fuzzy Control of Flexible-Joint Manipulators", *Special Issue of the Journal of Robots*, vol. 2, no. 2, pp. 66–91, DOI:10.3390/robotics2020066, 2013.

42. A. Javed, W. Owen, M. Biglarbegian, W. Melek, "A Hybrid EKF/KF State Estimator for a Skid-Steered ATV", *Vehicle System Dynamics*, vol. 52, no. 1, pp. 85-110, 2014.

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44. M. Biglarbegian, "A Novel Robust Leader-Following Control Design for Mobile Robots," *Springer: Journal of Intelligent and Robotics Systems*, DOI 10.1007/s10846-012-9795-1, 2012.

45. M. Biglarbegian, A. Sadeghian, W. W. Melek,"On the Accessibility/Controllability of Fuzzy Controllers," *Information Sciences*, vol. 202, no. 22, pp. 58-72, 2012.

46. M. Biglarbegian, W. W. Melek, J. Mendel,"On the Robustness of Type-1 and Interval Type-2 Fuzzy Logic Systems in Modeling," *Elsevier-Information Sciences*, vol. 181, no. 7, pp. 1325–1347, 2011.

47. M. Biglarbegian, W. W. Melek, J. Mendel,"Design of Novel Interval Type-2 Fuzzy Controllers for Modular and Reconfigurable robots : theory and experiments," *IEEE Transactions on Industrial Electronics*, vol. 58, no. 4, 2011.

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Using Semi-Active Dampers," *International Journal of Vehicle Systems*, vol. 14, no. 2, pp. 135-157, 2007.

51. M. Biglarbegian, J. W. Zu, "A Tractor-Semitrailer Model for Vehicles Carrying Liquids," *Vehicle System Dynamics*, vol. 44, no. 11, pp. 871-885, 2006.

52. M. Biglarbegian, "An efficient Monte Carlo Approach for Determining Shape Factors," *International Journal of Mechanical Engineering Education*, vol. 33, pp. 39-44, 2005.

53. F. Kowsary, M. Biglarbegian, "A Mathematical Confirmation for Higher LMTD Value of Counter Flow versus Parallel Flow Heat Exchangers," *ASME Journal of Heat Transfer*, vol. 125, pp. 182-184, 2003.

54. C. Lucas, D. Shahmirzadi, M. Biglarbegian, "A Co-Evolutionary Approach to Graph Coloring Problem," *Amirkabir Journal of Science and Technology*, vol. 13, no. 54, pp. 363-369, 2003.

Conference Papers

Accepted/Published

1. A. Newton, E. Hill, S. A. Gadsden, M. Biglarbegian, "Development of a nanosatellite attitude control simulator for ground-based research", *Proc. SPIE 12121, Sensors and Systems for Space Applications XV, 1212106*, June 2022, Orlando, Florida, USA, 2022.

2. E. Hill, S. A. Gadsden, M. Biglarbegian, "Tube-Based Model Predictive Control of Small Satellite Systems with Uncertainty Dynamics", *Canadian Society for Mechanical Engineering (CSME)*, June 2021, Charlottetown, PE, Canada, 2021.

3. E. Hill, S. A. Gadsden, M. Biglarbegian, "Adaptive Control Strategies based on the Unscented Kalman Filter and Interacting Multiple Models", American Control Conference (ACC), May 2021.

4. A. Newton, E. Hill, A. Gadsden, M. Biglarbegian, S. Yang, "Investigating Reaction Wheel Configuration and Control Law Pairings for CubeSats in the Presence of Faults", *Proceedings of the Canadian Society for Mechanical Engineering International Congress (CSME)*, Charlottetown, PE, Canada, June 2020.

5. B. M. Dyer, T. R. Smith, S. Andrew Gadsden, M. Biglarbegian, "Filtering Strategies for State Estimation of Omniwheel Robots", IEEE International Conference on Mechatronics and Automation (IEEE-IMCA), Beijing, China, Oct. 2020.

6. R. Byerlay, M. Biglarbegian, A. A. Aliabadi, "An Airborne Thermal Imaging Methodology for Mapping Land Surface Temperature (LST) with a High Spatiotemporal Resolution", *Canadian Society for Mechanical Engineering (CSME)*, London, Ontario, Canada, June 2019.

7. C. Bourque, A. Lee, E. Hill, S.A. Gadsden, A. Bardelcik, M. Biglarbegian, "Kalman Filtering and PID Control of an Inverted Pendulum Robot", *Canadian Society for Mechanical Engineering (CSME)*, London, Canada, June 2019.

8. M. Hajyian, S. Mahmud, M. Biglarbegian, H. Abdullah, "A Comperative Study on Cell Arrangement of Lithium-Ion Batteries in Porous Media", *Comsol Conference*, Boston, October 2018.

9. N. Lashkari, M. Biglarbegian, S. Yang, "Backstepping Tracking Control Design for a Tractor Robot Pulling Multiple Trailers, *American Control Conference (ACC)*, Milwaukee, USA, June 2018.

10. J. Chittle, A. Gadsden, M. Biglarbegian, "Mobile Robot Tracking Using an Overhead Camera and Sensor Fusion Techniques, *IEEE Canadian Conference on Electrical & Computer Engineering (CCECE)* , Quebec City, Canada, May 2018.

11. A. Cataford, A. Gadsden, K. Turpie, M. Biglarbegian, "AIR-LUSI: Estimatiom, Filtering, and PID Tracking Simulation, *IEEE CCECE*, Quebec City, Canada, May 2018.

12. M. Hajyian, M. Biglarbegian, S. Mahmud, H. Abdullah, "Design and Control of an Exoskeleton Based Device for Hand Rehabilitation", *IEEE International Symposium on Intelligent and Robotic (IRIS)*, October 2017, Ottawa, Canada.

13. M. Hajyian, S. Mahmud, M. Biglarbegian, H. Abdullah, "Natural Convection of Magnetic Nanofluid in an Annular Space: Effect of Magnetic Field Dependent Thermal Conductivity", *4th International Conference on Fluid Flow, Heat and Mass Transfer (FFHMT'17)*, August 2017, Toronto, Canada.

14. M. Shahriari, M. Biglarbegian, "A Prioritized Collision Avoidance Algorithm for Autonomous Driving, *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, Rio de Janeiro, Brazil, Nov. 2016.

15. N. Lashkari, M. Biglarbegian, S. Yang, "An Optimal Design of Tracking Controller for Articulated Vehicles with Omni-directional Wheels, *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, Rio de Janeiro, Brazil, Nov. 2016.

16. M. Shahriari, M. Biglarbegian, W. Melek, J. Kurian, "A New Computationally Efficient Dynamic Scheduling for Multi-Resource Constrained Procedures," *IEEE World Congress on Computational Intelligence (IEEE WCCI)*, Vancouver, July 2016.

17. B. Sahoo, W. Melek, M. Biglarbegian, "Steering Comparison for All Terrain Vehicles," *Proceedings of The Canadian Society for Mechanical Engineering International Congress*, Kelowna, BC, Canada, June 2016.

18. A. Elseyed, K. Tai, M. Biglarbegian, S. Mahmud, "Survey of Recent Advancements of Energy Harvesting Mechanisms," *IEEE Canadian Conference on Electrical and Computer Engineering, Vancouver, May 2016.*

19. M. Shahriari, M. Biglarbegian, "Conflict Resolution of a Cluttered Multi-Robot System Using Metaheuristic Optimization Algorithms," *Proceedings of IEEE Systems, Man, Cybernetics (SMC)*, Hong Kong, October 2015.

20. K. Tai, A. El-sayed, M. Biglarbegian, "Development of a Unique Gripper and Lifting Mechanisms for Automated Test Water Systems," *IEEE International Conference on Mechatronics & Automation (ICMA)*, Beijing, August 2015.

21. P. Won, M. Biglarbegian, W. Melek, "Development and Performance Comparison of Extended Kalman Filter and Particle Filter for Self-Reconfigurable Mobile Robots", *IEEE Symposium Series on Computational Intelligence*, Dec. 2014, Orlando, FL.

22. E. Colmenar, F. Al-Turjman, M. Biglarebgian, "Data Delivery and Gathering in IoT Applications: An Overview", *IEEE Conference on Local Computer Network (LCN)*, Calgary, Sept. 2014.

23. M. Biglarbegian, F. Al-Turjman, "Path Planning for Data Collectors in Precision Agriculture WSNs", *International Wireless Communications and Mobile Computing Conference (IWCMC 2014), Nicosia, Cyprus, August 2014.*

24. M. Schrieber, M. Biglarbegian, "Hardware Implementation of a Novel Inference Engine for Interval Type-2 Fuzzy Control on FPGA", *IEEE World Congress on Computational Intelligence*, Beijing, China, July 2014.

25. M. Biglarbegian, "On the Design of Robust Intelligent Controllers with Application to Mobile Robot Tracking," *American Control Conference (ACC)*, Montreal, June 2012.

26. T. Lambert, M. Biglarbegian, S. Mahmud, "Design of a Novel Intelligent controller for Efficient Power Delivery in Hybrid Vehicles ," *Submitted to ASME International Design Engineering*

Technical Conferences and Computers and Information in Engineering Conference (IDETC), Chicago, August 2012.

27. L. Wang, S. X. Yang, M. Biglarbegian, "Bio-inspired Navigation of Mobile Robots," *International Conference on Autonomous and Intelligent Systems*, Aveiro, Portugal, June 2012.
28. M. Biglarbegian, "On the Design of Robust Intelligent Controllers with Applications to Mobile Robot Tracking," *American Control Conference (ACC)*, Montreal, September 2011.
29. M. Biglarbegian, Sadeghian, A., Melek W. W.,"Accessibility of Fuzzy Controllers," *International Conference on Autonomous and Intelligent Systems*, Burnaby, BC, Canada, June 2011.
30. M. Biglarbegian M., W. W. Melek, J. Mendel,"Robustness of Interval Type-2 Fuzzy Logic Systems," *proceeding of North American Fuzzy Information Processing Society (NAFIPS)*, Toronto (**best student paper award**), July 2010.
31. M. Biglarbegian, W. W. Melek, J. M. Mendel, "A Practical Approach for Design of PD and PI-Like Interval Type-2 Fuzzy Controllers," *IEEE Systems, Man, cybenertics (SMC)*, San Antonio, Texas, October 2009,.
32. M. Biglarbegian, W. W. Melek, J. M. Mendel,"On the Systematic Design of Type-2 Fuzzy Systems," *IEEE World Congress on Computational Intelligence (WCCI)*, Hong Kong, June 2008.
33. M. Biglarbegian, W. W. Melek, J. M. Mendel,"Stability of Type-2 Fuzzy Systems," *proceeding of NAFIPS*, New York, May 2008.
34. M. Biglarbegian M., W. W. Melek, F. Golnaraghi,"A Novel Fuzzy Controller to Improve Desired Suspension Performance,"*ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference-DETC*, Las Vegas, Nevada, September 2007.
35. M. Biglarbegian M., W. W. Melek, F. Golnaraghi,"A Novel Fuzzy Controller for Stability of Vehicles," *proceeding of NAFIPS*, San Diego, California, June 2007.
36. M. Biglarbegian M., W. W. Melek, F. Golnaraghi,"Intelligent Control of Vehicle Semi-Active Suspension Systems for Improved Ride Comfort and Road Handling," *proceeding of NAFIPS*, Montreal, Canada, June 2006.
37. M. Biglarbegian, J. W. Zu, "Dynamic Analysis and Simulation of Vehicles Carrying Liquid Cargo During Braking, " *ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC*, vol.6 C, Long Beach, California, September 2005.

Symposiums/Poster: non-refereed

1. M. Fletcher, S. Neethirajan, M. Biglarbegian, "Design of an Intelligent System for Drug Delivery Using Bionanorobots" *CSBE/NABEC 2012 Annual Meeting, Orillia, Canada*, July 2012.
2. M. Biglarbegian, "Toward More Efficient Methods for Path Planning of Mobile Robots: Simplified Non-Convex Constraints," *Symposium on Advances in Intelligent Systems, Waterloo, Ontario*, December 2011.
3. M. Biglarbegian, "On the Design of Robust Formation Control of Multiple Mobile Robots," *Symposium on Advances in Intelligent Systems, University of Waterloo, Canada*, December 2011.

BOOK CHAPTERS

1. M. Biglarbegian, "On the robustness of higher order fuzzy sets," in Frontiers of Higher Order Fuzzy Sets, A. Sadeghian, H. Tahayori (Eds.) Springer, 2015.

2. M. Biglarbegian, "On the design of IT2 TSK FLCs," in Introduction to Type-2 Fuzzy Logic Control: Theory and Applications, J. Mendel, H. Hagras, W-W. Tan, W. Melek, H. Ying, (Eds.) IEEE-Wiley, 2014.

Research Grants

Funded Projects

- M. Biglarbegian (co-PI) "Empowering Prosthetic Users: embedding pressure sensing technology via 3D printing to create smart prosthetics", THE DASSAULT SYSTÈMES U.S. FOUNDATION, $59,000 USD (my share 50%), (2024-2025).
- "Development of Novel Data-Driven Methods for Modeling and Control with Applications" (PI), NSERC Discovery Grant, $160,000 (2023-2028)
- "Advanced Autonomous Mobile Manipulation for Flexible Manufacturing" (PI), National Research Council (NRC), $285,000 (2020-2023)
- "Intelligent Orchards: Redefining the Production and Management of Tree Fruits", this project was funded by two agencies: Weston: $134,066 and MITACS Accelerate: $90,000, total: $224,066 (2020-2022), my share: 33%
- "The Intelligent AppleJack: Development of an Apple Tree Inspection System utilizing Machine Vision and Learning Techniques", University of Guelph, $40,000 (co-PI, competitive grant), (2019-2021), my share: 33%
- "Mechanism Design and Control for Solar Panel Windows", NSERC Engage, $25,000, (2019-2020)
- "Novel Robust Motion Control Methods for the Formation of Robots with Docking Capabilities", *NSERC Discovery Grant*, $125,000, (2014-2022)
- "Development of Advanced Intelligent Estimation Algorithm for Mobile Robots", *NSERC Engage*, Total amount $25,000, (2017-2018)
- "Development of Predictive Analytics and Business Intelligence Tools for Improved Patient Management using Intelligent Decision Support Systems", *NSERC CRD*, $276,000 (co-PI), (2014-2017)
- "The Development of Novel Fuel Cell Technology for Mobile Applications", OCE Voucher for Innovation II Program, $343,000 (co-PI), (2016-2018)
- "Steam Reformer Studies and SOFC for Mobile Applications", OCE TalentEdge Program, 2016-2017, (co-investigator only: I had no funding for this grant)
- "Development of novel electromagnetic grippers for Automated Test Water Systems" *MITACS-Accelerate*, $15,000, (2014-1015)
- "Mobile robot localization" *MITACS-Globalink*, (2014)
- "Novel Solutions for Efficient Motion Control of Mechatronics Systems, *NSERC Engage*, $25,000, (2012)

Research Award:

- University of Guelph Research Award, $5,000, 2018

Presentations

In addition to conference presentations, the following is a list of my other presentations:

- *Invited Speaker*: "Advanced Autonomous Robotic Systems: Motion Planning and Intelligent Control", Jan. 2022, Carleton University, Department of Mechanical and Aerospace Engineering, Canada.
- *Invited Speaker*: "Novel Navigation and Control Methodologies for Advanced Mechatronics Systems", Jan. 2022, Concordia University, Mechanical, Department of Industrial, & Aerospace Engineering, Canada.

- *Invited Speaker*: "Advanced Autonomous Robotic Systems: Motion Planning and Intelligent Control", April 2019, Western University, ECE Engineering Department, Canada.
- *Invited Speaker*: "Motion Planning & Control for Advanced Robotic Systems", April 2018, KNTU University, ECE Engineering Department, Tehran, Iran.
- *Invited Speaker*: "Modeling, Control & Optimization for Advanced Robotic Systems", March 2018, KNTU University, Mechanical Engineering Department, Tehran, Iran.
- *Invited Speaker*: "Advanced Robotics: Motion Planning and Control for Autonomous Robots", January 2018, LAAS-CNRS, Toulouse, France.
- *Invited Speaker*: "Motion Planning and Control for Autonomous Vehicles", September 2017, Karlsruhe Institute of Technology, Germany.
- *Invited Speaker*: "Mechatronics and Mobile Robots", September 2016, Mechanical Engineering Dept., University of Oshawa Institute of Technology, Oshawa, ON, Canada.
- *Invited Speaker*: "Advanced Robotics and Control: Motion Planning and Navigation", April 2016, Mechanical Engineering Dept., University of Rhode Island, Kingston, RI, USA.
- *Invited Speaker*: "Advanced Robotics", February 2016, Mechanical Engineering Dept., University of Southern Illinois, Edwardsville, IL, USA.
- *Invited Speaker*: "Advanced Robotics: Motion Planning, Navigation, and Control", February 2016, Mechanical Engineering Dept., University of Iowa, Iowa City, IA, USA.
- *Invited Speaker*: "Type-2 Fuzzy Control Systems with Applications to Modular Robots", December 2014, Mechanical Engineering Dept., University of Tehran, Tehran, Iran.
- *Guest Lecturer*: "Fuzzy Logic Systems," *Symposium on Advances in Intelligent Systems, University of Waterloo, Ontario* , February 2014, Mechanical and Mechatronics Engineering Dept., University of Waterloo, Waterloo, ON, Canada.
- *Guest Speaker*: "Modular and Reconfigurable Robot Systems: Progress, Challenges, Future," *Symposium on Advances in Intelligent Systems, University of Waterloo, Ontario* , December 2012, University of Waterloo, Waterloo, ON, Canada.
- *Invited speaker*: "On the Design, Modeling and Control of Mechatronics Systems,", April 2011, University of Guelph, Guelph, ON, Canada.
- *Invited speaker*: "On the Design of Robust Type-2 Fuzzy Systems,", November 2010, University of Ryerson, Toronto, ON, Canada.
- "Robustness of Fuzzy Logic Systems," *IEEE-North American Fuzzy Information Processing Society (NAFIPS) conference*, July 2010, Toronto, ON, Canada.

Teaching

- **Associate Professor**: MAAE 3500, Feedback Control Systems, Carleton University, Fall 2023 (I revised my previous notes and created some *new materials* that didn't exist in my previous notes)
  Prepared lecture notes, presented weekly lectures, class size 107
- **Associate Professor**: MECH 5805F, Special Topics in Advanced Control with Applications to Mechatronics systems, Carleton University, Fall 2023 (I created this course for the first time)
  Prepared lecture notes, presented weekly lectures, assignments, and projects, class size 12
- **Assistant and Associate Professor**: ENGG*6090, Special Topics in Mechatronics, Robotics, and Control, University of Guelph, summer 2013, Winter 2014, Winter 2015, Winter 2016, Fall 2016, Winter 2019, Fall 2019, Winter 2021 (I created this course)
  Prepared lecture notes, presented weekly lectures, assignments, and projects, class size 5 to 10

- **Associate Professor**: ENGG*6490, Nonlinear and Intelligent Control, University of Guelph, Winter 2022 (I created this course for the first time at the U of Guelph)
  Prepared lecture notes, presented weekly lectures, assignments, class size 5
- **Assistant and Associate Professor**: ENGG*3490, Introduction to Mechatronics Systems Design, University of Guelph, Winter terms: 2012, 2013, 2014, 2015, 2016, 2017, 2019, 2020, 2021 (I created this course)
  Prepared lecture notes, presented weekly lectures, assignments, and projects; I also developed a new lab with several experiments for this course: class size 22 to 64
- **Assistant and Associate Professor**: ENGG*3510, Electromechanical Devices, University of Guelph, Fall terms: 2011, 2012, 2013, 2014, 2015, 2018, 2019, 2020 (I developed this course for the first time at the U of Guelph)
  *Prepared lecture notes, presented weekly lectures, designed tutorials, assignments, and projects; I also developed a new **laboratory** with several experiments for this course: class size 52 to 135*
- **Associate Professor**: ENGG*3410, Systems and Control, University of Guelph, Winter term: 2017, 2019 (I created this course)
  Prepared lecture notes, presented weekly lectures, designed tutorials, assignments, and projects; I also developed new labs with several experiments for this course: class size 180 students, managed 8 teaching assistants
- **Associate Professor: sessional lecturer**: MTE 544, Autonomous Mobile Robots, University of Waterloo,
  Prepared lecture notes, presented weekly lectures, designed assignments, and projects; class size : 60 students, managed 2 teaching assistants
- **Instructor**: ME 203, Ordinary Differential Equations, University of Waterloo, Fall 2008
  Prepared lecture notes, presented weekly lectures, designed tutorials, homeworks, and projects for a class of 81 students
- **Co-Instructor** Mechanical Engineering Design Workshop, University of Waterloo, Winter 2010
  Designed the project course, helped with preparing lecture notes, designed and presented tutorials, designed the course website, mentored students with their design in the lab
- Mentored an M.Sc. student on the design, modeling, and control of an active prosthetic knee, University of Waterloo, 2007-2008
- Supervised an undergraduate student on the implementation of a tracking controller on a two-wheel differential drive robot, University of Waterloo, summer 2009
- Teaching Assistant: Mechanical Engineering Design Workshop, University of Waterloo, Winter 2007, 2008, 2009 (awarded ***two times*** as the **best teaching assistant** of the Mechanical and Mechatronics Engineering department, U of Waterloo)
  this is a very hands on workshop where students developed a complete Mechatronics system from scratch
- Teaching Assistant: Advanced Engineering Mathematics, University of Waterloo, Spring 2006 and Spring 2007
  presented weekly tutorials, graded projects and exams
- Teaching Assistant: Differential Equations, University of Waterloo, Fall 2005
  presented weekly tutorials, graded exams and projects
- Teaching Assistant: Dynamics, University of Toronto, Winter 2004 and Winter 2005
  presented weekly tutorials, graded quizzes
- Teaching Assistant: Mechanics of Materials I, University of Tehran, Fall 1999
  presented weekly tutorials

Supervision

PhD supervision

- Elyse Hill **Ph.D.**, School of Engineering, University of Guelph, 2017-2021, NASA Postdoctoral fellow.
- Mohammadhossein Hajyian **Ph.D.**, School of Engineering, University of Guelph, 2020 (now with Armstrong Fluid Technology: `http://armstrongfluidtechnology.com/`)
- Negin Lashkari **Ph.D.**, School of Engineering, University of Guelph, graduated: 2018 (now with General Motors: `http://www.gm.ca/gm/`)
- Mohammadali Shahriari, **Ph.D.**, School of Engineering, University of Guelph, 2017 (now with General Motors: `http://www.gm.ca/gm/`)
- Sharif Islam, **Ph.D.**, School of Engineering, University of Guelph, graduated: 2017, (Process Engineer with Canada Post)

M.A.Sc and M.Eng. supervision

- Keanan Dumais **M.A.Sc.**, Sensor development, Carleton University, Sept. 2023-now.
- Spencer Ploeger **M.A.Sc.**, Motion Planning using Stochastic and non-Stochastic Machine Learning and Control for a Mobile Manipulator Robot, University of Guelph, 2021-2023 (now with Erode AI in Montreal).
- Cesar Wu **M.A.Sc.**, Agricultural Robot, University of Guelph, 2020-2022 (now with NuPort Robotics).
- Saif-Mattar, **M.Eng.**, Soft Robotics using Auxetic Materials, University of Guelph, 2021-2022.
- Benjamin Dyer, **M.A.Sc.**, University of Guelph, Sept. 2019-2021 (now pursing PhD in Physics at McMaster University)
- Joseph Lee, **M.A.Sc.**, University of Guelph, 2019-201 (now with Nested Minds Network)
- Matine Hajian (co-supervised **M.A.Sc.**, Development of Control Strategies for Mixed Autonomous and Human-driven Vehicles, KNTU (Iran), 2020-2021.
- Ryan Byerlay (**M.A.Sc.**, University of Guelph, 2018-2020 (now with Independent Environmental Consultants)
- Amit Patel, **M.Eng.**, University of Guelph, May 2018-May 2019 (currently with Magna international)
- Jake Chittle, **M.Eng.**, University of Guelph, 2015 - 2018 (now with Honda)
- Bismaya Sahoo, **M.A.Sc.**, University of Waterloo, graduated: 2018 (now with Zebra Technologies `https://www.zebra.com/us/en.html`)
- You Lyu, **M.Eng.**, University of Guelph, graduated: 2018
- Abdulrahman El-Sayed, **M.Eng.**, graduated: 2015, (CEO of CampusMate Inc)
- Kevin Tai, **M.Eng.**, graduated: 2015 (now with HHangus: `http://www.hhangus.com/`)
- Abu Muslim, **M.Eng.**, graduated: 2015 (Senior Data Engineering Analyst at Loblaw Companies Limited: `https://www.loblaw.ca/`)
- Matthew Schriber, **M.Eng.**, graduated: 2014 (with L3 WESCAM. : `https://www.l3harris.com/en-ca/canada`)
- John Cloutier, **M.A.Sc.**, graduated: 2014, now a postdoc at U of Guelph.
- Tim Lambert,**M.A.Sc.**, graduated: 2013 (currently with: Virgin Hyperloop `https://virginhyperloop.com/`)
- Azam Javed, U of Waterloo, graduated: 2013 (now with Tesla motor `http://www.teslamotors.com/`).

Postdoctoral fellow and visiting students

- Zhe Xu (co-supervised), **Postdoctoral fellow**, Aug. 2023- present.

- Peter Won, **Postdoctoral fellow**, Dec. 2012 - April 2014, (now with A123 Systems: `http://www.a123systems.com/`)
- Jiang Anzu, U of Guelph, **Visiting Ph.D. student**, September 2016-Aug 2017
- Tu Yulong, U of Guelph, **Visiting Ph.D. student**, September 2016-Aug 2017

Undergraduate supervision: supervised or co-supervised

- Alia Nichol, Carleton U., **Undergraduate Research Assistant**, Winter-summer 2024 (Feb. 2024-present)
- Kevin Zhou, Carleton U., Fall 2023 (Sept. 2023 - Dec. 2023)
- Jacob Bodera , U of Guelph, **Undergraduate Research Assistant**, Fall 2023 (Sept.-Dec. 2023)
- Keanan Dumais, Carleton U., **Undergraduate Research Assistant**, (July-Aug. 2023)
- Aidan Holvik, U of Guelph, **Undergraduate Research Assistant**, Summer 2022 (May.-Aug. 2022)
- Rachael Mohl, U of Guelph, **Undergraduate Research Assistant**, Summer 2022 (May.-Aug. 2022)
- Alasdair MacLean, U of Guelph, **Undergraduate Research Assistant**, Summer 2022 (May.-Aug. 2022)
- Joel Deen, U of Guelph, **Undergraduate Research Assistant**, fall 2020, fall 2021
- Spencer Ploeger, U of Guelph, **Undergraduate Research Assistant**, summer 2020
- Tanzim Mahmud, U of Guelph, **Undergraduate Research Assistant**, summer 2020
- Trevor Smith (supervised), U of Guelph, **Undergraduate Research Assistant**, summer 2019
- Marinus Lurz (supervised), U of Guelph, **Undergraduate Research Assistant**, February 2016-August 2017.
- Lars Meier-Ebert (supervised), U of Guelph, **MITACS Globalink Undergraduate Student**, May 2017-August 2017.
- Owen-Botelho (co-supervised), U of Guelph, **Undergraduate Research Assistant**, May 2017-August 2017.
- Hanyiah Saleh (co-supervised), U of Guelph, **Undergraduate Research Assistant**, May 2017-August 2017.
- Joshua Chau (supervised), U of Guelph, **Undergraduate Research Assistant**, January 2017-April 2017.
- Ridwan Rahman (supervised), U of Guelph, **Undergraduate Research Assistant**, January 2017-April 2017.
- Rehann John (supervised), U of Guelph, **Undergraduate Research Assistant**, January 2017-April 2017.
- Kaitlyn Yan (supervised), U of Guelph, **Undergraduate Research Assistant**, January 2017-April 2017.
- Loius Espinoza(supervised), U of Guelph, **Undergraduate Research Assistant**, May 2016-February 2017.
- Nabeel Syed (supervised), U of Waterloo, **Undergraduate Research Assistant**, Summer 2015.
- Jake Park (supervised), U of Waterloo, **Undergraduate Research Assistant**, Summer 2015.
- Abhinav Rajavani (supervised), U of Guelph, **MITACS Globalink Undergraduate Student**, summer 2014

- Swetank Ambar (supervised), U of Guelph, **MITACS Globalink Undergraduate Student**, summer 2014
- Jihan Wu (co-supervised), U of Guelph, **Undergraduate Research Assistant**, May 2013-August 2013.
- Andrew Zuk (supervised), U of Guelph, **Undergraduate Research Assistant**, May 2013-August 2013.
- Kevin Tai (supervised), U of Guelph, **Undergraduate Research Assistant**, May 2013-August 2013.
- Mark Fletcher (co-supervised), U of Guelph, **Undergraduate Research Assistant**, May 2013-August 2013.
- Evan Walsh (supervised), U of Guelph, **Undergraduate Research Assistant**, May 2012-August 2012.
- Mohanad Alhismawi (supervised), U of Guelph, **Undergraduate Research Assistant**, Summer 2012.
- co-supervised: Shlok Patel, Nolan Jarv, Thomas Doiron, Mackenzie Dean, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2022-April 2022
- supervised: Wasay Ahmadi, Ozeyodin Ghyas, Jayrone Quilaton, Omar Tannous, Hamza Ajaz, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2022-April 2022
- supervised: Stephen Abraham, Robert Roitman, Mahmood Mostafa Mohiuddin, Sohail Ahmed, Rohail Thadani, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2022-April 2022
- co-supervised: Thomas Bengert, Elijah Garrett, Liam Clune, Owen Kidnie, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2021-April 2021
- supervised: Laura Murphy, Gurtej Dhami, Eric Faguy, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2021-April 2021
- co-supervised: Saif Matar, Mahmoud Elkhalifa, Mayada Elkhalifa, Noor-E-Zehra Jaffar, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2020-April 2020
- supervised: Elliot Darcel, Benjamin Davey, Brett Sicard, Spencer Weaver, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2019-April 2019
- supervised: Alexander Moksyakov, Andriy Yuzva, Jonathan Macpherson, Nathaniel Milani, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2019-April 2019
- supervised: Karan Rao, Michael Mills and Tianyue Cai, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2019-April 2019
- supervised: Cameron Gendron, Daniel Gordon, Robert Scott, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2019-April 2019
- supervised: Eric Chadwick, Keven Cann, Thuvaragan Vithiyananthan, Travis Pootoolal **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2017-April 2017
- supervised: Brad Patterson, Emily Lockhart, Sebastian Sadowski, William Seymour **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2017-April 2017

- supervised: Benjamin Beardsall, David Gaul, Maxwell Kooh, Vishal Pal **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2017-April 2017
- supervised: Erik Dick, David Walters, Scott Raddatz **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Sept. 2016-December 2016
- supervised: Harakshdeep Gill, Komal Banawit, Shoaib Syed, Keerthi Sukhavasi **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2016-April 2016
- supervised: Collin Brenna, Terrance DeVrise, Melissa Falkner, Christian McCrave **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2016-April 2016
- supervised: Wendel Brook, Michal Czernik, Erick Palacios, Nathanael Love **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2016-April 2016
- supervised: Michael Mohan, Scott Vanderwier, David Gupta, Kyle Calvert **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2015-April 2015
- supervised: David Simone, Katherine Foster, Evan Giehler, Henry Evans **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2015-April 2015
- supervised: Robert Boss, Lauren Patrick, Angela Dang, Brittany McFarlane, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2014-April 2014
- supervised: David Call, Zhihan We, Mohammad Khan, **undergraduate students: 4th-year capstone project** , School of Engineering, University of Guelph, Sept. 2014-Dec. 2014
- supervised: Robert Boss, Lauren Patrick, Angela Dang, Brittany McFarlane, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2014-April 2014
- supervised: Amatulrahman Al-Abassi, Amatulraheem Al-Abassi, Harris Moattar, William Brydges, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2014-April 2014
- supervised: Padraic Griffin, Jonathan Walsh, Jay Vogler, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Sept. 2014-Dec. 2014
- supervised: Nicole Serrao, Karanvir Chattha, Devesh Agrawal, Alexander Griffith, **undergraduate students: 4th-year capstone project**, School of Engineering, University of Guelph, Jan. 2013-April 2013

Served Committees

- 'Graduate Scholarship' committee member, 2023-present, Mechanical and Aerospace Engineering Department, Carleton University
- 'Mechatronics Engineering Program Development' committee member, 2023-present, Mechanical and Aerospace Engineering Department, Carleton University
- 'Faculty hiring' committee member for Mechanical Engineering (Mechatronics position), 2022, School of Engineering, University of Guelph

  Member of the accreditation team to visit Western University (I was invited at the Mechatronics Expert), 2022
- "Mechatronics Engineering": New Engineering Program (to be launched in 2026), **Chair**, School of Engineering, Sept. 2021- July 2022
  As a chair my role involves curriculum development (including program learning outcomes,

graduate attributes), communication with leadership, administrative duties, coordinating with several units of campus (e.g. Office of Quality Assurance, Co-op and Experiential Learning Office, Library)

- Lab and Safety, Chair, School of Engineering, May 2021-Aug. 2022
- Mechatronics Engineering Program Development, Member, 2020-2023
- Tenure and Promotion (T&P) member, School of Engineering, University of Guelph, 2018-2020
- Acting Program Area Head for Mechanical Engineering Group, School of Engineering, University of Guelph, July-August 2019
- 'Faculty hiring', committee member for Mechanical Engineering (2 positions), School of Engineering, University of Guelph, Sept. 2016 - April 2017
- Program committee member, 2015-2020
- 'Faculty hiring' committee member for Computer Engineering, 2015 to 2016, School of Engineering
- Admission committee member, School of Engineering, University of Guelph, Aug 2011 to December 2015
- Awards committee member, September 2014 to December 2015
- 'Faculty hiring' committee member for Computer Engineering (2 positions), School of Engineering, University of Guelph, April 2013 to June 2013
- Equipment (Phase 2) committee member, Member, School of Engineering, University of Guelph, Jun 2012 to Jun 2013,
- Faculty Advisor for Robotics Club, School of Engineering (I established this club), University of Guelph, Jan 2012 to 2022,
- Co-organized Science Olympic, co-organizer, College of Engineering & Physical Sciences, University of Guelph, May 2012

Professional Activities

- Associate Editor of International Journal of "Robotics and Automation", November 2015-present
- Associate Editor of journal of "Intelligence and Robotics", June 2021-present
- Program visitor for Mechatronics System Engineering accreditation, Western Univerrsity, Nov. 2022
- Co-organized a special session at *IEEE IRIS* conference, Ottawa, 2017
- Research Grant Reviewer for *NSERC: 2012-present*
- Research Grant Reviewer for *MITACS: 2014-present*
- Research Infrastructure Grant Reviewer for *CFI: 2013-present*
- Reviewer for *IEEE Transactions on Robotics: 2017-present*
- Reviewer for *IEEE Transactions on Cybernetics: 2015-present*
- Reviewer for *IEEE Transactions on System, Man, and Cybernetics (SMC): 2008-present*
- Reviewer for *IEEE Transactions on Industrial Electronics: 2009-present*
- Reviewer for *IEEE Transactions on Control System Technology: 2009-present*
- Reviewer for *IEEE/ASME Transactions on Mechatronics: 2007-2010*
- Reviewer for *Robotica: 2012-present*
- Reviewer for *Elsevier-Information Sciences: 2010-present*
- Reviewer for *Elsevier-Applied Soft Computing: 2014-present*
- Reviewer for *IEEE Transactions on Neural Networks: 2010-present*

- Reviewer for *International Journal of Robotics and Automation: 2009-present*
- Reviewer for *Control and Intelligent Systems: 2009-present*
- Reviewer and Program committee member of IEEE World Congress on Computational Intelligence, Beijing, July 2014
- Organized and chaired a special session on 'Autonomous Systems and Intelligent Control with Applications", International Conference on Autonomous and Intelligent Systems (AIS), Aveiro, Portugal, June 2012
- Program committee member of IEEE World Congress on Computational Intelligence, Fuzz-IEEE section, Brisbane, Australia, June 2012
- Program committee member of the Advanced on Intelligent Systems, Waterloo, December 2011
- Organized and chaired a special session on 'Intelligent and Nonlinear Control Systems with Applications", International Conference on Autonomous and Intelligent Systems (AIS), Burnaby, BC, Canada, June 2011
- Track co-chair of the International Conference on AIS, Burnaby, BC, June 2011
- Program committee member of the Competition Task Force of the IEEE Computational Intelligence, Taiwan, June 2011
- Program committee member of Symposium on Advanced Computational Intelligence, Paris, France, April 2011
- Presented a tutorial on the "On the Robustness of Fuzzy Logic Systems for Modeling and Control Applications", *NAFIPS* conference, Toronto, July 2010
- Organized and chaired a special session on "Type-2 Fuzzy Logic Systems and Control", *NAFIPS* conference, Toronto, July 2010
- Program committee member of the NAFIPS conference, Toronto, July 2010
- Organized 2 special sessions on "Fuzzy Logic Systems and Control", *IEEE SMC* conference, San Antonio, Texas, October 2009

Professional Membership

- Institute of Electrical and Electronics Engineers (*IEEE* Senior Member)
- IEEE Robotics and Automation Society member

Hicham Chaoui, Ph.D., P.E., SMIEEE
Carleton University — Associate Professor
1125 Colonel by Drive — Phone: 613-520-2600 ext. 7467
Ottawa, ON K1S 5B6, Canada — E-mail: hicham.chaoui@carleton.ca

HIGHLIGHTS

- Acquired 15+ years of experience (10 years in academia + 7 years in industry)
- Published 200+ articles (h-index: 33, 4000+ citations – Google Scholar)
- Supervision/co-supervision: 6/3 (9) postdoc, 15/4 (19) Ph.D., 20/4 (24) M.S. (total: 50+)
- Awards: early researcher award, research excellence award, top editor recognition, gold medal…
- Associate Editor, IEEE Trans. Pow. Electro., IEEE Trans. Veh. Tech., IEEE Trans. ASE, & more

EDUCATION

- Ph.D., Electrical Engineering (with honors), University of Quebec, QC, Canada, 2011
- D.E.S.S., Project Management (graduate degree), University of Quebec, QC, Canada, 2007
- M.S., Computer Science (with honors), University of Quebec, QC, Canada, 2004
- M.S., Electrical Engineering (robotics), University of Quebec, QC, Canada, 2002
- B.S., Electrical Engineering, Institut Supérieur du Génie Appliqué, Morocco, 1999

PROFESSIONAL EXPERIENCE

- 2017-pres. *Associate Professor (2019-pres.) – Assistant Professor (2017-2019)*
  Carleton University, Ottawa, ON, Canada
- 2014-2016 *Assistant Professor*
  Tennessee Technological University, Cookeville, TN, USA
- 2013-2014 *Teaching Professor*
  Cégep de l'Outaouais, Gatineau, QC, Canada
- 2013-2014 *Vice-President of Innovation and Technology Development*
  TDE Techno Design, R&D Department, Montreal, QC, Canada
- 2012-pres. *Adjunct Professor*
  University of Quebec, Trois-Rivières, QC, Canada
- 2012-2013 *Control and Instrumentation Engineer*
  Orbite Technologies Inc., Montreal, QC, Canada
- 2011-2012 *Electrical Design Engineer*
  Toromont Cat (CATTERPILLAR), Energy Division, Montreal, Canada
- 2009-2011 *Research Fellow*
  École Polytechnique de Montréal, Montreal, QC, Canada
- 2007-2009 *Project Leader*
  ABB Group, Montreal, QC, Canada

AWARDS AND HONORS

- Early Researcher Award, Government of Ontario, 2022
- FED Research Excellence Award, Carleton University, 2021
- Top Editor Recognition, IEEE Vehicular Technology Society, 2020
- Best Paper Award, IEEE Transaction on Industrial Electronics, 2015
- Governor General of Canada gold medal, 2012
- Best university thesis award, health, natural science and engineering, 2012
- Award of excellence (honors): Ph.D. thesis, 2011
- Award of excellence (honors): M.Sc. thesis, 2005

FUNDING AND GRANTS

- "Robotic-Based Real-Time Health Monitoring Agroforestry", *TTU–CATIE Research Exchange Program,* $8K, (PI) – 2024-2025.
- "Online Diagnosis and Lifetime Prognosis of Next Generation Energy Storage Systems", *Discovery-Supplement, Natural Sciences and Engineering Research Council of Canada,* $28K, (PI) – 2023-2024.
- "Vision-based Terrain Classification", *Rheinmetall Provectus,* $81.6K, (co-PI) – 2023-2024.
- "Real-Time Self-Monitoring Energy Storage Systems", *Early Researcher Award, Government of Ontario,* $190K, (PI) – 2022-2027.
- "Artificial Intelligence Enhanced Resilience-Oriented Energy Management and Control for Cyber-Physical Microgrids", *John R. Evans Leaders Fund (JELF), Canada Foundation for Innovation (CFI),* $150K, (co-PI) – 2022-2027.
- "Distributed Digital Intelligence Network (D2IN): Development of Disruptive and Low-cost Microsystems for Edge Computing", *Canada Foundation for Innovation (CFI),* $15.93M, (Collaborator) – 2021-2026.
- "COVID-19: Operational Optimization of an Autonomous Disinfection Vehicle in Indoor Environment", *MITACS*, $90K, (co-PI) – 2020-2021.
- "Improving Sound in High Performance Audio Systems", *Collaborative Research and Development (CRD) Grant, Natural Sciences and Engineering Research Council of Canada,* $1.47M, (Collaborator) – 2019-2024.
- "Algorithm Implementation Tools on Heterogeneous Platforms for the Electric Grid and 5G Networks", *Collaborative Research and Development (CRD) Grant, Natural Sciences and Engineering Research Council of Canada,* $1.67M, (co-PI) – 2018-2023.
- "Online Diagnosis and Lifetime Prognosis of Next Generation Energy Storage Systems", *Discovery, Natural Sciences and Eng. Research Council of Canada,* $140K, (PI) – 2018-2023.
- NSERC General Research Fund, *Natural Sciences and Engineering Research Council of Canada,* $10K, (PI) – 2017-2022.
- "Secure and Privacy Preserving Cyber Physical Systems", *National Science Foundation*, $360K, (Collaborator) – 2016-2018.
- "Self-Charging Unmanned Aerial System for Power Lines Inspection", *Tennessee Board of Regents*, $40K, (co-PI) – 2015-2016.
- "Adaptive Neural Control of Permanent Magnet Synchronous Machines with Guaranteed Stability", *FQRNT,* QC, Canada, $130K, (co-PI) – 2013-2016.

EDITORIAL ACTIVITIES

- General co-Chair, IEEE Vehicle Power and Propulsion Conference (VPPC'24)
- Associate Editor, IEEE Transactions on Power Electronics (2022-present)
- Associate Editor, IEEE Transactions on Automation Science and Engineering (2021-present)
- Associate Editor, Intelligence and Robotics (2021-present)
- Associate Editor, International Journal of Robotics and Automation (2019-present)
- Associate Editor, IEEE Transactions on Vehicular Technology (2018-present)
- Associate Editor, Actuators, MDPI (2021-present)
- Associate Editor, Robotics, MDPI (2020-present)
- Editor, Book - Intelligent Control and Smart Energy Management, Springer (2020-2021)
- Guest Editor, Special Issue, Computers & Electrical Engineering, Elsevier (2022)
- Guest Editor, Special Issue, Energies, MDPI (2022)
- Guest Editor, Special Issue, Machines, MDPI (2022)
- Guest Editor, Special Issue, Intelligence and Robotics (2022)
- Guest Editor, Connected Vehicle Series, IEEE Transactions on Vehicular Technology (2020)
- Guest Editor, Special Issue, Intelligent Control and Smart Energy Management: Springer (2020)

- Guest Editor, Special Issue, Neural Computing and Applications, Springer (2020)
- Guest Editor, Special Issue: Digital and Intelligent Systems, Sustainability, MDPI (2020)
- Guest Editor, Special Issue: Actuators for Land Transport, Actuators, MDPI (2020)
- Guest Editor, Special Issue: Modeling and Control, Energies, MDPI (2020-2021)
- Guest Editor, Special Issue: Intelligent Control Theory, Robotics, MDPI (2019-2020)
- Associate Editor, IEEE Intelligent Vehicles Symposium (IV'22,'21,'20,'19)
- Track Chair, Special Session, IEEE Conference on Industrial Electronics Society (IECON'20)
- TPC member, IEEE International Symposium on Robotic and Sensors Environments (ROSE'20)
- Track Chair, IEEE Vehicle Power and Propulsion Conference (VPPC'22,'20,'18,'16,'15)
- Tutorial Chair, IEEE Vehicle Power and Propulsion Conference (VPPC'19,'18)
- TPC member, IEEE International Symposium on Robotics and Intelligent Sensors (IRIS'19)
- Track Chair & Award Chair, IEEE Int. Symposium on Robotics and Intelligent Sensors (IRIS'17)
- Workshop Organizer, IEEE Intelligent Vehicles Symposium (IV'16)
- IEEE-IES Technical Committee Member: Motion Control & Energy Storage (2016-present)
- IEEE-IES Technical Committee Member: Transportation Electrification (2015-present)

REVIEW/PANEL ACTIVITIES

- Engineering Panel Member, Ontario Research Fund – Research Excellence program (ORF-RE).
- Reviewer, Natural Sciences and Engineering Research Council of Canada
- Reviewer, Fonds de Recherche du Québec – Nature et technologies (FQRNT).
- Reviewer, Mitacs Accelerate.
- Reviewer, France Canada Research Fund.
- Reviewer, W.E. Cowie Innovation Award.
- Reviewer, Young Individual Research Grant, Singapore.
- Reviewer, Programme Samuel-De-Champlain

PROFESSIONAL AFFILIATION

- Professional Engineer (P.Eng.)
- Institute of Electrical and Electronic Engineers (IEEE): Senior Member

LANGUAGES

- English, French, Moroccan.

TRAINING OF HIGH QUALIFIED PERSONNEL

- **SOLE SUPERVISION:**

  Postdoctoral researchers:

  - Mohamad Alzayed: electrical engineering, Carleton University, Canada (2022-).
  - Chafik Okar: electrical engineering, Carleton University, Canada (2019-2022).
  - Ali Jebelli: electrical engineering, Carleton University, Canada (2019-2021).
  - Allal El Moubarek Bouzid: electrical engineering, Carleton University, Canada (2018-2019).
  - Mohammad Mansouri: electrical engineering, Tennessee Tech. Univ., USA (2015-2017).
  - Mohamed Kafi: electrical engineering, Tennessee Tech. Univ., USA (2015-2016).

  Ph.D. Students:

  - Emad Elhaji: Ph.D., electrical engineering, Carleton University, Canada (2021-).
  - Mohammad Hahseminasab: Ph.D., electrical eng., Carleton University, Canada (2021-).
  - Arun Raja Palpandian: Ph.D., electrical engineering, Carleton University, Canada (2021-).
  - Mohammad Zamani: Ph.D., electrical engineering, Carleton University, Canada (2020-).

- Armin Lotfy: Ph.D., electrical engineering, Carleton University, Canada (2020-).
- Osarodion Egbomwan: Ph.D., electrical engineering, Carleton University, Canada (2019-).
- Alaref Elhaj: Ph.D., electrical engineering, Carleton University, Canada (2019-).
- Safi Bamati: Ph.D., electrical engineering, Carleton University, Canada (2019-).
- Yashar Farajpour: Ph.D., electrical engineering, Carleton University, Canada (2019-).
- Anas Tiane: Ph.D., electrical engineering, Carleton University, Canada (2021-2023).
- Mohamad Alzayed: Ph.D., electrical engineering, Carleton University, Canada (2018-2022).
- Mehdy Khayamy: Ph.D., electrical engineering, Tennessee Tech. Univ., USA (2014-2017).

Master's Students:

- Jonathan Plangger: M.A.Sc., electrical engineering, Carleton University, Canada (2021-).
- Joseph Omakor: M.A.Sc., electrical engineering, Carleton University, Canada (2021-2023).
- Chimezirim Nkemdirim: M.A.Sc., electrical eng., Carleton University, Canada (2021-2023).
- Mouhcine Harib: M.A.Sc., electrical engineering, Carleton University, Canada (2021-2023).
- Vaishnavi Vemuri: M.Eng., electrical engineering, Carleton University, Canada (2021-2023).
- Yitong Shen: M.A.Sc., electrical engineering, Carleton University, Canada (2021-2022).
- Philippe Massicotte: M.A.Sc., electrical eng., Carleton University, Canada (2020-2022).
- Abdulazeez Abba: M.A.Sc., sustainable energy, Carleton University, Canada (2020-2022).
- Unnati Thakkar: M.A.Sc., electrical engineering, Carleton University, Canada (2019-2021).
- Rosita Ahmadi: M.A.Sc., electrical engineering, Carleton University, Canada (2019-2020).
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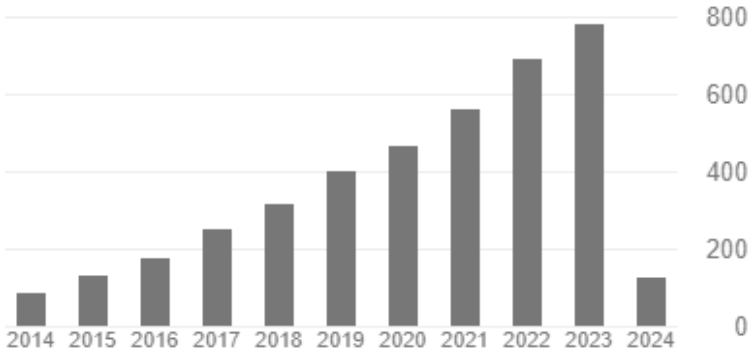

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133. M.K. Dayeni, A. Macias, L. Boulon, S. Kelouwani, and H. Chaoui: "Real-Time Fuzzy Logic Based Supervisory Control Scheme for Energetic Macroscopic Representation of a Fuel Cell/Battery Vehicle", *IEEE Veh. Power and Prop. Conf. (VPPC)*, Belfort, France, Dec. 2017.
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RESEARCH INTERESTS

Guidance, Navigation & Control ◇ Physics-informed Reinforcement Learning ◇ Neuromorphic Intelligence ◇ Embodied Cognition ◇ Geometric Mechanics & Control ◇ Traction Control of Vehicular Systems ◇ Robust & Optimal Control ◇ Multi-Sensor Fusion ◇ Multi-agent Systems ◇ Model Predictive Control ◇ Robotics & Mechatronics ◇ Soft Robotics ◇ Multi-Legged Robotics ◇ Robot Damage Recovery ◇ Vehicle-manipulator Systems.

EMPLOYMENT

- Carleton University, ON, Canada
  Canada Research Chair, Tier 2, in Autonomous Space Robotics and Mechatronics 2018/10-
  Associate Professor, Mechanical and Aerospace Engineering 2023/07-
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  ASRoM-Lab **Mission:** Developing concepts, theories, methodologies and technologies for advanced guidance, navigation and control of next-generation space robotics, based on techniques in Geometric Mechanics and Artificial Intelligence, and experimentally testing them in realistic scenarios
- MacDonald, Dettwiler and Associates (MDA), ON, Canada
  R&D Engineer, Guidance, Navigation and Control - Space Robotics & Space Systems 2014/07-2017/12
  Lead R&D Engineer, Orbital Effects on Capture and Release of Visiting Vehicles 2014/10-2017/12
- University of Calgary, AB, Canada
  Postdoctoral Fellow, Mathematics and Statistics - Geometric Mechanics 2014/01-2014/06
  Course Instructor, Mathematics and Statistics - Multivariate Calculus 2014/01-2014/04
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  Research Assistant, Mathematics - Geometric Mechanics and Control 2010/01-2013/12
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EDUCATION

- **Doctor of Philosophy**, Aerospace Science and Engineering - Space Robotics 2013
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- **Master of Applied Science**, Aerospace Science and Engineering - Mechatronics 2008
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AWARDS AND HONOURS

- **Certificate of Reviewing** from Acta Astronautica journal (Elsevier) 2023/08
  In recognition of the review made for Acta Astronautica journal
- **Certificate of Reviewing** from Aerospace Science and Technology journal (Elsevier) 2023/10
  In recognition of the review made for Aerospace Science and Technology journal
- **Honorary Acknowledgement of service** as an Expert Reviewer for the 2022 competition of the New Frontiers in Research Fund, Transformation stream 2022/11
- Invited to serve as a member of the **Multidisciplinary/Multisectoral Review Panel** for the 2022 competition of New Frontiers in Research Fund (NFRF), Transformation stream 2022/01
  Declined due to conflict of interest
- **Honorary Acknowledgement of service** as a member of the **Multidisciplinary Review Panel** for the 2020 competition of New Frontiers in Research Fund (NFRF), Exploration stream 2021/03
- Nominated for **Faculty Graduate Mentoring Award** by the Office of Vice President Research and International, Carleton University 2020/02
  In recognition of outstanding graduate student mentorship (41 professors nominated campus-wide and 6 received the award)
- **Early Career Discovery Launch Supplement** award form Natural Sciences and Engineering Research Council of Canada (NSERC) 2019/04
- **Canada Research Chair** (Tier 2) award from the Federal Tri-agency Institutional Programs 2018/10
- **Certificate of Reviewing** from Mechatronics journal (Elsevier) 2017/12
  In recognition of the review made for Mechatronics journal
- **Certificate of Outstanding Contribution in Reviewing** from Mechatronics journal (Elsevier)
  In recognition of the contributions made to the quality of Mechatronics journal 2017/12
- **Honorary Acknowledgement of Service and Leadership** from the manager of the Guidance, Navigation, and Controls department, MDA 2016/06
  In recognition of the contributions and leadership as a multibody dynamics engineer on the L&SE, ExoMars and LSM programs

PROFESSIONAL ASSOCIATIONS

- **Member**, Institute of Electrical and Electronics Engineers (IEEE) 2016/01-
  IEEE Young Professionals 2016/01-
  IEEE Robotics and Automation Society 2016/01-
  IEEE Systems Council 2018/01-
  IEEE Systems, Man, and Cybernetics Society 2023/01-
- **Member**, American Institute of Aeronautics and Astronautics (AIAA) 2018/01-
- **Member**, Professional Engineers Ontario (PEO) 2019/05-

RESEARCH CONTRIBUTIONS

■ FUNDING AND GRANTS

UNDER REVIEW

- **Qualified Spaceflight Professionals** (Collaborator-$1.65M)
  NSERC, Collaborative Research and Training Experience (project no. 584867; LOI submitted: 2023/05/31)
  Carleton University (Lead PI: Dr. Prashant Waghmare)

I am a member of a team of researchers and educators with focus on Robotics. The funding will be used towards designing a program to train aspiring students from the post-secondary environment in Canada to become certified as qualified human spaceflight professionals.

- **Circular Economy Housing: Re-aligning Architecture/ Engineering/Construction (AEC) Digital Workflows and Fabrication for Canada's Housing Crisis** (Co-PI-$280K)
  (project no. 44290; submitted: 2023/11/01)
  Canada Foundation for Innovation, Innovation Fund (Lead PI: Dr. Sheryl Boyle)
  Carleton University
  I am the co-PI with focus on the Robotic 3D printing, CNC, and milling. The funding will be used towards purchasing equipment to establish a robotic infrastructure for on-site building manufacturing at Carleton University.

AWARDED

- **Lunar Rover Mission Phase A** 2021-2022
  Canadian Space Agency, Lunar Exploration Accelerator Program (Technology Team Member-$1.8M)
  Carleton University (Lead PI: MDA Robotics)
  This project is led by MDA Robotics and my lab along with our collaborators at NRC (Dr. Wei Huang) and Polytechnique Montreal (Dr. Pooneh Maghoul) are providing support during the Phase A of the project as part of the Technology Team assembled by MDA. We are also involved in the next phase of this project. The dollar amount that will be allocated to my lab is not pre-determined and depends on the contractual work done for MDA.
- **Neurocomputation of normal versus abnormal brain-body interaction for conscious reconfigurable and fault-tolerant robotics** 2020-2024
  (Nominated PI-$273,175)
  New Frontiers for Research Fund, Exploration
  Carleton University
  I am the lead PI who brought together a multidisciplinary team of researchers from robotics, computer science, and neuroscience. The project also has one Co-PI (Dr. Maryam Mehri Dehnavi) and one Co-Applicant (Dr. Amedeo D'Angiulli) who are contributing to the advancement of the project. I am the sole PI responsible for managing the funds and overseeing the progress of the project. Each PI has an equal fund allocation of 33%. The grant was extended due to COVID-19 pandemic.
- **A Hardware-in-the-loop Test Facility for Space Robotics** 2020
  Canada Foundation for Innovation, John R. Evans Leaders Fund (PI-$211,015)
  Carleton University
  I am the sole PI of this project. The funding has been used towards purchasing equipment, i.e., 2 KUKA LBR iiwa robotic arms and a workstation, to establish a hardware-in-the-loop test facility for space manipulator systems. The funding includes $15K Infrastructure Operating Fund.
- **Resilient Space Robotics: Towards Autonomy of Next-generation Space Missions** 2019-2025
  (PI-$162K)
  NSERC Discovery Grant
  Carleton University
  I am the sole PI of this project. The breakdown of the fund is $27K/year. The grant was extended for one year due to COVID-19 pandemic.
- **Resilient Space Robotics: Towards Autonomy of Next-generation Space Missions** 2019
  (PI-$12.5K)
  NSERC Discovery Launch Supplement Award
  Carleton University
  This is a one-instalment award for distinguished early career researchers applying for the Discovery Grant.
- **Advanced Autonomy of Next-generation Space Missions** 2018-2023
  Canada Research Chair, Tier 2 (PI-$600K)
  Carleton University

I am the sole PI of this project. The award includes $500K ($100K/year) that goes towards my salary and $100K ($20K/year) that is in the form of research grant to accomplish the goals of the project.

- **Advanced Autonomy of Next-generation Space Missions** 2018-2023
  Unrestricted Research Fund from OVPRI at Carleton (PI-$50K)
  Carleton University
  This is an internal research fund to support my Canada Research Chair project. The fund breakdown is $10K/year.

COMPLETED

- **Fault Diagnostics System for Space Robotics using Machine Learning Techniques** 2021/08-2021/12 (PI-$15K)
  Mitacs Accelerate International
  Carleton University
  The project was defined in collaboration with MDA Robotics. This fund was used to support the internship of a Canadian student studying overseas at Carleton University. The student (Mr. Malav Naik) was recruited from Purdue University to complete this project. I was the sole PI of the project supervising the student while working at Carleton/MDA.
- **Rapid Operations Planning for Space Robotics Using Machine Learning Techniques** 2018/08-2018/12 (PI-$15K)
  Mitacs Accelerate International
  Carleton University
  The project was defined in collaboration with MDA Robotics. This fund was used to support the internship of a Canadian student studying overseas at Carleton University. The student (Mr. Justin Mansell) was recruited from Purdue University to complete this project. I was the sole PI of the project supervising the student while working at Carleton/MDA.
- **On-orbit Calibration of SSRMS FMS** 2016/03-2017/12
  Canadian Space Agency (Co-Applicant-$50K)
  MDA Robotics, ISS program[1]
  I was part of the engineering team preparing and supporting the work package corresponding to this project.
- **Optimization of Point Turn Kinematics** 2016/03-2016/07
  Canadian Space Agency (Co-Applicant-$20K)
  MDA Robotics, MESR program[2]
  I was part of the engineering team preparing and supporting the work package corresponding to this project.
- **LELR Control Enhancement** 2015/01-2016/01
  Canadian Space Agency (Co-Applicant-$75K)
  MDA Robotics, LEAD program[3]
  I was part of the engineering team preparing and supporting the work package corresponding to this project.
- **SPOTS Orbital Dynamics** 2014/07-2015/12
  Canadian Space Agency (Co-Applicant-$300K)
  MDA Robotics, ISS program[1]
  I was part of the engineering team preparing and supporting the work package corresponding to this project.

■ SUPERVISING HIGHLY QUALIFIED PERSONNEL (HQP)

PH.D. STUDENTS

1. Vaughn Gzenda 2023/01-
   Carleton University sole supervisor
   Embodied Neuromorphic Cognitive Intelligence for Soft Robots

[1]Logistics and Sustaining Engineering program, supporting the International Space Station
[2]Mars Exploration Science Rover program
[3]Lunar Exploration Analogue Deployment program

2. Mohammadjavad Javadi (**OGS**, $15K/year) — 2021/09-
   Carleton University — sole supervisor
   Shape Morphing Untethered 2D Soft Robotics with Multi-Modal Locomotion
3. Mahboubeh Zarei Jalalabadi (**J.Y. E.W. Wong Award** $5K), — 2020/09-
   Carleton University — sole supervisor
   Fault and Anomaly Detection and Isolation in Wheeled Mobile Robots Using Symmetric Track Fusion in a Network of Sensors
4. Sahand Farghdani — 2020/09-
   Carleton University — sole supervisor
   Damage Recovery in Reconfigurable Multi-Legged Robotic Systems
5. Borna Monazzah Moghaddam (Fast-tracked to Ph.D. in 2019) — 2018/09-
   Carleton University — sole supervisor
   A Geometric Approach to Robust Control of Orbital Manipulators for Non-Cooperative Debris Mitigation

M.A.SC. STUDENTS

1. Martin Do Pham — 2022/01-
   University of Toronto — co-supervisor (with Dr. Dehnavi)
   Neuromorphic Computation for EEG Signal Processing
2. Philip Okotete — 2022/09-
   Carleton University — co-supervisor (with Dr. Huang)
   Multi-Objective Design Optimization of Rail Vehicles
3. Kyle Manke — 2023/09-
   Carleton University — sole supervisor
   Modelling and Shape Control of an Inch-Worm Soft Robot in Locomotion

RESEARCH STAFF

1. Priyam Panchal (Research Associate), — 2023/05-
   Carleton University — sole supervisor
   Commissioning Hardware-In-The-Loop Simulator for Space Manipulators: Collaborative Control of KUKA LBR iiwa Robots
2. Omar Abdelrahman (Research Associate), — 2023/05-
   Carleton University — sole supervisor
   Testing and Simulation of a Hexapedal Robot for Damage Identification
3. Mili Patel (Undergrad Research Associate, **I-CUREUS**), — 2023/09-
   Carleton University — sole supervisor
   Damage Identification Strategies for a Hexapedal Robot

VISITING SCHOLARS

1. Dr. Farzaneh Abdollahi, Visiting Professor — 2021/08-2022/07
   Carleton University
   Geometric Neural Networks for Optimal Control of Multi-Agent Systems on Lie Groups
   This visit initiated an active ongoing collaboration with Dr. Abdollahi's lab.

ALUMNI

1. Zach Morin-Barich, Undergrad Research Associate (**NSERC USRA**) — 2022/09-2023/08
   Carleton University — sole supervisor
   Commissioning Hardware-in-the-loop Simulator for Space Robotics
   Current Position: Forth year student at Carleton University
2. Sean Dauphinee, Undergrad Research Associate — 2022/09-2023/04
   Carleton University — sole supervisor
   Commissioning Hardware-in-the-loop Simulator for Space Robotics
   Current Position: Third year student at Carleton University
3. Hon Yin Sze, Co-op student (**NSERC USRA**) — 2021/05-2022/12
   Carleton University — sole supervisor
   Online Trajectory Generation for Uncertain Space Manipulators Capturing Moving Targets using Transfer Learning in DDPG
   Current Position: Engineer at Hong Kong Aero Engine Service Limited (HAESL)
4. Vaughn Gzenda, M.A.Sc. (**Nominated for University Medal**) — 2020/09-2022/12
   Carleton University — sole supervisor
   Recursive Feedback Linearization of Slow-Fast Dynamic Realization of Nonholonomic Control Systems
   Current Position: Ph.D. candidate at ASRoM-Lab
5. Hossain Md. Samei, M.A.Sc. (**Jasbir Singh Hanspal Schol Award**; **R.D. Richmond Travel Award**) — 2021/01-2022/09
   Carleton University — sole supervisor
   Geometric Recursive Dynamic Modelling and Simulation of Soft Robotic Systems
   Current Position: Simulation Engineer at Invest Ottawa
6. Patrick Rousso, M.A.Sc. (**Nominated for University Medal**) — 2018/09-2022/05
   Carleton University — sole supervisor
   Workspace Control of Free-Floating Space Manipulators for Implementation in a Novel On-Orbit Servicing Mission Architecture
   Current Position: Robotics Engineer at TeleSat
7. Santiago Martinez Acevedo, Undergrad Research Associate — 2021/09-2022/05
   Carleton University — sole supervisor
   Workspace Path Planning for Space Manipulators in Proximity Operations with Non-cooperative Targets
   Current Position: Jr. Member of Technical Staff at MDA
8. Sanaz Samsam, M.A.Sc. — 2020/01-2021-12
   Carleton University — sole supervisor
   An Evolutionary Framework for Multi-objective Trajectory Design and Robust Model Predictive Control in Long-range Rendezvous Missions
   Current Position: SIL Software Integration Engineer at GM
9. Mohammadreza Mottaghi, M.A.Sc. (**Nominated for University Medal**) — 2019/09-2021/11
   Carleton University — sole supervisor
   Optimal Robust Output-tracking of Autonomous Rovers with Dynamic Traction Control
   Current Position: Robotic Software Engineer at Neupeak Robotics
   The student was co-supervised by Dr. Wei Huang in the second half of the thesis to develop a software-in-the-loop simulation using Vortex Studio and verify his results.
10. Malav Naik, Intern — 2021/08-2021/12
    Carleton University — co-supervisor

Fault Diagnostics System for Space Robotics using Machine Learning Techniques
Current Position: Intermediate Member of Technical Staff at MDA
The intern was recruited from Purdue University to complete a project that was defined in collaboration with MDA. He spent half of his internship time at MDA. He was co-supervised by Dr. Joseph Bakambu at MDA.

11. Mayur Nunkoo, Undergrad Research Associate — 2020/09-2021/06
Carleton University — sole supervisor
Multibody Dynamics Simulator for Space Applications
Current Position: Fourth Year Student at Carleton University

12. Justin Mansell, Intern — 2018/08-2018/12
Carleton University — co-supervisor
Rapid Operations Planning for Space Robotics Using Machine Learning
Current Position: Visiting Assistant Professor at Purdue University
The intern was recruited from Purdue University to complete a project that was defined in collaboration with MDA. He spent half of his internship time at MDA. He was co-supervised by Dr. Joseph Bakambu at MDA.

■ MENTORSHIP IN INDUSTRY

1. Alex Jacob, Engineer — 2017-2018
MDA Robotics — mentor
A Geometric Formulation of Elastic Multibodies to Address SPOTS Limitations for DSXR Application
Current Position: Controls Engineer at MDA

2. Dr. Tomohisa Oki, Engineer — 2017-2018
MDA Robotics — mentor
A Geometric Formulation of Elastic Multibodies to Address SPOTS Limitations for DSXR Application
Current Position: Controls Engineer at MDA

3. Phoenix Roy, Intern — 2017-2018
MDA Robotics — mentor
Contact Dynamics in SPOTS
Current Position: Jr. Member of Technical Staff at MDA

4. Mohammed Kagalwala, Intern — 2016-2017
MDA Robotics — mentor
Spacecraft Dynamics and Control
Current Position: Member of Technical Staff at MDA

■ PUBLICATIONS[†]

JOURNAL PAPERS IN PREPARATION

1. R. Chhabra, "Connections and Input-Output Control of Nonholonomic Hamiltonian Systems on Manifolds," To be submitted to Automatica, March 2024.
Role: I was the PI of the research. I developed the technical content of the paper and prepared the final draft of the manuscript.

2. B. M. Moghaddam and R. Chhabra, "Robust Geometric Workspace Control of Space Manipulators in Disturbed Orbits," to be submitted to IEEE Transactions on Robotics, April 2024.
Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.

[†]HQP and collaborators are respectively highlighted by underline and asterisk ∗.

3. B. M. Moghaddam and R. Chhabra, "Relative Lagrange-Poincaré Equations for Space Manipulators in Disturbed Orbital Environments," to be submitted to Aerospace Science and Technology, June 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
4. S. Samsam and R. Chhabra, "Priority-based Pareto Optimal Service Scheduling in OOS Missions with Multiple Servicers and Multiple Targets," to be submitted to Aerospace Science and Technology, May 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
5. R. Chhabra, "Intrinsic Lagrangian and Hamiltonian Dynamics of Robots with General Holonomic and Nonholonomic Joints," To be submitted to IEEE Robotic and Automation Letters, March 2024.
   Role: I was the PI of the research. I developed the technical content of the paper and prepared the final draft of the manuscript.
6. M. R. Mottaghi and R. Chhabra, "Optimal Robust Output-tracking of Autonomous Vehicles with Dynamic Traction Control," To be submitted to Nonlinear Dynamics, May 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
7. S. Farghdani and R. Chhabra, "Singularity-Free Symbolic Whole-Body Dynamical Equations of Legged Robots for Damage Identification," To be submitted to IEEE Transactions on Robotics, February 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.

SUBMITTED JOURNAL PAPERS

8. M. J. Javadi and R. Chhabra, "Geometrically Exact Hard Magneto-Elastic Cosserat Shells on SE(3): Part A – Quasi-Static Formulation for Shape Morphing," Soft Robotics, under review, submitted in February 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
9. M. J. Javadi and R. Chhabra, "Geometrically Exact Hard Magneto-Elastic Cosserat Shells on SE(3): Part B – Dynamic Formulation for Locomotion," Soft Robotics, under review, submitted in February 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
10. V. Gzenda and R. Chhabra, "Affine Connection Approach to the Realization of Nonholonomic Constraints by Strong Friction Forces," Nonlinear Dynamics, under review, submitted in January 2024.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
11. R. Chhabra, M. R. Emami* and Y. Karshon*, "Geometry of Multibody Motion: An Intrinsic Lie Groupoid Approach," Mechanism and Machine Theory, under review, submitted in September 2023.
    Role: The research was conducted as an extension of my collaboration with my Ph.D. supervisors. I developed the technical content and prepared the final draft of the paper with minimal input from my supervisors.
12. R. Chhabra and F. Abdollahi*, "A Stable Neural Network Controller on Matrix Lie Groups: Application to Formation of Multi-Agent Systems," IEEE Transactions on Neural Networks and Learning Systems, under review, submitted in November 2023.
    Role: I was the PI of the research. In a collaborative work both authors significantly contributed to the technical content and edit of the paper.
13. V. Gzenda and R. Chhabra, "Recursive Input-Output Linearization of Nonholonomic Hamiltonian Control Systems Realized on Slow-Fast Manifolds," IEEE Transactions on Automatic Control, first revision, submitted in May 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical

input. I reviewed the technical content of the paper and provided detailed editorial feedback.

14. M. Zarei and R. Chhabra, "Consistent Distributed Localization on Matrix Lie Groups," IEEE Robotics and Automation Letters, under review, submitted in November 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
15. M. R. Mottaghi, R. Chhabra, and W. Huang*, "Fast Traction Control of Planetary Rovers on Prescribed Trajectories with Wheel-Fighting Consideration," Aerospace Science and Technology, under review, submitted in November 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.

REFEREED JOURNAL PAPERS

16. M. Zarei, M. R. Mottaghi, and R. Chhabra, "Sequential Track Fusion in Multi-Sensor Networks of Unscented Kalman Filters: A Case of Slip Estimation in Planetary Mobile Robots," Acta Astronautica, accepted, 2024.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
17. H. Samei and R. Chhabra, "SuRFR: A Fast Recursive Simulator for Soft Manipulators with Discrete Joints on SE(3)," Mechanism and Machine Theory, in press, 2024.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
18. B. M. Moghaddam and R. Chhabra, "Singularity-Free Lagrange-Poincaré Equations on Lie Groups for Vehicle-Manipulator Systems," IEEE Transactions on Robotics, in press, 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
19. M. Pham, A. D'Angiulli*, M. M. Dehnavi*, and R. Chhabra, "From Brain Models to Neurorobotic Embodied Cognition: A Spiking Tour of Biologically Plausible Neural Processes," Brain Sciences, vol. 13, no. 9, 2023.
    Role: I was the lead PI of the research. I closely supervised the work by providing research directions and significant technical input. The first author is officially Dr. Dehnavi's student, but holds frequent weekly meetings with me. All PIs reviewed the technical content of the paper and provided detailed editorial feedback.
20. P. Rousso, R. Chhabra, "Singularity-Robust Full-Pose Workspace Control of Space Manipulators with Non-Zero Momentum," Acta Astronautica, vol. 208, pp. 322-342, 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
21. M. Golestani, R. Chhabra and M. Esmailzadeh, "Finite-time Nonlinear H_∞ Control of Robot Manipulators with Guaranteed Prescribed Performance," IEEE Control Systems Letters, vol. 7, pp. 1363 - 1368, 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback. The first author will be officially my Ph.D. student starting in winter 2023. This research was conducted as a preliminary study of the topic that will be investigated in depth during his Ph.D. thesis.
22. S. Samsam and R. Chhabra, "Nonlinear Model Predictive Control of J_2-Perturbed Impulsive Transfer Trajectories in Long-Range Rendezvous Missions", Aerospace Science and Technology, vol. 132, 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
23. M. R. Mottaghi, R. Chhabra, "Robust Optimal Output-tracking Control of Constrained Mechanical Systems with Application to Autonomous Rovers," IEEE Transactions on Control Systems Technology, vol. 31, no. 1, pp. 83-98, 2023.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical

input. I reviewed the technical content of the paper and provided detailed editorial feedback.

24. M. Zarei and R. Chhabra, "Advancements in Autonomous Mobility of Planetary Wheeled Mobile Robots: A Review," Frontiers in Space Technologies, vol. 3, 2022.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
25. S. Samsam and R. Chhabra, "Multi-impulse Smooth Trajectory Design for Long-range Rendezvous with an Orbiting Target using Multi-objective Non-dominated Sorting Genetic Algorithm," Aerospace Science and Technology, vol. 120, 2022.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
26. B. M. Moghaddam and R. Chhabra, "On the Guidance, Navigation and Control of In-orbit Space Robotic Missions: A Survey and Prospective Vision," Acta Astronautica, vol. 174, pp. 70-100, 2021.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
27. B. M. Moghaddam, W. Huang*, L. Steiginga, R. Chhabra, "Roll Dynamics of Long Combination Semi-Trailers with Steerable Axles," International Journal of Vehicle Performance, vol. 8, no. 2/3, 2022.
    Role: I was the co-PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback. The research was conducted as part of an internship that my HQP did at NRC.
28. M. Zarei and R. Chhabra, "An Explicit Sub-Optimal Track-to-Track Fusion for Nonlinear Kalman Filter-Based Multi-Sensor Systems," IEEE Control Systems Letters, vol. 6, pp. 253-258, 2021.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
29. R. Chhabra, M. R. Emami and Y. Karshon, "Reduction of Hamiltonian Mechanical Systems with Affine Constraints: A Geometric Unification," ASME Journal of Computational and Nonlinear Dynamics, vol. 12, no. 2, 2017.
    Role: The research was conducted as an extension of my Ph.D. work and co-authored with my Ph.D. supervisors. I developed the technical content and prepared the final draft of the paper with minimal input from my supervisors.
30. L. M. Bates, R. Chhabra and J. Śniatycki, "Elastica as a Dynamical System," Journal of Geometry and Physics, vol. 110, pp. 348-381, 2016.
    Role: The research was conducted during my postdoctoral fellowship and co-authored with my supervisors. I developed the technical content and prepared drafts of the paper based on my supervisors' comments.
31. R. Chhabra and M. R. Emami, "Symplectic Reduction of Holonomic Open-chain Multi-body Systems with Constant Momentum," Journal of Geometry and Physics, vol. 89, pp. 82-110, 2015.
    Role: The research was conducted as part of my Ph.D. work and co-authored with my primary Ph.D. supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.
32. R. Chhabra and M. R. Emami, "A Unified Approach to Input-output Linearization and Concurrent Control of Underactuated Open-chain Multi-body Systems with Holonomic and Nonholonomic Constraints," Journal of Dynamical and Control Systems, vol. 22(1), pp. 129-168, 2016.
    Role: The research was conducted as part of my Ph.D. work and co-authored with my primary Ph.D. supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.
33. R. Chhabra and M. R. Emami, "Nonholonomic Dynamical Reduction of Open-chain Multi-body Systems: A Geometric Approach," Mechanism and Machine Theory, vol. 82, pp. 231-255, 2014.
    Role: The research was conducted as part of my Ph.D. work and co-authored with my primary Ph.D. supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.
34. R. Chhabra and M. R. Emami, "A Linguistic Approach to Concurrent Design," Journal of Intelligent and Fuzzy Systems, vol. 28, no. 5, pp. 1985-2001, 2015.

Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.

35. R. Chhabra and M. R. Emami, "A Holistic Approach to Concurrent Engineering and Its Application to Robotics," Concurrent Engineering: Research and Applications, vol. 22, no. 1, pp. 48-61, 2014.
    Role: The research was conducted as part of my Ph.D. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.
36. R. Chhabra and M. R. Emami, "A Generalized Exponential Formula for Forward and Differential Kinematics of Open-chain Multi-body Systems," Mechanism and Machine Theory, vol. 73, pp. 61-75, 2014.
    Role: The research was conducted as part of my Ph.D. work and co-authored with my primary Ph.D. supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.
37. R. Chhabra and M. R. Emami, "A Holistic Concurrent Design Approach to Robotics using Hardware-in-the-loop Simulation," Mechatronics, vol. 23, no. 3, pp. 335-345, April 2013.
    Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.
38. R. Chhabra and M. R. Emami, "Holistic System Modeling in Mechatronics," Mechatronics, vol. 21, no. 1, pp. 166-175, February 2011.
    Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.

SUBMITTED CONFERENCE PAPERS

1. V. Gzenda and R. Chhabra, "Wheeled Mobile Robots on Rough Terrains as Stochastic Nonholonomic Systems," Robotics: Science and Systems (RSS), under review, submitted in January 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.

REFEREED CONFERENCE PAPERS

2. M. Zarei and R. Chhabra, "Sequential Track Fusion in UKF-Based Networks of Sensors for Slip Estimation in Mobile Robots," American Control Conference (ACC), Toronto, ON, Canada, July 8-12 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
3. H. Y. Sze and R. Chhabra, "Obstacle-free Trajectory Planning of an Uncertain Space Manipulator: Learning from a Fixed-Based Manipulator," American Control Conference (ACC), Toronto, ON, Canada, July 8-12 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
4. P. Okotete, Wei Huang*, R. Chhabra, and Alexandre Woelfle, "Sensitivity Analysis and Multi-Objective Optimization of Forced-Steering Bogies of Railway Transit Cars for Curving and Tangent Performance Improvement using NSGA-III," International Conference of Rail Transportation (ICRT), Shanghai, China, August 7-9 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback. The work is performed in close collaboration with NRC.
5. S. Farghdani and R. Chhabra, "Singularity-Free Whole-Body Dynamical Equations of Legged Robots for Damage Simulation," AIAA Science and Technology, Orlando, FL, USA, January 8-12 2024.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.

6. B. M. Moghaddam and R. Chhabra, “Target Tracking Control of Space-Manipulators on Lie Groups," IEEE Conference on Systems, Man, and Cybernetics (SMC), Honolulu, Oahu, Hawaii, USA, October 1-4 2023.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
7. H. Samei and R. Chhabra, “A Fast Geometric Framework for Dynamic Cosserat Rods with Discrete Actuated Joints," IEEE International Conference on Robotics and Automation (ICRA), London, UK, May 29 - June 2 2023.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
8. H. Y. Sze and R. Chhabra, “Trajectory Generation for Space Manipulators Capturing Moving Targets Using Transfer Learning," IEEE Aerospace Conference, Big Sky, MT, USA, March 4-11 2023.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
9. M. R. Mottaghi, R. Chhabra and W. Huang*, “High-fidelity Software-in-the-loop Simulation of a Six-wheel Lunar Rover for Control Design," IEEE Aerospace Conference, Big Sky, MT, USA, March 4-11 2023.
   Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
10. F. Abdollahi* and R. Chhabra, “Actuator Fault Recovery in Formation Control of Uncertain Multi-agent Systems on the Lie Group SE(3)," American Control Conference (ACC), Atlanta, GA, USA, June 8-10 2022.
    Role: I was the PI of the research. In a collaborative work both authors significantly contributed to the technical content and edit of the paper.
11. P. Rousso and R. Chhabra, “Workspace Control of Free-Floating Space Manipulators with Non-Zero Momentum on Lie Groups," American Control Conference (ACC), Atlanta, GA, USA, June 8-10 2022.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
12. P. Rousso, S. Samsam, and R. Chhabra, “A Mission Architecture for On-orbit Servicing Industrialization,” IEEE Aerospace Conference, Big Sky, MT, USA, March 6-13, 2021.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
13. S. Samsam and R. Chhabra, “Multi-impulse Shape-based Trajectory Optimization for Target Chasing in On-orbit Servicing Missions,” IEEE Aerospace Conference, Big Sky, MT, USA, March 6-13, 2021.
    Role: I was the PI of the research. I closely supervised the work by providing research directions and significant technical input. I reviewed the technical content of the paper and provided detailed editorial feedback.
14. R. Chhabra, “Dynamical Reduction and Output-tracking Control of the Lunar Exploration Light Rover (LELR),” IEEE Aerospace Conference, Big Sky, MT, USA, March 5-12, 2016.
    Role: This research was conducted at MDA Robotics. I developed the technical content and prepared the final draft of the paper with minimal input from my supervisor and colleagues.
15. R. Chhabra, M. R. Emami, “A Mechatronic Approach to Robot Manipulator Design using Hardware-in-the-loop Simulation,” RSI/ISM International Conference on Robotics and Mechatronics (ICRoM2013), Tehran, Iran, February 13-15, 2013.
    Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor’s comments.
16. R. Chhabra and M. R. Emami, “Concurrent Synthesis of Robot Manipulators using Hardware-in-the-loop Simulation,” IEEE International Conference on Robotics and Automation (ICRA), Kobe, Japan, May 12-17, 2009.
    Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor’s comments.

17. R. Chhabra and M. R. Emami, "Linguistic Mechatronics," IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), Xian, China, July 2-5, 2008.
    Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.

BOOK CHAPTERS

1. M. R. Emami and R. Chhabra, "Concurrent Engineering of Robot Manipulators," In: Robot Manipulators New Achievements, A. Lazinica and h. Kawai (Ed.), ISBN: 978-953-307-090-2, InTech, pp. 211-240, April 2010.
   Role: The research was conducted as part of my M.A.Sc. work and co-authored with my supervisor. I developed the technical content and prepared drafts of the paper based on my supervisor's comments.

POSTERS

1. S. G. Cuddy-Walsh*, M. Bauer, J. J. Demiannay, T. Kwok, N. Mahendiran, N. Rideout, J. Stockall, R. Chhabra, and L. A. Beaton-Green* "Development of a Robotic Dosimetry System for X-ray Device Characterization," Health Canada Science Forum, 14-18 February 2022.
   Role: I was the Project Manager of the capstone project. I closely supervised the work by providing design ideas and significant technical input. I also contributed to the preparation of the poster.

DISSERTATIONS

1. R. Chhabra, "A Unified Geometric Framework for Kinematics, Dynamics and Concurrent Control of Free-base, Open-chain Multi-body Systems with Holonomic and Nonholonomic Constraints," Ph.D. Thesis, University of Toronto Institute for Aerospace Studies, Canada, December 2013.
2. R. Chhabra, "Concurrent Design of Reconfigurable Robots using a Robotic Hardware-in-the-loop Simulation," M.A.Sc. Thesis, University of Toronto Institute for Aerospace Studies, Canada, September 2008.
3. R. Chhabra, "A Fuzzy Control Strategy for Tail-sitters," B.A.SC. Thesis, Sharif University of Technology, Iran, June 2006.

■ INVITED TALKS

1. Resilient Autonomy of Cooperative Multi-Robot Systems
   University of Waterloo, Waterloo, Canada — 2023/05/05
2. Resilient Autonomy of Cooperative Multi-Robot Systems for Space Exploration
   York University, Toronto, Canada — 2023/04/24
3. Resilient Autonomy of Cooperative Multi-Robot Systems
   University of British Columbia, Vancouver, Canada — 2023/03/29
4. Resilient Navigation and Control in Cooperative Multi-Vehicle Systems
   Queen's University, Canada — 2022/09/15
5. Long-Term Autonomy of Aerospace Robotics: Challenges and Resolutions
   Keynote Speaker in the International Conference on Robotics,
   Intelligent Automation and Control Technologies (RIACT 2022)
   Vellore Institute of Technology, India — 2022/09/24
6. Geometric Space Robotics: Towards Resilient Autonomy of Space Missions
   Isfahan University of Technology, Isfahan, Iran — 2019/05/21
7. Geometric Space Robotics: Towards Resilient Autonomy of Space Missions
   Sharif University of Technology, Tehran, Iran — 2019/05/20
8. Industrialization of Space Missions and the Role of Autonomy in the New Space Economy

Panelist in the Winning Strategies for a New Space Economy panel
2019 OAC R&T Event, Toronto, Canada 2019/03/21

9. Resilient Space Robotics: Towards Autonomy of Space Missions
MDA Robotics, Brampton, Canada 2018/10/24
10. Feedback Linearization and Output Control of LELR
Based on Dynamical Reduction of Nonholonomic Systems
MDA Robotics, Brampton, Canada 2015/02/13
11. From Geometric Modelling and Control to Concurrent Design of Mechatronic Multi-bodies
Maplesoft Company, Waterloo, Canada 2014/04/25
12. Dynamical Reduction and Control of Holonomic and Nonholonomic Open-chain Multi-body Systems
International Young Researchers Workshop on Geometry, Mechanics and Control
Barcelona, Spain 2013/12/11
13. A Three-step Dynamical Reduction of Nonholonomic Open-chain Multi-body Systems
Symplectic Seminar, Department of Mathematics, University of Toronto, Canada 2013/11/25

■ PUBLIC OUTREACH

1. Intervew with Ottawa Today with Mark Sutcliffe: 50^{th} Anniversary of Apollo 11. 2019/07/16
2. Intervew with 580CFRA, News & Views with Rob Snow, hosted by Anna Desmarais: 50^{th} Anniversary of Apollo 11. 2019/07/16
3. R. Chhabra, “Moon Landing Anniversary: One Small Step for Man ... A Giant Leap for Space Robots," The Conversation Canada, July 2019.

■ R&D ACTIVITIES IN INDUSTRY

PROJECTS

- Pre-capture mission planning of chaser-manipulator systems for large space debris removal
- On-orbit calibration of force/moment sensor of the SSRMS[1] considering thermal drift
- Satellite jettison deployer design for SSRMS and SPDM[2]
- Nonlinear modal analysis of moving-base elastic robots in contact with the environment
- Spherical harmonic model of the gravitational force and gravity gradient torque for relative dynamics of elastic multi-body systems
- Wind and air density estimation in Thermosphere for aerodynamic force/torque approximation
- Multi-body model and nonlinear control of the LELR[3]: dynamical reduction and feedback linearization
- Electromechanical analysis of the BEMA[4] of ExoMars rover during rover deployment
- Developing and improving the Space Station Operations and Training Simulator
- Involved in emerging R&D projects: 1) control of singular manipulators, and 2) control of cooperative elastic manipulators.

[1] Space Station Remote Manipulator System
[2] Special Purpose Dexterous Manipulator
[3] Lunar Exploration Light Rover
[4] Bogie Electro-Mechanical Assembly

TECHNICAL REPORTS[5]

Orbital mechanics toolbox and capture/release missions

1. R. Chhabra, "Effect of altitude in the release of visiting vehicles at ISS[6]," MDA internal report, L&SE[7], June 2017.
2. R. Chhabra, "HTV[8] FFC[9] Loads Analysis," MDA internal report, L&SE, August 2016.
3. R. Chhabra, "An Investigation on Relative Rates of GF[10] with Respect to LEE[11] in Dual-Berthed Release," MDA internal report, L&SE, April 2016.
4. R. Chhabra, "Sensitivity Analysis for Dual Berthed HTV Release — Iteration 2," MDA internal report, L&SE, March 2016.
5. R. Chhabra, "Sensitivity Analysis for Dual Berthed Cygnus Release — Iteration 2," MDA internal report, L&SE, March 2016.
6. R. Chhabra, "Refined Missed Capture Analysis — Quasi-static and Dynamic Methodologies," MDA internal report, L&SE, March 2016.
7. R. Chhabra, "Orbital Mechanics in the SPOTS[12]," MDA internal Report, L&SE, November 2015.
8. R. Chhabra, "Dragon FFC Loads Analysis with the New Capture Point," MDA internal report, L&SE, November 2015.
9. R. Chhabra, "SPOTS Orbital Dynamics Correlation with NASA TRICK (Phase 3)," MDA internal report, L&SE, October 2015.
10. R. Chhabra, "SPOTS Orbital Dynamics Correlation with NASA TRICK (Phase 2)," MDA internal report, L&SE, May 2015.
11. R. Chhabra, "SPOTS Orbital Dynamics Correlation with NASA TRICK (Phase 1)," MDA internal report, L&SE, February 2015.
12. R. Chhabra, "Nonlinear Modal Analysis of Flexible Robot Arms," MDA internal report, GN&C[13] , October 2014.

LELR & MESR[14]

13. R. Chhabra, "WP7 — Optimization of Point Turn Kinematics," MDA internal report, MESR, June 2016.
14. R. Chhabra, "LELR Speed Controller Tuning," MDA internal report, LELR, May 2015.
15. R. Chhabra, "Torque Control of LELR Based on Feedback Linearization and Dynamical Reduction of Nonholonomic Systems," MDA internal report, LELR, February 2015.

SSRMS FMS[15]

16. R. Chhabra, "A Hybrid GBT[16] /FMS Thermal Filter," MDA internal report, L&SE, July 2017.

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[5]Role: I was the lead investigator of the projects. I authored the technical reports, where I developed models, performed analysis, and drew conclusions relevant to mission-critical decision makings. All of the reports were reviewed by an engineering team and a manager.

[6]International Space Station

[7]Logestic and Sustaining Engineering

[8]H-II Transfer Vehicle

[9]Free-Flyer Capture

[10]Grapple Fixture

[11]Latching End Effector

[12]Space Station Operations and Training Simulator

[13]Guidance, Navigation and Control

[14]Mars Exploration Science Rover

[15]Force/Moment Sensor

[16]Gear-Box Twist

17. R. Chhabra, "SSRMS FMS Calibration Matrix Estimation," MDA internal report, L&SE, October 2016.
18. R. Chhabra, "SSRMS FMS Fine Characterization Plan," MDA internal report, L&SE, March 2016.

ExoMars

19. R. Chhabra, "Effect of Wheel Release on BEMA During Rover Deployment," MDA internal report, BEMA, March 2016.

SSRMS analyses

20. Chhabra, "LEE/FRGF[17] Interface Separation and Stiffness at 600 lbf Rigidization Force," MDA internal report, L&SE, November 2017.
21. R. Chhabra, "Reducing Rigidization Force to 600 lbf for LEE GBL[18] Capture of Fixed GFs with JEU3[19] Disabled: Performance Study for POA[20] , SSRMS and SPDM LEEs," MDA internal report, L&SE, December 2017.
22. R. Chhabra, "Revisiting the JCS[21] Parameters for SSRMS Joints with Higher Friction in GBL Mode," MDA internal report, L&SE, October 2017.
23. R. Chhabra, "Insertion into Dragon Trunk with SSRMS in FMA[22] Mode," MDA internal report, L&SE, October 2017.
24. R. Chhabra, "LEE POA (S/N 202) Configuration Parameters Update to Include GBL," MDA internal report, L&SE, October 2017.
25. R. Chhabra, "Kinematic Analysis for HTV Capture," MDA internal report, L&SE, October 2015.

SPDM analyses

26. R. Chhabra, "Fault Study for SPDM LEE Lubrication Operation," MDA internal report, L&SE, February 2017.
27. R. Chhabra, "SPDM Deployer Requirements," MDA internal report, L&SE, November 2016.
28. R. Chhabra, "OTCM[23] Umbilical Model in SPOTS," MDA internal report, L&SE, June 2016.
29. R. Chhabra, "Simulation Analysis of SPDM Joint Diagnostics Based on Fast Fourier Transform," MDA internal report, L&SE, January 2016.

■ WORKSHOPS

1. 8^{th} International Young Researchers Workshop on Geometry, Mechanics and Control, Barcelona, Spain. 2013/12
2. Focus Program on Geometry, Mechanics and Dynamics the Legacy of Jerry Marsden, Fields Institute, Toronto, Canada. 2012/07
3. Topological Robotics, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany. 2010/10

[17] Flight-Releasable Grapple Fixture
[18] Gear-Box Limping
[19] Joint Electronic Unit
[20] Payload/Orbital Replacement Unit Accommodations
[21] Joint Control System
[22] Force/Moment Accommodation
[23] ORU/Tool Changeout Mechanisms

TEACHING EXPERIENCE

■ FULL COURSES

NEWLY-DEVELOPED COURSES

- **(MECH5801) Geometric Foundations of Robotics**, Carleton University, (Winter & Fall 2022-23)
  Newly designed graduate course: 3 hours/week lectures; 5 marked assignments; final project report and presentation.
  Developed the course objectives, project description, syllabus, assignments, and lecture notes.
  This course familiarizes the students with the modern techniques in the analysis and control of robotic systems. We study the motion of rigid bodies on the Special Euclidean Lie group. Using the exponential parameterization of single degree-of-freedom joints, we formulate the kinematics and dynamics of open-chain robotic systems with multiple links and joints. Some robotic control techniques are covered and their stability is studied. The course is finalized by formulating the dynamics of nonholonomic systems and an exposure to their output-tracking control.
- **(MAAE4907L) Capstone Design Project: Mechatronic Dosimetry System**, Carleton University, (2021-23)
  Newly designed 4^{th} *year capstone project* in collaboration with **Health Canada**: 3 hours/week meetings; 4 technical memoranda; 4 presentations; prototype; demo.
  Developed the project proposal, management structure, objectives, timelines, and report format.
  The project involves 3 engineering teams: mechanical design, manufacturing and assembly, and software and electronics. The teams collaborate with each other and with the supervisory team to contribute to various aspects of the design and development of a robotic dosimetry system for X-ray device characterization that will be commissioned at Health Canada. The project involves exposure to the basics of biomedical devices used for imaging and to the radiation dosimetry systems. The focus is on practising standard procedures for designing robotic systems, including: (i) identification of design criteria and constraints, (ii) performing detailed analyses of different subsystem, (iii) studying the functionality of different subsystems and the information flow among them, (iv) critical decision making in different phases of design, (v) 3D printing, hardware assembly, and software design, and (vi) comprehensive testing and validation of the prototype.

REDESIGNED COURSES

- **(MAAE3500) Feedback Control Systems**, Carleton University, (Winter 2019-22)
  3^{rd} year undergraduate course: 3 hours/week lectures; 3 marked labs; 3 quizzes; midterm; final.
  Developed the course objectives, syllabus, practice problems, labs, lecture notes, quizzes, midterm and final exam questions. I was involved with introducing experimental lab components in the course, for the first time in 2019.
  The course is an introduction to linear feedback control systems. It covers the analysis and design of classical linear control systems, such as PI, PID, and PD controllers, and lag, lead, and lead-lag compensators, in both time and frequency domain. It includes the stability analysis and the Routh-Hurwitz criteria for linear systems. Students are familiarized with control design techniques using root locus, Bode and Nyquist plots.
- **(MECH4806) Mechatronics**, Carleton University, (Winter 2019-21)
  Fully redesigned 4^{th} *year elective/graduate course*: 3 hours/week lectures; 3 marked labs; final project; group presentation; YouTube video of the developed mechatronic system; midterm; final.
  Developed the course objectives, project description, syllabus, practice problems, labs, lecture notes, midterm and final exam questions.
  This course is an introduction to the synergistic integration of mechanical, electronic and software components to design and develop mechatronic devices. The course covers system modelling and digital control of electromechanical systems, with a focus on the simulation and implementation. Basics of semiconductor electronics, combinational and sequential logic circuits, microcontrollers, sensors, and actuators are discussed. The course includes hands-on lab components and design/development of a mechatronic system, which expose the students to a full cycle of mechatronic design process: critical decision making, planning, budgeting, system integration, and testing.

- **(MATH331) Multivariate Calculus**, University of Calgary, (Winter 2014)
  3^{rd} year undergraduate course: 3 hours/week lectures; 4 marked assignments; midterm; final.
  Developed the course objectives, syllabus, assignments, practice problems, lecture notes, midterm and final exam questions.
  This course is an introduction to the systems of linear differential equations and multi-variable calculus. It covers eigenvalues and eigenvectors and how they are used to solve a system of linear ordinary differential equations. It also discusses multi-variable functions in 2D and 3D and linear partial differential equations. In the second half of the course, the students are exposed to vector calculus in 3D and topics such as line, surface and volume integrals. They learn how to employ Green's and Stokes' theorems.
- **(AER304) Aerospace Laboratory II**, University of Toronto, (Winter 2010)
  3^{rd} year undergraduate course: 3 introductory lectures; 2 laboratory experiments; 2 laboratory reports.
  Developed the course outline, introductory presentations, and report templates.
  Teams of two students perform two experiments in the Aerospace Laboratory, while the notion of Remote Access Aerospace Laboratories (RAAL) is also implemented in the course. The two experiments included in this course are: (i) Photoelastic Stress Analysis, and (ii) Supersonic Flow and Shockwaves. In the first introductory lecture, students are familiarized with the beam theory and the theory of photoelastic for stress analysis. They learn about supersonic flow, supersonic wind tunnels, and flow visualization, in the second lecture. The third lecture is on experimental data analysis and report writing. The students perform the experiments in person during the semester, and they can repeat them remotely at scheduled times.
- **(AER303) Aerospace Laboratory I**, University of Toronto, (Fall 2009)
  3^{rd} year undergraduate course: 3 introductory lectures; 2 laboratory experiments; 2 laboratory reports.
  Developed the course outline, introductory presentations, and report templates.
  Teams of two students perform two experiments in the Aerospace Laboratory, while the notion of Remote Access Aerospace Laboratories (RAAL) is also implemented in the course. The two experiments included in this course are: (i) Strain Gage and Materials Testing, and (ii) Aerodynamic Forces on Airfoils in Sub-sonic Flow. In the first introductory lecture, students are familiarized with low subsonic aerodynamics theory and the theory of airfoils. They review the basics of strength of materials and strain gauges, in the second lecture. The third lecture is on experimental data analysis and report writing. The students perform the experiments in person during the semester, and they can repeat them remotely at scheduled times.
- **(J-AER-1) Fundamentals of Aeronautics**, University of Toronto, (Summer 2008)
  Newly designed course for high school students as part of the DEEP program: lectures.
  Developed the lecture presentations and held a fun paper airplane contest.
  The course covers low subsonic aerodynamics and the theory of airfoils in a lay language.

■ DIRECTED STUDIES

- **(MAAE4917) Directed Studies: Modelling and Simulation of Articulated Heavy Vehicles with Active Control Systems**, Carleton University, (Winter 2022)
  Newly designed undergraduate level course on special topics in collaboration with **National Research Council of Canada (NRC)**: 3 hours/week meetings; reading assignments; final project report and presentation.
  Developed the course objectives, syllabus, and course outline.
  This study involves modelling and simulation of articulated heavy vehicles with active control systems, and includes the following objectives: (i) Developing articulated heavy vehicle dynamics models; (ii) Developing active control systems for articulated heavy vehicles; (iii) Conducting simulations with active safety systems to demonstrate the safety and maneuverability enhancements in various driving scenarios and road conditions.
  Students: Sahar Shoaib ◇ Philip Okotete ◇ Blossom Omotayo.
- **(MAAE4917) Directed Studies: Online Motion Planning of Space Manipulators using Reinforcement Learning**, Carleton University, (Winter 2022)
  Newly designed undergraduate level course on special topics: 3 hours/week meetings; reading assignments; final project report and presentation.

Developed the course objectives, syllabus, and course outline.
This study focuses on the guidance and control algorithms for pre-capture maneuvers of a chaser-manipulator system to guarantee successful feature tracking and autonomous capturing of a tumbling debris in the presence of environmental disturbances. The course involves fundamentals of robotics, motion planning, and reinforcement learning.
Students: Santiago Martinez Acevedo.

- **(MAAE4917) Directed Studies: Kinematics, Dynamics, and Control of Multibody Systems**, Carleton University, (Fall 2020)

  Newly designed graduate level course on special topics: 3 hours/week meetings; reading assignments; final project report and presentation.
  Developed the course objectives, syllabus, and course outline.
  The course involves reading materials that are discussed in details during weekly meetings. In a project, the students must apply the covered topics on a system and perform some numerical studies. This course familiarizes the students with the modern techniques in the analysis and control of robotic systems. We study the motion of rigid bodies on the Special Euclidean Lie group. Using the exponential parameterization of single degree-of-freedom joints, we formulate the kinematics and dynamics of open-chain robotic systems with multiple links and joints. Some robotic control techniques are covered and their stability is studied. The course is finalized by formulating the dynamics of nonholonomic systems and an exposure to their output-tracking control.
  Students: Vaughn Gzenda ◇ Sami Nassif-Lachapelle.

- **(MAAE4917) Directed Studies: Nonholonomic Mechanics and Control**, Carleton University, (Winter 2020)

  Newly designed graduate level course on special topics: 3 hours/week meetings; reading assignments; final project report and presentation.
  Developed the course objectives, syllabus, and course outline.
  The course involves reading materials that are discussed in details during weekly meetings. In a project, the students must apply the covered topics on a system and perform some numerical studies. This course is an introduction to advanced notions in geometric mechanics, e.g., vector fields, differential forms, Lie derivatives, and fibre bundles. The students also learn Lagrange-d'Alembert principle, symmetric nonholonomic systems, and momentum equations, in both Hamiltonian and Lagrangian setting. Finally, Hamiltonian and Lagrangian control systems are studied.
  Students: Borna Monazzah Moghaddam ◇ Mohammadreza Mottaghi.

■ GUEST LECTURES

- **(ECOR1055) Introduction to Engineering**, Carleton University, (Fall 2020-23)
  1^{st} year engineering core course that familiarizes the students with different engineering disciplines.
  Developed a presentation for one lecture as a *guest lecturer* on space exploration and space robotic technologies, and held a Q&A session.

- **(MAAE4907J) Capstone Project: Intelligent Telepresence Assistive Device (iTAD)**, Carleton University, (Fall 2021 & Winter 2022)
  4^{th} year capstone project on designing and building a robotic telepresence assistive device.
  Invited as an *external examiner* for the final design review of the student teams.

SERVICES

■ EDITORIAL

- **Associate Editor**, Aerospace Journal, Space Robotics and Mechatronics 2022/08-
- **Associate Editor**, Frontiers in Space Technologies, Reviews In Space Debris 2022/07-
- **Associate Editor**, IEEE International Conference on Intelligent Robots and Systems 2021/02-2021/06

- **Planning Chair of Organizing Committee**, 2023 The International Association for Vehicle System Dynamics (IAVSD): 28th Symposium on the Dynamics of Vehicles on Roads and on Tracks 2021/01-
  Role: Involved in budget management, attracting sponsors, arranging for accommodation, meal plan and conference venue, and hiring/managing a PCO. Also involved in managing editors and associate editors.
- **Guest Editor**, International Journal of Advanced Robotic Systems, Space Robotics 2019/12-2020/03

■ ADMINISTRATIVE

- **Member**, Working Group, AI Collaborative Specialization Program, Carleton University 2022/02-
  Role: Involved in establishing a research center, and proposal preparation and curriculum development of a new university-wide collaborative program on artificial intelligence.
- **Member**, Hiring Committee, Carleton University 2021/05-2022/05
  Role: Involved in application review, creating the shortlist, conducting the interviews, and the hiring process.
- **Member**, NSERC NFRF-Exploration 2020 Multidisciplinary Review Panel 2020/11-2021/03
  Role: Reviewed more than 20 proposals and judged the finalist proposals in the multidisciplinary review panel meetings.
- **Member**, NSERC Ph.D. Evaluation Committee, Carleton University 2018/09-2018/12
  Role: Reviewed more than 40 proposals from the science and engineering departments and participated in the committee meetings to nominate high quality students for the NSERC PGS D scholarship.
- **Member**, Curriculum Committee - Aerospace, Carleton University 2018/07-
  Role: Involved in curriculum development and modification for the aerospace program in the Department of Mechanical and Aerospace Engineering.
- **Member**, Dynamics and Controls Strand Committee, Carleton University 2018/07-
  Role: Involved in the departmental activities in the field of dynamics and control, including assigning labs to the relevant courses, approving graduate courses, and investigating the need for lab equipment.
- **Member**, Space Station Operation and Training Simulator (SPOTS) Committee, MDA 2016/07-2017/12
  Role: Involved in identifying and resolving issues with different routines in SPOTS, approving the requests for new improvements, and designing and implementing testing procedures.

■ PEER REVIEW

REFERRED JOURNALS

IEEE Transactions on Robotics ◇ IEEE Robotics and Automation Letters ◇ IEEE Transactions on Automatic Control ◇ IEEE Transactions on Systems, Man, and Cybernetics: Systems ◇ IEEE Control Systems Letters ◇ Automatica ◇ Aerospace Science and Technology ◇ Acta Astronautica ◇ Mechatronics ◇ Nonlinear Dynamics ◇ Astronautical Sciences ◇ AIAA Journal of Guidance, Control and Dynamics ◇ Robotica ◇ Concurrent Engineering: Research and Applications ◇ Fuzzy Sets and Systems ◇ International Journal of Robotics and Automation ◇ International Journal of Information Technology & Decision Making ◇ International Journal of Mechanical Engineering and Mechatronics ◇ International Journal of Advanced Robotic Systems.

REFERRED CONFERENCES

American Control Conference (ACC) ◇ IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) ◇ IEEE International Conference on Robotics and Automation (ICRA) ◇ IEEE Aerospace Conference.

GRANT APPLICATIONS

- NSERC New Frontiers for Research Fund-Transformation 2022
- NSERC New Frontiers for Research Fund-Exploration Multidisciplinary Review Panel 2021
- NSERC Discovery Grant 2021

- NSERC Collaborative Research and Development Grant 2021
- Ontario Ministry of Economic Development and Growth (fund value: $15M, project value: $5.6B) 2018
- Mitacs Elevate 2020

■ EXAMINATION BOARDS

PH.D. THESES

- Alexander Tettenborn, "Use Of AI Methods For Autonomous Geological Rock Classification Through Visual Texture Analysis," Ph.D. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, August 2023.
- Iain Martin, "Real-Time Operator-in-the-loop Anti-Sway Control for Shipboard Cranes," Ph.D. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, March 2022.
- Steffan Lloyd, "Advanced Modelling and Control Methods for Precision Robotic Machining Tasks," Ph.D. Thesis Proposal, Department of Mechanical and Aerospace Engineering, Carleton University, June 2021.
- Iain Martin, "Development of an Anti-Sway Control System and Real-Time Operator-in-the-loop Simulator for Shipboard Cranes," Ph.D. Thesis Proposal, Department of Mechanical and Aerospace Engineering, Carleton University, July 2020.
- Collins Ogundipe, "Control of Spaceborne Manipulators for Onorbit Servicing Especially Looking at Bio-inspired Control using Forward Modelling as Implemented in the Cerebellum and Viscoelastic Responses in the Joints," Ph.D. Thesis Proposal, Department of Mechanical and Aerospace Engineering, Carleton University, January 2020.
- Colin Miyata, "A Novel Framework for User Safety in Human-Robot Interactions through the Use of Tactile Sensors," Ph.D. Thesis Proposal, Department of Mechanical and Aerospace Engineering, Carleton University, September 2018.

M.A.SC. THESES

- Amir Shadband, "Computational and Experimental Characterization of a Novel Nonlinear Magnetic Shock Absorber with Applications to Ground Vehicles," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, September 2023.
- Maryam Parhizkar, "Localizing Retinal Blood Vessels In Fundus Images using Fuzzy Logic Approach," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, March 2022.
- Arsalan Ahmed, "Multi-Sensor Fusion for Navigation of Ground Vehicles Using Dual Extended Kalman Filter," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, November 2021.
- William P. Parsons, "Dynamic Aeroelastic Performance Optimization of Adaptive Aerospace Structures Employing Structural Geometric Nonlinearities," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, August 2021.
- Shubhank Sondhiya, "The Robotic Molecular Biologist - Automated Processing of Astrobiological Samples for Planetary Missions," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, April 2020.
- Muhammadh Ali Abdhullah Salman, "Effects of Geometric Nonlinearities on the Fidelity of Aeroelasticity Loads Analyses of Very Flexible Airframes," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, March 2019.
- Cassidy Westin, "Modelling and Simulation of Marine Cables with a Dynamic Winch and Sheave Contact," M.A.Sc. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, August 2018.

EXTERNAL EXAMINER

- Kok Lin Wong, "A variational approach towards supercritical Hamiltonian systems and (p, 2)-Laplace equations," Ph.D. Thesis, Department of Mathematics, Carleton University, August 2023.
- Sayyedsina Voshtani, "Atmospheric Methane Data Assimilation in the CMAQ Air Quality Model," Ph.D. Thesis, Department of Civil and Environmental Engineering, Carleton University, September 2022.
- Bhargav Konidala, "Modeling and Simulation of the Locomotion Mechanics of a Class of Legged Autonomous Robots," M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, June 2023.
- Yanzhang Wu, "Sensing Nonlinear Viscoelastic Constitutive Parameters with a Geometrically Nonlinear Beam: Modeling and Simulation," M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, June 2020.
- Xueyang Yao, "Discrete 2D Transforms in Polar Coordinates," M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, April 2018.

■ PRESENTATIONS, MEETINGS

- Systems and Control Theory, Waterloo — 2023/05/02-05
- Ontario Universities' Fair, Toronto — 2019/09/27-29
- Canadarm3 Roadshow, MDA, Brampton — 2019/08/06
- 2019 Ontario Aerospace Council (OAC) Research and Technology Event, Toronto — 2019/03/21
  Presented on the role of industrialization and autonomy in the New Space Economy
- EU Delegation on Space Application Technologies, Carleton University, Ottawa — 2018/09/12
  Discussed my research on space technologies and its terrestrial applications
- Autonomous and Connected Systems Meeting, Carleton University, Ottawa — 2018/07/18
  Presented my research on guidance, navigation and control of space robotics
- Brown Bag Lunch, Autonomous Systems Research Centre, Carleton University, Ottawa — 2018/04/25
  Met with executives of companies active in autonomous and connected vehicles
- 2018 Ontario Aerospace Council (OAC) Research and Technology Event, Toronto — 2018/03/07-08
  Presented Carleton University's research capabilities in aerospace sector

■ CERTIFICATES, COURSES AND WORKSHOPS

- New Frontiers in Research Fund (NFRF) Workshop (Carleton University, 2019)
- New Faculty Orientation (OVPRI) (Carleton University, 2018)
- NSERC Discovery Grant Workshop (CORIS) (Carleton University, 2018)
- Accessibility for Ontarians with Disabilities (AODA) - Customer Service Standard (Carleton University, 2018)
- Accessibility for Ontarians with Disabilities (AODA) - Employment Standard (Carleton University, 2018)
- Accessibility for Ontarians with Disabilities (AODA) - Info & Communication Standard (Carleton University, 2018)
- Worker Health & Safety Awareness Training (Carleton University, 2018)
- Violence & Harassment Training (Carleton University, 2018)
- Electrical Safety Awareness (ESA) (MDA, 2014)
- Electrostatic Discharge Control Awareness Only (ASDC Awareness Only) (MDA, 2014)
- Workplace Hazardous Materials Information System (WHMIS) (MDA, 2014)
- Occupational Health and Safety (OH&S) (MDA, 2014)

Edward D. Cyr, PhD, PEng

Ottawa, ON | edwardcyr@cunet.carleton.ca

EDUCATION

2012 – 2017 **Ph.D. Mechanical Engineering,** University of Waterloo, Waterloo, Ontario, Canada.
Thesis Topic: *Computational Materials Science and Metal Formability.*

2007 – 2012 **B.A.Sc. Mechanical Engineering,** University of Waterloo, Waterloo, Ontario, Canada.
Graduated with Honours Distinction

EXPERIENCE

Carleton University, Department of Mechanical & Aerospace Engineering (Ottawa ON)

2021-present **Instructor II**

- Faculty instructor for Engineering Core and Mechanical & Aerospace Engineering undergraduate and MEng graduate-level courses.
- Initiated Student-Faculty committee to increase communication and provide a platform for addressing student-faculty concerns.
- University Senator (Awards Committee) and member of the Aerospace Curriculum Committee, 1st-year and Recruitment Committee, Carleton Mechanical & Aerospace Society (CMAS) Faculty Representative, Formula Student (FSAE) Faculty Representative, FED Engineering Core Working Group MAE Faculty Representative.
- CMAS Teaching Award (2022) and CSES Teaching Award (2023)

TWISS Electric Ltd. (Burlington, ON)

2021 **Project Estimator**

- Estimation and Bidding: Analyze blueprints, specifications, proposals, and other documentation to prepare time, cost, and labor estimates for projects or services. Prepare and submit competitive project bids and cost estimates.
- Project Planning: Collaborate with engineers, architects, clients, and contractors on project cost estimates. Adjust cost estimates when necessary to accommodate changes in project scope or timeline.

University of New Brunswick, Department of Mechanical Engineering (Fredericton (NB)

2019-2021 **Director of Programs & Innovation, (Marine Additive Manufacturing Centre of Excellence)**

- Project Management and Coordination: Oversee the financial planning, management, and marketing of the ACOA-AIF project at MAMCE. Ensure timely completion within budget and liaise between various project groups to keep the project scope on track.
- Research and Development: Foster collaborative research relationships with industry partners and develop project proposals. Actively seek funding opportunities through government agencies to support ongoing and future projects.
- Outreach and Industry Relations: Engage with educational institutions, media, and other organizations to promote research and education about additive manufacturing. Serve as the primary contact for industry and equipment suppliers, manage procurement logistics, and maintain accurate and organized financial reports.

2017-2019 **McCain Postdoctoral Fellow in Innovation**

- Inaugural recipient of the McCain Fellowship in Innovation
- Research: Conduct experimental and numerical modelling research on additive manufacturing of Aluminum and Steel alloys, utilizing laser powder-bed techniques and methodologies.
- Funding Applications: Assist in the preparation and submission of project funding applications, ensuring all requirements are met and maximizing the chances of securing funding.
- Supervision: Provide guidance and supervision to graduate students, fostering an environment of learning and academic growth.

University of Waterloo, Department of Mechanical & Mechatronics Engineering (Waterloo, ON)

2010 – 2017 **Undergraduate/Graduate Researcher, Computational Mechanics Research Group**
Research focused on microstructure modeling and large deformation modeling of aluminum sheet metals at high temperatures. Experience using high-performance computing (Calcul Québec) and advanced stress analysis using self-developed Fortran and C++ codes.

2017 **Undergraduate Instructor, Department of Mechanical and Mechatronics Engineering**
Developed updated version of Kinematics and Dynamics of Machinery (ME 321) course with 110 students. Received outstanding review from class critiques and was voted to represent 3rd year Mechatronics on the Student-Faculty Council.

2016 **Visiting Scientist, General Motors Technical Centre, Oshawa, Ontario, Canada**
Researched phenomenological/computational modeling of failure near weldments in aluminum.

2014 – 2016 **Design Project Supervisor, Department of Systems Design/Mechanical Engineering**
SYDE 362 – Systems Design Workshop, ME 380 – Mechanical Design Workshop

2008 – 2009 **Engineering Outreach Coordinator, Engineering Science Quest**
Designed, developed, and coordinated engineering outreach workshops and summer camp programs for Engineering Science Quest and completed a two-month training course on curriculum development, teaching practices, and classroom management.

Phase 4 Electric (Sault Ste. Marie, ON)

2006 – 2008 **Electrical Apprentice**
Junior apprentice in industrial and commercial job sites, responsible for reading and implementing technical design drawings for large commercial/industrial projects. Gained experience and training working with large electrical grid systems and infrastructure.

UNIVERSITY TEACHING

Carleton University, Ottawa, Ontario, Canada

Since 2017 **Instructor II**
ECOR 1047 - Visual Communication
ECOR 1048 - Dynamics
MAAE 2101 - Engineering Dynamics
MAAE 2300 - Fluid Dynamics I
AERO 3002 - Aerospace Design & Practice
MAAE 4907C - Blended-Wing-Body UAV
MAAE 4907D - Formula SAE

University of New Brunswick, Fredericton, New Brunswick, Canada

Since 2017 **Graduate/Undergraduate Sessional Instructor**
ME 5233 – Metal Forming Analysis
ME 5833 – Structural Design for Additive Manufacturing
ME 6003 – Dislocations and Plasticity
ME 2003 – Dynamics for Engineers

University of Waterloo, Waterloo, Ontario, Canada

2017 **Sessional Course Instructor**
ME 321 – Kinematics and Dynamics of Machinery
(*voted class professor to represent 3rd-year MME at student faculty meetings)

2013 – 2017 **Teaching Assistant**
ME 481/SYDE 481 – Senior Design Project
ME 423 – Mechanical Design II
ME 380 – Mechanical Design Workshop
ME 303 – Advanced Engineering Mathematics
ME/MTE 119 – Mechanics of Deformable Solids/Statics
ME 321 – Kinematics and Dynamics of Machinery

2013 – 2017 **Fundamentals of University Teaching Certificate, Center for Teaching Excellence**
An eight-month course involving the completion of six three-hour workshops and teaching assessments on various teaching methods/practices

COMMUNITY INVOLVEMENT

Ottawa River Canoe Club, Dunrobin, ON

2023-2024 **Executive Director - Masters (Paddle 4 Life)**
Strategic planning and programming for masters paddling. Coordinate with members and board of directors to improve the program, and provide recommendations for club advancement.

Capital Winter Club, Fredericton, NB

2017-2020 **Vice President, Director of Youth Development, Chair of Scheduling Committee**
Plan/coordinate youth development programs/competitions for 100+ youth curlers.
Scheduling Committee Chair: organize/coordinate 20 leagues and 500+ curlers.

2019 **Canadian University/College Curling National Championship Commentator (CBC)**
Volunteer and CBC live broadcast commentator for one week of live coverage of the university/college curling national championships at the Willie O'Ree Place, Fredericton.

University of Waterloo, Waterloo, ON

2014 – 2016 **President & Head Coach, Waterloo Triathlon Club**
Organize club training schedule, membership, facility rentals, finances, and coordination with athletic department at UW. Worked with Waterloo varsity swim program to establish a triathlon swimming partnership with triathlon club members during summer months.

2013 – 2015 **Waterloo Warriors Men's Swimming Team Captain**
Organize team building events, assist with planning competitions and travel. Mediate team conflicts and build inclusive environment for student athletes to train, compete, and learn.

PUBLICATIONS

Journal

[1] Amir Mostafaei, Amit K. Verma, Mohammadreza Asherloo, **Edward Cyr**, ……., Anthony D. Rollett, (2021) "Recent Progress in Data Analytics and Machine Learning Approaches in Additive Manufacturing Processes" *Progress in Materials Science*, Request to Co-Author

[2] MH Ghoncheh, M Sanjari, A Shojaei Zoeram, **E Cyr**, B Shalchi Amirkhiz, A Lloyd, M Haghshenas, M Mohammadi, (2020) "On the Microstructure and Solidification Behavior of a Novel Additively Manufactured Al-Cu-Mg-Ag-Ti-B Alloy", Available at SSRN 3646449

[3] **Edward Cyr**, Josh Kelley, Amir Hadadzadeh, Mohsen Mohammadi, (2019) "Benchmarking Additive Repair Using Powder Bed Fusion Technique: Selective Laser Melting of AlSi10Mg on Duramold-2™ Substrate", *Journal of Manufacturing Processes*, Submitted.

[4] Nathaniel Despres, **Edward Cyr**, Peyman Satoodeh, Mohsen Mohammadi, (2019) "Deep Learning and Design for Additive Manufacturing: A Framework for Microlattice Architecture", *Journal of the Metals, Minerals & Materials Society (JOM) – Special Issue*, Submitted.

[5] Joey Tallon, **Edward Cyr**, Alan Lloyd, Mohsen Mohammadi, (2019) "Crush Performance of Additively Manufactured Maraging Steel Microlattice Reinforced Plates", *Engineering Failure Analysis*, Accepted.

[6] N. Despres, **Edward Cyr**, L. Vincent, R. Taviss, M. Mohammadi, (2019) "A performance metric for additively manufactured microlattice structures under different loading conditions", *Proceedings of the Institution of Mechanical Engineers, Part L: Journal of Materials: Design and Applications*, **233(9)**, 1814-1829.

[7] **Edward Cyr**, Alan Lloyd, Mohsen Mohammadi, (2018) "Tension-compression asymmetry of additively manufactured Maraging steel", *Journal of Manufacturing Processes*, **35**, 289-294.

[8] **Edward Cyr**, H. Asgari, R. Shamsdini, M. Purdy, K. Hosseinkhani, M. Mohammadi, (2018) "Fracture behaviour of additively manufactured MS1–H13 hybrid hard steels," *Materials Letters*, **212**, 174-177.

[9] J. Kelly, **Edward Cyr**, M. Mohammadi, (2018) "Finite element analysis and experimental characterization of SMC composite car hoods under complex loadings", *Journal of Composites Science*, **2**, 53.

[10] C. Baxter, **Edward Cyr**, A. Odeshi, M. Mohammadi, (2018) "Constitutive models for the dynamic behaviour of direct metal laser sintered AlSi10Mg_200C under high strain rate shock loading", *Materials Science and Engineering: A*, **731**, 296-308.

[11] J. Rossiter, **Edward Cyr**, A. Brahme, J. Kang, R. Mishra, D. Wilkinson, K. Inal, (2018) "Numerical Simulations of the Effects of Grain Boundaries on Non-Uniform Deformation in FCC Polycrystals," *International Journal of Plasticity*, Article in Review.

[12] **Edward Cyr**, A. Brahme, M. Mohammadi, R.K. Mishra, K. Inal, (2018) "A new crystal plasticity framework to simulate large strain behaviour of aluminum alloys at warm temperatures," *Materials Science and Engineering: A*, **727**, 11-28.

[13] **Edward Cyr**, M. Mohammadi, R.K. Mishra, K. Inal, (2017) "Formability of Aluminum Alloys at Elevated Temperatures Using a New Thermo-Elasto-Viscoplastic Crystal Plasticity Framework," *International Journal of Mechanical Sciences*, **128-129**, 312-325.

[14] **Edward Cyr**, M. Mohammadi, R.K. Mishra, K. Inal, (2015) "A Three Dimensional (3D) Thermo-Elasto-Viscoplastic Constitutive Model for FCC Polycrystals," *International Journal of Plasticity*, **70**, 166-190.

Conference (presenter underlined)

[15] **Edward Cyr**, Mackenzie Purdy, Peyman Satoodeh, Mohsen Mohammadi, (2020) "High-Resolution Holistic Characterization in Additive Manufacturing", *The Minerals, Metals and Materials Society (TMS) Annual Meeting & Exhibition*, San Diego, California, USA.

[16] **Edward Cyr**, Amir Hadadzadeh, Babak Shalchi Amirkhiz, Joshua Kelly, Mohsen Mohammadi, "Selective laser melting (SLM) additive repair of Duramold-2 substrate using AlSi10Mg, *The Minerals, Metals and Materials Society (TMS) Annual Meeting & Exhibition*, San Diego, California, USA.

[17] **Mohsen Mohammadi**, Edward Cyr, Amir Hadadzadeh, Babak Shalchi Amirkhiz, (2019) "Hierarchical microstructure and strengthening phenomena in additively manufactured aluminum alloys", 3rd International Conference on Light Materials – Science and Technology (LightMAT 2019), Manchester, UK.

[18] **Edward Cyr**, M. Mohammadi, (2018) "Crystal plasticity modeling of high strain-rate behaviour and recrystallization of additively manufactured AlSi10Mg," *International Conference on Aluminum Alloys (ICAA16)*, Montreal, Canada.

[19] C. Baxter, **Edward Cyr**, H. Asgari, M. Mohammadi, (2018) "Anisotropy and high strain-rate behaviour of AlSi10Mg produced by direct metal laser sintering (DMLS)," *International Conference on Aluminum Alloys (ICAA16)*, Montreal, Canada.

[20] Kaan Inal, **Edward Cyr**, Raj Mishra, (2017) "Temperature-dependent plasticity: a new constitutive framework for fcc polycrystals", *International Symposium on Plasticity*, Puerto Vallarta, Mexico.

[21] K. Inal, **Edward Cyr**, RK. Mishra, (2016) "A new thermos-elasto-viscoplastic crystal plasticity framework to predict formability of aluminum alloys at elevated temperatures", *Journal of Physics: Conference Series*, **734**, 032136.

[22] **Edward Cyr**, Mohsen Mohammadi, Kaan Inal, Raj Mishra, (2016) "Numerical modeling of formability of aluminum alloys at elevated temperatures using a thermo-elasto-viscoplastic crystal plasticity framework" *International Symposium on Plasticity*, Kona, Hawaii, USA.

[23] **Edward Cyr**, Mohsen Mohammadi, Raj Mishra, Kaan Inal, (2015) "A New Three-Dimensional Thermo-Elasto-Viscoplastic Constitutive Model for FCC Polycrystals," *The Minerals, Metals and Materials Society (TMS) Annual Meeting & Exhibition*, Orlando, Florida, USA.

[24] **Edward Cyr**, C. Kohar, M. Mohammadi, R.K. Mishra, K. Inal, (2013) "Failure Analysis and Surface Roughness Prediction in Roller Hemming Using Crystal Plasticity Simulation," *EURO LightMAT 2013 – Magnesium, Aluminum, Titanium*, Bremen, Germany.

Industry (Internal Technical Reports)

[25] **Edward Cyr**, (2011) "Investigating the Feasibility of an Automated Process to Construct FE Models from EBSD Data," GM R&D Collaborative Report.

[26] **Edward Cyr**, (2010) "Investigating Numerical Modeling of Aluminum Sheet in Diode Laser Heat Treatment," GM R&D Collaborative Report.

[27] **Edward Cyr**, (2009) "Understanding Stress-Strain Relation and Strain Rate Sensitivity of Magnesium AZ31 Using Saimoto – Van Houtte Analysis," GM R&D Collaborative Report.

Richard M. Dansereau

B.Sc., Ph.D., P.Eng. (PEO), IEEE Senior Member

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Ottawa, Ontario K1S 5B6
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richard.dansereau@carleton.ca

EDUCATION

1995 - 2001. **Ph. D. (Comp. Eng.)**, University of Manitoba, Dept. of ECE

- Cumulative GPA: 4.4 / 4.5 (A=4.0, so equivalently 4.0/4.0 on standard scale of 4)
- **CHET**: Certificate of Higher Education Teaching (2000)
- NSERC Scholarship (1997 – 1999)
- TRLabs Graduate Fellowship (1996 – 2000)
- Active Electronics Award for Excellence in Research (1998)
- The Duff Roblin Fellowship (1996 – 1997)

1990 - 1995. **B. Sc. (Comp. Eng.)** with Distinction, Univ. of Manitoba, Dept. of ECE

- Cumulative GPA: 3.87 / 4.0
- Dean's Honour Roll (1990 – 1995)
- Participant in 16 month Industrial Internship Program (1993 – 1994)
- "Canada Scholar" Scholarship (1990 – 1995)
- University of Manitoba Alumni Association Entrance Scholarship (1990)
- Vincent Massey Collegiate 25th Reunion Scholarship (1990)

EMPLOYMENT EXPERIENCE

Administrative:

July 2022 – Present: Carleton University, **Associate Dean (Graduate Studies and Postdoctoral Affairs),** Faculty of Engineering & Design
July 2015 – June 2020: Carleton University, **Associate Dean (Student Affairs)**, Faculty of Engineering & Design

Academic:

July 2015 – Present: **Carleton University**, **Professor**
July 2021 – June 2022: **Carleton University, Sabbatical Leave**
July 2020 – June 2021: **Carleton University, Administrative Leave**
July 2008 – June 2015: **Carleton University**, **Associate Professor**
September 2001 – June 2008: **Carleton University**, **Assistant Professor**
July 2008 – June 2009: **Carleton University, Sabbatical Leave**
September 2007 – April 2008: **Carleton University, Parental Leave**
August 2000 – August 2001: **Georgia Institute of Technology**, Research Engineer I / Instructor

- Teaching and research in digital signal processing with the Center for Signal and Image Processing (CSIP) under supervision of Dr. Ronald W. Schafer.

January 1999 – April 2000: **Univ. of Manitoba**, **Lecturer Level II**, Dept. of ECE

- Course instructor for two sections of a course

EMPLOYMENT EXPERIENCE (cont...)

Industrial/Research:

April 1999 – February 2000: **SpectraWorks, Inc.**, System Designer/Developer
- Development of IP over MPEG satellite communication systems

November 1996 – June 2000: **TRLabs**, Graduate Research Student
- Performing research in progressive image transmission and compression techniques

January 1996 – August 2000: **Sun Microsystems**, SunCAP (Campus Access Program)
- Hardware, software, and system support for Sun Microsystems equipment

January 1996 – August 2000: **Richard Dansereau Consulting**, Computer Consulting
- Computer consulting, troubleshooting, and system administration

May 1995 – August 1995: **Bell-Northern Research**, System Analyst/Administrator
- Software support/administration for global PAS/DDME database system

May 1993 – August 1994: **Bell-Northern Research**, System Designer/Administrator
- Development, testing and administration of a large INGRES database system

May 1992 – August 1992: **Winnipeg Hydro**, System Analyst/Programmer
- Design and development of internal database system

May 1991 – September 1991: **Winnipeg Hydro**, System Analyst/Programmer
- Design, coding and maintenance of various database systems

TEACHING EXPERIENCE

September 2001 – Present: **Carleton University**, Dept. of SCE

- SYSC 3600 – **Systems and Simulation** (9 offerings, previously 94.360)
  - Fall 2001/2002/2003/2004 and Winter 2010/2011/2012/2013/2014
- SYSC 3610 – **Biomedical Systems, Modeling, and Control** (6 offerings)
  - New course introduced at Carleton University requiring complete development of lectures and 12 labs
  - Fall 2014/2015/2016/2017/2018/2019
- SYSC 4405 – **Digital Signal Processing** (13 offerings, previously 94.445)
  - Winter 2002/2003/2004/2005/2006/2012/2013,
    Fall 2006/2009/2010/2013/2022/2023
- SYSC 5602 – **Digital Signal Processing** (11 offerings, previously 94.562)
  - Winter 2003/2004/2006/2007/2014/2015/2016/2017/2023 and Fall 2004/2009
- MECH 5906 – **Directed Studies** (1 offering)
  - Summer 2015
- SYSC 5370 – **Multiresolution Signal Decomposition** (3 offerings)
  - New course on wavelets, filterbanks, and multiresolution analysis taught for first time at Carleton University
  - Fall 2011, Winter 2018, and Winter 2019

August 2000 – August 2001: **Georgia Institute of Technology**, Instructor, Dept. of ECE

- ECE 2025 - **Introduction of Digital Signal Processing** (1 offering)
  - Summer 2001
- ECE 2025 - **Introduction of Digital Signal Processing** (2 recitation sections)
  - Fall 2000, Winter 2001
- ECE 2030 - **Introduction to Computer Engineering** (3 offerings)
  - Fall 2000, Winter 2001, Summer 2001
- ECE 4271 - **Applications of Digital Signal Processing** (1 offering)
  - Winter 2001

January 1999 – April 2000: **Univ. of Manitoba**, Lecturer Level II, Dept. of ECE

- 24.376 **Digital Systems Design I** (Lecturer, Winter 2000)
- 24.424 **Digital System Organization** (Lecturer, Winter 1999)
  - Note: 24.376 and 24.424 were the same course that was renumbered/renamed

September 1999: **Univ. of Manitoba**, Workshop Leader, University Teaching Services

- **Effective Tutorial Teaching Workshop**

January 1996 – December 1999: **Univ. of Manitoba**, Teaching Assistant, Dept. of ECE

- Lab TA for 24.423 **Microprocessor Interfacing** (Dr. W. Kinsner, Fall 1999)
- Lab TA for 24.423 **Microprocessor Interfacing** (Dr. W. Kinsner, Fall 1998)
- Tutorial instructor for 24.353 **Network Theory** (Dr. G. O. Martens, Spring 1996)

GRADUATE SUPERVISION

Postdoctoral Fellows:

- M. Hossein Radfar, (2007-2008, co-supervision with Geoffrey Chan from Queen's University)

Ph.D. Students (In Progress):

- Hediyeh Toufani, **"MR-based tractography through deep learning spinal column separation"** (2022/09–present, OCIBME through University of Ottawa, co-supervised with Dr. Tsai and Dr. Phan)
- Zohre Faroushi, **"Audio-visual speech separation through deep learning"** (2022/09–present, OCIECE)

Ph.D. Students (Completed):

[TP13] Youhao Yu, **"Reconstruction of compressive sensed (CS) images with deep equilibrium model (DEQ) based on iterative shrinkage-thresholding algorithm (ISTA)"** (2015/09–2023/05, OCIECE)

[TP12] Zahra Ashouri Talouki, **"Kernel-Based PET image reconstruction using dynamic PET and MR anatomical information"** (2015/09–2022/01, OCIECE, Alexander Graham Bell Canada Graduate Scholarship-Doctoral (CGS D), Ontario Graduate Scholarship, co-supervised with Dr. de Kemp at the Ottawa Heart Institute)

[TP11] Hossein Chahrour, **"Signal processing methods in Riemannian geometry with application to drone detection"** (2015/01–2021/09, OCIECE, co-supervised with Prof. Rajan and placement at DRDC)

[TP10] Tayebeh Lotfi Mahyari, **"Image separation using multi-layer image segmentation for translucent partially overlapped objects"** (2014/09-2019/04, OCIECE)

[TP9] Ce Peng, "**Monaural music separation via supervised non-negative matrix factorization with side-information**" (2012/09–2017/09, OCIECE)

[TP8] Assem Moustafa Mohammed Rashad Assem, "**Low latency compressive sensing using multi-resolution analysis in radar signal processing**" (2014/09–2017/08, OCIECE)

[TP7] Hoda Dehghan, "**EMG signal decomposition thru semi-blind source separation**" (2011/08–2016/05, OCIECE, co-supervised with A.D.C. Chan)

[TP6] Jie Zhu, "**Error-resilient video coding using multiple description coding and 3D-SPIHT**", (2009–2012, OCIECE)

[TP5] M. Mahmoud Aly Fouad Abdel-Motagally, **Image registration under arbitrarily-shaped locally variant illumination and occlusions**, Ph.D. Thesis: Carleton University. (2007–2010, OCIECE, co-supervision with A. Whitehead)

[TP4] Tarek Khairy Mohamed Helaly, **Analysis and characterization of nonlinear distortion due to high power amplifiers in wireless communication systems**,

Ph.D. Thesis: Carleton University. (2007–2010, OCIECE, co-supervision with M. El-Tanany)

[TP3] Yasser Mahgoub, **Co-channel speech separation using state-space reconstruction and sinusoidal modelling**, Ph.D. Thesis: Carleton University, 206 pp., April 2010.

[TP2] M. Hossein Radfar, **Single channel speech separation**, Ph.D. Thesis: Amirkabir University, Sept. 2007, (defended 29/09/2007, co-supervised with Prof. Sayadiyan).

[TP1] D. Lo, **Audio-video talker localization for video conferencing**, Ph.D. Thesis: Carleton University, 135 pp., July 2005 (co-supervised with Prof. Goubran).

Visiting PhD Students:

- Ahmed Wesam Sallam, **Real-time object tracking in video**, (2011/05–2011/08)
- Alaa Fathy Seleim Eldeken, **Blocking artifact removal in HEVC**, (2014/11–2015/02)

M.A.Sc. Students (In Progress):

- Yuxiao Zhou, **Directional of arrival estimation**, (2021/09–present, OCIECE, co-supervised with Prof. Rajan).
- Shaad Fazal, **Cervical cell image separation**, (2022/09–present, OCIECE)

M.A.Sc. Students (Not completed):

- Bharathi Surisetti, **Fetal ECG signal separation**, (2015/09–2018/08, OCIECE)

M.A.Sc. Students (Completed):

[TM16]Tung Nguyen, **Complex NMF for multichannel source separation**, (2014/09–2017/01, OCIECE)

[TM15]Mamoon Rashid, **Cramer-Rao lower bound derivation and performance analysis for space-based SAR SMTI**, (2012–2016/01, OCIECE)

[TM14]Revanth Pentyala, **Musical score to musical recording time-frequency registration**, (2012–2015, OCIECE)

[TM13]Shabana Baig, **Quantitative analysis of the performance of center-of-pressure measures in static posturography**, (2011–2013, OCIBME, co-supervision with A.D.C. Chan)

[TM12]Ali Ghazisaeidi, **Estimating human limb motion from video sequences with anatomical knowledge**, MASc. Thesis: Carleton University. (2010–2011, OCIECE, co-supervision with P. Payeur, previously co-supervised by A.

Cuhadar)

[TM11]Junci Zhang, **Robust wavelet coefficient encoding for wavelet scalable video coding**, MASc. Thesis: Carleton University, 2010. (2004–2010, OCIECE, part-time)

[TM10]Alex McKenzie, **On methods for the suppression of aliasing in time-series gene expression data**, MASc. Thesis: Carleton University, 2010. (2006–2010, OCIBME, OGS Scholar, co-supervised with Prof. J.R. Green)

[TM9] Junwu Zhu, **Perceptual Noise Shaping in Dual-tree Complex Wavelet Transform for Image Coding,** MASc. Thesis: Carleton University, 75 pp., May 2010 (OCIECE, co-supervised with Prof. Joslin)

[TM8] T. Pandeliev, **Asymmetrical load-balancing for incremental fast Fourier transform on multi-core processors**, MASc. Thesis: Carleton University, Oct. 2009 (ISS, School of Computer Science, co-supervised with Prof. Smid).

[TM7] F. Petngang, **Resolution scalable image coding using rational wavelet transform**, MASc. Thesis: Carleton University, Sep. 2009 (OCIECE, Ontario Graduate Scholarship, co-supervised with Prof. Joslin).

[TM6] M. Fanaswala, **Regularized super-resolution of multi-view images**, MASc. Thesis: Carleton University, Sep. 2009 (OCIECE, OGSST Scholar, John Ruptash Memorial Fellowship, Ontario Graduate Scholarship, co-supervised with Prof. Dubois).

[TM5] K. Yonis, **Objective video quality assessment using the 3D dual-tree complex wavelet transform**, MASc. Thesis: Carleton University, May 2009 (OCIECE).

[TM4] V. Badee, **Fetal electrocardiogram extraction and enhancement using triggered adaptive filtering**, MASc. Thesis: Carleton University, Dec. 2006 (Ontario Graduate Scholarship, co-supervised with Prof. Chan).

[TM3] G. Agnello, **Parametric mixing for centralized VoIP conferencing using ITU-T recommendation G.722.2**, MASc. Thesis: Carleton University, 135 pp., Jan. 2006 (OCIECE).

[TM2] S. Jin, **Multiple packet-streams in encrypted voice over IP**, MASc. Thesis: Carleton University, 135 pp., May 2003 (OCIECE, co-supervised with Prof. Goubran).

[TM1] C. Li, **Lip feature extraction and audio-video synchronization**, MASc. Thesis: Carleton University, 112 pp., May 2003 (OCIECE, co-supervised with Prof. Goubran).

UNDERGRADUATE SUPERVISION

2023–2024 - 4th Year Projects (24 students)

[Y53] Mohamed Selim, Aymaan Newaz, Basel Syed, and Mohammed Jemal, **"Autonomous driving: Lidar mapping and positioning"**, *4th Year Project*, Carleton University (supervised by R. M. Dansereau and Chao Shen).

[Y52] Liam Gaudet, Ian Holmes, Curtis Davies, and Robert Simionescu, **"Autonomous driving: Lane detection and lane keeping"**, *4th Year Project*, Carleton University (supervised by R. M. Dansereau and Chao Shen).

[Y51] Sagar Syal, Ray Prina, Sangat Buttar, Himanshu Singh, and Sundar Vengadeswaran, **"Autonomous driving: Autonomous navigation (planning & control)"**, *4th Year Project*, Carleton University (supervised by R. M. Dansereau and Chao Shen).

[Y50] Shishir Vatsa, Akshay Vashisht, and Matthew Parker, **"Autonomous driving: Road sign and traffic light detection"**, *4th Year Project*, Carleton University (supervised by R. M. Dansereau and Chao Shen).

[Y49] Leslie Ejeh, Oritsemeyiwa Jordan Temile, Chibuzo Okpara, Geoffery Koranteng, Matthew Drury, Loufei Sun, Jiajing Zhou, and Sam Scrivens, **"Assisted Autonomous Vehicles"**, *4th Year Project*, Carleton University (supervised by R. M. Dansereau and Xiao Huang).

2022–2023 - 4th Year Projects (19 students)

[Y48] Michael Isa, Georgio Korkolis, Seyr Naser, and Razem Shahin, **"Autonomous vehicle project: Central embedded system controller and management"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y47] Devon Fruck, Vijay Ramalingom, Aksh Ravishankar, Anish Tankala, and ShuJian Wang, **"Autonomous vehicle project: Stay in your lane! Lane keeping"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y46] Muhammad Furqan and Imran Latif, **"Autonomous vehicle project: Yellow means go faster! Intersection control and safety"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and Chao Shen).

[Y45] Frank Dow, Kareem El Assad, Joshua Gatto, and Gilles Myny, **"Autonomous vehicle project: Potholes, Barricades and Cones on My!"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y44] Philip Baird, Flynn Graham, Omar Hashmi, and Asad Waheed, **"Autonomous vehicle project: Pedestrian behaviour prediction"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

2019–2020 - 4th Year Projects (4 students)

[Y43] Luke Van Fraassen, Hanan Salamoun, Udochukwu Njoku, and Eli Ocloo,

"Multichannel contactless ECG monitor", *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

2016–2017 - 4th Year Projects (8 students)

[Y42] Dina Refaey and Ali Abdelbadie, **"Tin can radar for breathing monitoring"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y41] Andre Liu and Zening Jiang, **"Tin can radar for navigation for the blind"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y40] Calvin Neethling, Abdallah Saket, Balakumar Balasingam, and Karim Osman, **"Robot arm"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

2015–2016 - 4th Year Projects (6 students)

[Y39] Yuzhou Liu, Minh Mai, and Brandon To, **"Human Interface for Robotic Control"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y38] Dylan Ferguson, Maryn Marsland, and Sherif Kamal Eldin, **"Speech learning application"**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau, co-supervised by Eva Kartchava).

2014–2015 - 4th Year Projects (17 students)

[Y37] Anna Kah, Yasmin McDonald, Akshay Puli, and Sana Shaaban, "**Portable wearable ECG**", *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y36] Zachariah Fradette, Setute Hotor, Zeno Israr, Harrison McDonald, Syeda Fatima Tayyaba, and Benjamin Weber, "**Remote interactive laboratory experimentation (RILE)**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau, A.D.C. Chan and Mojtaba Ahmadi).

[Y35] Geoffrey Kinson, Ryan Kuiper, Tara Little, and Emma Paxton, "**Virtual reality meeting rooms**", *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

[Y34] Grant Dawson, Anastasios Minas, and Mensur Pajaziti, "**ECG monitor with mobile application**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau).

2013–2014 - 4th Year Projects (13 students)

[Y33] Debarati Das, Zannatul Ferdous, and Ashraful Alam, "**Contactless ECG heart monitoring**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2014.

[Y32] Joshua Broverman and Daniel Li, "**Musical instrument / vocal suppression in a musical recording**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2014.

[Y31] Tracy Udubra, Adam Lang, Sho Horiuchi, and Jordan Shaaked, "**Jackhammer headphones**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2014.

[Y30] Michael Hamon, Matthew Smith, Karen Madore, and Michael D. Mulligan, "**Gesture based UI for augmented reality system**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2014.

2012–2013 - 4th Year Projects (7 students)

[Y29] Barnabus Fung, Abdulhak Nagy, and Jonathan Wong, "**Contactless electrocardiogram monitoring**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2013.

[Y28] Steven Klickermann and Peter Wright, "**Instrument/vocal suppression in a musical recording**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2013.

[Y27] Kevin Lee and Amanda Bath Visaya, "**The locust car**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and A.D.C. Chan), 2013.

2011–2012 - 4th Year Projects (6 students)

[Y26] Yazan Awwad, Dawod Nofal, Abbas Mughal, and Wail Al-Waili, "**Ultra low power ECG monitor using compressive sensing**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2012.

[Y25] Mohammad Farhan and Harel Lichtenstein, "**EMG controlled robot car**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and A.D.C. Chan), 2012.

2010–2011 - 4th Year Projects (9 students)

[Y24] Michail Greshishchev and Aaron McClennon-Sowchuk, "**Object removal in multi-view photos**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2011.

[Y23] Syed Adnan Ali, Phana Keo, Swaroop Srinivasan and Auns Yasin, "**Ultra-low power ECG monitor with compressive sensing**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2011.

[Y22] Sakshi Oberoi, Nitin Verma and Zain Sayed, "**iPhone Voice-Operated Wheelchair System**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2011.

2009–2010 - 4th Year Projects (4 students)

[Y21] Fayz Al Hajri, Moufed Elefrangy, Leila Tlebaldiyeva and Marwa Yassine, "**Ultra low power portable ECG monitor using compressive sensing**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2010.

2006–2007 - 4th Year Projects (6 students)

[Y20] Jevin Maltais and Sebastian Jagodzinski, "**Automatic Speech Reading Part 1: Real-time Lip Tracking**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2007.

[Y19] Aleksandar Simic and Pooyan Rostamkhani, "**Text Reader for the Visually Impaired using CamPhone/PDA**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2007.

[Y18] Tianhe Zhang and Konstantin Privalov, "**Automatic sign language recognition through motion capture**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and A.D.C. Chan), 2007.

Summer 2006 – 1st Year Internship (2 students)

- Patrick Lalonde, "**Real-time face tracking**"
- Matt Solheim, "**Real-time skin detection**"

2005–2006 – 4th Year Projects (8 students)

[Y17] Abdullah Al-Dalati, Jetaime Lowe, Lisa Meitin, and Andrew Rowden, "**Automatic sign language recognition through motion capture**," **(Awarded the *NSERC Best Project Award*)**, *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and A.D.C. Chan), 2006.

[Y16] Bang Nguyen, "**Text detection in natural scenes**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2006.

[Y15] Roby Ayres and Natasha Tajik, "**Point-of-sale fingerprint verification**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2006.

[Y14] Pierre-Olivier Savoie, "**Fetal ECG enhancement through beamforming,"** *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and A.D.C. Chan), 2006.

Summer 2006 – NSERC Undergraduate Student Researchers (1 student)

- Waqas Muhi Kanwar, "**Lip-tracking in video**", (NSERC-USRA scholar)

2004–2005 – 4th Year Projects (7 students)

[Y13] Michael Smith, "**Superresolution of images to improve text readability**," **(Honourable mention for Best Poster Award)** *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2005.

[Y12] Nigel Gocan and Stephen Ortis, "**Fetal ECG extraction through adaptive noise cancellation**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau and A.D.C. Chan), 2005.

[Y11] Victor Tazlauanu, "**Chaotic communication and synchronization using an implementation of Chua's circuit**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2005.

[Y10] Sing Kuan Goh, Hai Nguyen and Cuong Vuu, "**Face detection/recognition for class attendance application**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2005.

2003–2004 – 4th Year Projects (8 students)

[Y9] Minjian (Olive) Xu, "**Polyphonic music transcription - from recording to musical score**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2004.

[Y8] Ehab Hamid, "**Face detection in colour images**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2004.

[Y7] Cindy Ah-Yuen, "**Face detection and tracking in video**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2004.

[Y6] Andrew Bell, Kevin Mar and Matthew Yee, "**Automatic traffic sign detection and identification in images**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2004.

[Y5] Ertan Oral, "**Co-channel speech separation in convolutive mixtures**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2004.

[Y4] Ian Gagne, "**Image watermarking using quantization index modulation**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2004.

2002–2003 – 4th Year Projects (4 students)

[Y3] Olivier Dagenais, "**Polyphonic instrument detection in music**," *4th Year Project Report (Computer Science)*: Carleton University (supervised by R. M. Dansereau and W. Li), 2003.

[Y2] Chi Leung Hung and Xia Wu, "**Automatic traffic sign detection and identification in images**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2003.

[Y1] Wael Akram Mahmoud, "**Single channel speech separation**," *4th Year Project Report*: Carleton University (supervised by R. M. Dansereau), 2003.

Innovation in Teaching Methods and Curriculum Development

SYSC 3600 – Systems and Simulation

- Extended the lab offering from 3 labs to a full set of 12 labs for the course. These additional labs now satisfy the Undergraduate Calendar and provide students with much needed additional practical experience.
  - Note: Prior to my appointment in 2001, 5 labs had existed but 2 of the hardware based labs were eliminated before I arrived in 2001 with the decommissioning of the department's analog computers.
- Led the acquisition of an inverted pendulum platform for class demonstrations and for recruitment demonstrations.
- Introduction of a lab verification based grading system that provides for immediate teacher/student feedback to ensure proper understanding of material. This change allowed for the elimination of lab reports and frees up TA's time to for more one-on-one interaction with students.
- With all of the additions to labs and lectures and arguable increase in workload, student satisfaction has risen dramatically.

SYSC 3610 – Biomedical Systems, Modeling, and Control

- New course introduced into the Biomedical & Electrical Engineering and the Biomedical & Mechanical Engineering programs for Fall 2014.
- Ground-up development of course curriculum
- Ground-up development of 12 labs (in progress for Fall 2014)
- Use of blended teaching where some lecture material is off-loaded to online viewing to free up class time for more interactive dialogs
- Introduction of a lab verification based grading system that provides for immediate teacher/student feedback to ensure proper understanding of material. This change allowed for the elimination of lab reports and frees up TA's time to for more one-on-one interaction with students.

SYSC 4405 – Digital Signal Processing

- Led acquisition of the TMS320C6713 DSP Starter Kits for the course labs.
- Developed a set of 6 labs, with some using the acquired TMS320C6713 DSP Starter Kits.
- Introduction of a lab verification based grading system that provides for immediate teacher/student feedback to ensure proper understanding of material. This change allowed for the elimination of lab reports and frees up TA's time to for more one-on-one interaction with students.

SYSC 5602 – Digital Signal Processing

- Brought aspects of labs into the assignments to incorporate some practical implementations that go beyond theory.

SYSC 5370 – Multiresolution Signal Decomposition

- New course taught for first time at Carleton University
- Ground-up development of course material

PUBLICATIONS

Refereed Journal Papers (submitted/in-preparation):

[J35] Z. Ashouri, R. M. Dansereau, G. Wang, and R. de Kemp, "**Multi-scale wavelet kernel-based PET reconstruction using MR prior information and feature-driven spatial weighting**," *submitted to IET Signal Processing*, Nov. 2023.

[J34] A. M. Assem, R. M. Dansereau, and S. Elgayar, "**Recovery guarantees for S-transform matrix**," *in preparation*, 2022.

[J33] C. Peng and R. M. Dansereau, "**Side-information supervised source template non-negative matrix factorization for monaural music separation**," *in preparation*, 2022.

Refereed Journal Papers (published/accepted):

[J32] Youhao Yu and R. M. Dansereau, "**MsDC-DEQ-Net: Deep equilibrium model (DEQ) with multi-scale dilated convolution for image compressive sensing (CS)**," *IET Signal Processing*, vol. 2024, pp. 1–12, January 2024. https://doi.org/10.1049/2024/6666549

[J31] T. Lotfi Mahyari and R. M. Dansereau, "**Multi-layer random walker image segmentation for overlapped cervical cells using probabilistic deep learning methods**," *IET Image Processing*, pp. 1–14, May 2022. https://doi.org/10.1049/ipr2.12531

[J30] Z. Ashouri, G. Wang, R. M. Dansereau, and R. de Kemp, "**Evaluation of wavelet kernel-based PET image reconstruction**," *IEEE Transactions on Radiation and Plasma Medical Sciences*, vol. 6, no. 5, pp. 564–573, May 2022. doi: 10.1109/TRPMS.2021.3103104.

[J29] H. Chahrour, R. Dansereau, S. Rajan, and B. Balaji, "**Target detection through Riemannian geometric approach with application to drone detection,**" *IEEE Access*, vol. 9, pp. 123950–123963, 2021. doi: 10.1109/ACCESS.2021.3105594

[J28] Youhao Yu and R. M. Dansereau, "**Fast reconstruction of 1D compressive sensing data using a deep neural network,**" *International Journal of Signal Processing Systems (IJSPS)*, vol. 8, no. 1, pp. 26–31, March 2020. doi: 10.18178/ijsps.8.1.26-31

[J27] M. M. Fouad and R. M. Dansereau, "**An optimized parallel order scheme of the deblocking filtering process for enhancing the performance of the HEVC standard using GPUs,**" *Multimedia Tools and Applications*, vol. 76, no. 23, pp. 24609–24634, December 2017.

[J26] M. Rashid and R. M. Dansereau, "**Cramer-Rao lower bound derivation and performance analysis for space-based SAR GMTI,**" *IEEE Transactions on Geoscience and Remote Sensing*, vol. 55, no. 11, pp. 6031–6043, November 2017.

[J25] H. Dehghan, R. M. Dansereau, and A. D. C. Chan, "**Restricted isometry property on banded block Toeplitz matrices with application to multi-**

channel convolutive source separation," *IEEE Transactions on Signal Processing*, vol. 63, no. 21, pp. 5665–5676, November 2015.

[J24] A. Onsy, M. M. Fouad, B. Shaw, and R. M. Dansereau, "**A new method for monitoring gears surface failures using enhanced image registration approach**," *SAE International Journal of Aerospace*, vol. 7, no. 1, pp. 182–189, Sep. 2014.

[J23] M. M. Fouad and R. M. Dansereau, "**Lossless image compression using a simplified MED algorithm with integer wavelet transform**," *International Journal of Image, Graphics and Signal Processing (IJIGSP)*, vol. 6, no. 1, pp. 18–23, Nov. 2013.

[J22] S. Baig, R. M. Dansereau, A. D. C. Chan, A. Remaud, and M. Bilodeau, "**Cluster analysis of center-of-pressure measures**," *International Journal of Electrical and Computer System (IJECS)*, vol. 1, no. 1, pp. 9–17, 2012. DOI: 10.11159/ijecs.2012.002

[J21] T. K. Helaly and R. M. Dansereau, "**Toward an Efficient and Reliable Nonlinearity Measure,**" *IEEE Communications Letters*, vol. 16, no. 11, pp. 1816–1819, November 2012.

[J20] M. M. Fouad, R. M. Dansereau, and A. D. Whitehead, "**Geometric image registration under arbitrarily-shaped locally variant illuminations,**" *Signal, Image and Video Processing*, vol. 6, no. 4, pp. 521–532, 2012. doi:10.1007/s11760-010-0178-4

[J19] Jie Zhu and R. M. Dansereau, "**Error-resilient and error concealment 3-D SPIHT for multiple description video coding with added redundancy,**" *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 22, no. 6, pp. 855–868, June 2012.

[J18] M. M. Fouad, R. M. Dansereau, and A. D. Whitehead, "**Image registration under illumination variations using region-based confidence weighted M-estimators,**" *IEEE Transactions on Image Processing*, vol. 21, no. 3, pp. 1046–1060, March 2012.

[J17] T. K. Helaly, R. M. Dansereau, and M. El-Tanany, "**BER performance of OFDM signals in presence of nonlinear distortion due to SSPA,**" *Wireless Personal Communications*, vol. 64, no. 4, pp. 749–760, Jan. 2011 (online) and June 2012 (print).

[J16] T. K. Helaly, R. M. Dansereau, and M. El-Tanany, "**An efficient measure for nonlinear distortion severity due to HPA in downlink DS-CDMA signals,**" *EURASIP Journal on Wireless Communications and Networking*, vol. 2010 (2010), Article ID 945427, 9 pages.

[J15] M. H. Radfar, R. M. Dansereau, and W.-Y. Chan, "**Monaural speech separation based on gain adapted minimum mean square error estimation**," *Journal of Signal Processing Systems for Signal, Image, and Video Technology*, vol. 61, no. 1, pp. 21–37, Oct. 2010. doi:10.1007/s11265-008-0274-7

[J14] T. K. Helaly, R. M. Dansereau, and M. El-Tanany, "**Analysis of BER performance in presence of nonlinear distortion due to PD-HPA in downlink DS-CDMA signals**," *IEEE Communications Letters*, vol. 14, no. 4, pp. 273–275, April 2010.

[J13] M. Talebinejad, A. D. C. Chan, A. Miri, and R. M. Dansereau, "**Fractal analysis of surface electromyography signals: A novel power spectrum-based method,**" *Journal of Electromyography & Kinesiology*, vol. 19, no. 5, pp. 840–850, Oct. 2009.

[J12] Y. A. Mahgoub and R. M. Dansereau, "**Time domain method for precise estimation of sinusoidal model parameters of co-channel speech**," *Research Letters in Signal Processing*, vol. 2008, Article ID 364674, 5 pages, 2008. doi:10.1155/2008/364674

[J11] M. H. Radfar, R. M. Dansereau, and A. Sayadiyan, "**Speaker independent model based single channel speech separation**," *Neurocomputing*, vol. 72, no. 1–3, pp. 71–78, Dec. 2008.

[J10] W. Kinsner and R. Dansereau, "**A relative fractal dimension spectrum for a perceptual complexity measure**," *International Journal of Cognitive Informatics and Natural Intelligence*, vol. 2, no. 1, pp. 73–86, Jan.–Mar., 2008.

[J9] M. H. Radfar and R. M. Dansereau, "**Single-channel speech separation using soft mask filtering**," *IEEE Transactions on Audio, Speech and Language Processing*, vol. 15, no. 8, pp. 2299–2310, Nov. 2007.

[J8] M. H. Radfar, R. M. Dansereau, and A. Sayadiyan, "**A maximum likelihood estimation of vocal-tract-related filter characteristics for single channel speech separation**," *EURASIP Journal on Audio, Speech, and Music Processing*, vol. 2007, Article ID 84186, 15 pages, 2007. doi:10.1155/2007/84186

[J7] Zhong Lin, R. A. Goubran, and R. M. Dansereau, "**Noise estimation using speech/non-speech frame decision and subband spectral tracking**," *Speech Communication (special issue on Speech Enhancement)*, vol. 49, no. 7–8, pp. 542–557, July–August 2007.

[J6] M. H. Radfar, R. M. Dansereau, and A. Sayadiyan, "**A generalized approach for model-based speaker-dependent single channel speech separation**," *Iranian Journal of Science and Technology (IJST)*, vol. 31, no. B3, pp. 361–375, July 2007.

[J5] M. H. Radfar, R. M. Dansereau, and A. Sayadiyan, "**Monaural speech segregation based on fusion of source-driven with model-driven techniques**," *Speech Communication*, vol. 49, no. 6, pp. 464–476, June 2007.

[J4] M. H. Radfar, A. H. Banihashemi, R. M. Dansereau, and A. Sayadiyan, "**Nonlinear minimum mean square error estimator for mixture-maximisation approximation**," *Electronic Letters*, vol. 42, no. 12, pp. 75–76, June 2006. (Note: Printed paper has authors listed as M. H. Radfar, R. M. Dansereau, and A. Sayadiyan)

[J3] D. Lo, R. Goubran, and R. Dansereau, "**Robust joint audio-video localization in video conferencing using reliability information II: Bayesian network fusion**," *IEEE Transactions on Instrumentation and Measurement*, vol. 54, no. 4, pp. 1541–1547, Aug. 2005.

[J2] D. Lo, R. Goubran, R. Dansereau, G. Thompson, and D. Schulz, "**Robust joint audio-video localization in video conferencing using reliability information**," *IEEE Transactions on Instrumentation and Measurement*, vol. 53, no. 4, pp. 1132–1139, Aug. 2004.

[J1] R. Dansereau and W. Kinsner, "**Progressive image transmission using wavelet packets guided by metrics**," *Journal of Mathematical Modelling and Scientific Computing*, vol. 10, 2000. (ISSN 1067-0688)

Unrefereed Papers (published):

[A1] M. H. Radfar, R. M. Dansereau, and W. Wong, "**Speech Separation Using Gain-Adapted Factorial Hidden Markov Models,**" *Computing and Research Repository (CoRR)*, vol. Abs/1901.07604, Jan. 2019, http://arxiv.org/abs/1901.07604

Conference Papers (submitted/in-preparation):

Conference Papers Accepted Based On Full Paper Submission:

[C79] Youhao Yu and R. M. Dansereau, "**STP-DEQ-Net: A Deep Equilibrium Model Based on ISTA Method for Image Compressive Sensing**," accepted to the *30th European Signal Processing Conference (EUSIPCO 2022, Belgrade, Serbia)*, August 29–September 2, 2022.

[C78] Youhao Yu and R. M. Dansereau, "**STP-Net: Semi-tensor product neural network for image compressive sensing**," accepted to *The Seventh International Conference on Advances in Signal, Image and Video Processing (SIGNAL 2022, Venice, Italy)*, May 22–26, 2022, pp. 7–12.

[C76] T. Lotfi Mahyari and R. M. Dansereau, "**Deep learning methods for image decomposition of cervical cells,**" *2020 28th European Signal Processing Conference (EUSIPCO2020, Amsterdam, the Netherlands)*, 2021, pp. 1110–1114, doi: 10.23919/Eusipco47968.2020.9287435.

[C74] H. Chahrour, R. Dansereau, S. Rajan, and B. Balaji, "**Improved covariance matrix estimation using Riemannian geometry for beamforming applications**," *IEEE Radar Conference (RadarConf'2020, Washington, USA)*, April 27–May 1, 2020, pp. 693–697.

[C73] T. Lotfi Mahyari and R. M. Dansereau, "**Deep learning methods for image**

segmentation containing translucent overlapped objects," *Proc. of GlobalSIP (Ottawa, Canada)*, November 11–14, 2019.

[C69] Z. Ashouri, C. Hunter, B. Spencer, G. Wang, R. M. Dansereau, and R. de Kemp, "**Kernel-Based Reconstruction of C-11-Hydroxyephedrine Cardiac PET Images of the Sympathetic Nervous System**," *Proc. of Engineering in Medicine and Biology (EMBC, Berlin, Germany)*, July 23–27, 2019.

[C68] H. Chahrour, R. Dansereau, S. Rajan, and B. Balaji, "**Direction of Arrival Estimation using Riemannian Mean and Distance**," *Proc. of IEEE Radar Conference (RadarConf'2019, Boston, USA)*, April 22–29, 2019.

[C67] H. Chahrour, S. Rajan, and R. M. Dansereau, B. Balaji, "**Hybrid spread spectrum orthogonal waveforms for MIMO radar,**" *Proc. of IEEE Radar Conference (RadarConf'2018, Oklahoma City, USA)*, April 23–27, 2018.

[C66] H. Chahrour, S. Rajan, and R. M. Dansereau, B. Balaji, "**Hybrid beamforming for interference mitigation in MIMO radar,**" *Proc. of IEEE Radar Conference (RadarConf'2018, Oklahoma City, USA)*, April 23–27, 2018.

[C65] T. Lotfi Mahyari and R. M. Dansereau, "**Random walks for image segmentation containing translucent overlapped objects,**" *IEEE Global Conference on Signal and Information Processing (GlobalSIP, Montreal, Canada)*, November 14–16, 2017, pp. 45–50.

[C64] B. Surisetti and R. M. Dansereau, "**Multi-modal fetal ECG extraction using multi-kernel Gaussian processes,**" *IEEE Global Conference on Signal and Information Processing (GlobalSIP, Montreal, Canada)*, November 14–16, 2017, pp. 943–947.

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[C61] A. Assem and R. M. Dansereau, "**Compressive sensing using S-transform in pulse radar**," in *Proc. of 40th International Conference on Telecommunications and Signal Processing (TSP, Barcelona, Spain)*, July 5–7, 2017, pp. 488–492, doi: 10.1109/TSP.2017.8076034.

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[C59] A. Assem, R. M. Dansereau, and F. Ahmed, "**Adaptive sub-Nyquist sampling based on Haar wavelet and compressive sensing in pulsed radar**," in *Proc. of International Workshop on Compressed Sensing Theory and its Applications to Radar, Sonar, and Remote Sensing (CoSeRa 2016, Aachen, Germany)*, September 19-22, 2016.

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[C54] M. M. Fouad and R. M. Dansereau, "**A lossless image compression technique by combining integer wavelet transform with a simplified MED algorithm,**" in *Proc. of International Conference on Electrical and Computer Systems (ICECS'2012, Ottawa)*, August 22–24, pp. 129.1–129.6, 2012.

[C53] H. Dehghan, R. M. Dansereau, and A. D. C. Chan, "**Iterative blind source separation of EMG signals based on the joint domain sparsity,**" in *Proc. of Canadian Medical and Biological Engineering Conference (CMBEC35, Halifax)*, June 20–22, 2012.

[C51] R. B. Wallace, R. M. Dansereau, and R. A. Goubran, "**Methods for the detection of ECG characteristic points**," in *Proc. of Intern. Symposium on Medical Measurements and Applications (MeMeA 2012, Budapest)*, May 18-19, 2012.

[C50] M. M. Fouad, R. M. Dansereau, and A. D. Whitehead, "**Two-step super-resolution technique using bounded total variation and bisquare M-estimator under local illumination changes**," in *Proc. of IEEE Intern. Conf. on Image Processing (ICIP'2011, Brussels)*, September 11-14, 2011, pp. 1381-1384.

[C49] Junwu Zhu, R. M. Dansereau, and C. Joslin, "**Perceptual noise shaping in dual-tree complex wavelet transform for image coding**," in *Proc. of IEEE Intern. Conf. on Image Processing (ICIP'2011, Brussels)*, September 11-14, 2011, pp. 241-244.

[C48] M. H. Radfar, R. M. Dansereau, W.-Y. Chan, and W. Wong, "**MPtracker: A new multi-pitch detection and separation algorithm for mixed speech signals**," in *Proc. of IEEE Intern. Conf. on Acoustics, Speech, and Signal Processing (ICASSP'2011 Prague)*, May. 22-27, 2011, pp. 4468-4471.

[C47] M. M. Fouad, R. M. Dansereau, and A. D. Whitehead, "**Image registration under local illumination variations using robust bisquare M-estimation,**" in *Proc. of IEEE Intern. Conf. on Image Processing (ICIP'2010, Hong Kong)*,

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[C46] T. K. Helaly, R. M. Dansereau, and M. El-Tanany, "**Factors affecting spectral regrowth in DS-CDMA signals due to PD-HPA nonlinear distortion**," in *Proc. of Vehicular Technology Conference (VTC2010-Fall, Ottawa, Ontario)*, September 6-9, 2010.

[C45] K. Yonis and R. M. Dansereau, "**Video quality prediction using a 3D dual-tree complex wavelet structural similarity index**," in *A. Elmoataz et al. (Eds.): ICISP 2010, LNCS 6134*, pp. 359-367. Springer, Heidelberg (2010).

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VQ-based single channel speech separation technique," in *Proc. of IEEE International Symposium on Signal Processing and Information Technology (ISSPIT'2006 Vancouver)*, August 27-30, 2006, pp. 572-577.

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[C12] R. M. Dansereau, C. Li, and R. A. Goubran, "**Lip feature extraction using motion, color, and edge information**," in *Proc. of the IEEE Intern. Workshop on Haptic, Audio and Visual Environments and their Applications (HAVE'2003 Ottawa)*, Sept. 20-21, 2003, pp. 1-6.

[C11] C. Li, R. M. Dansereau, and R. A. Goubran, "**Acoustic speech to lip feature mapping for multimedia applications**," in *Proc. of the IEEE Intern. Symposium on Image and Signal Processing and Analysis (ISPA'2003 Rome)*, Sept. 18-20, 2003, vol. 2, pp. 829-832.

[C10] R. Dansereau, W. Kinsner, and V. Cevher, "**Wavelet packet best basis search using generalized Rényi entropy**," in *Proc. of the IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'2002 Winnipeg)*, May 12-15, 2002, vol. 2, pp. 1005-1008.

[C9] R. Dansereau and W. Kinsner, "**New relative multifractal dimension measures**," in *Proc. of 26th International Conference on Acoustics, Speech, and Signal Processing (ICASSP'2001 Salt Lake City)*, May 7-11 2001, vol. 3, pp. 1741-1744.

Conference Papers Accepted Based On Extended Abstract Submission:

[C77-poster] Z. Ashouri, G. Wang, R. M. Dansereau, and R. de Kemp, "**Multi-scale wavelet kernel-based PET reconstruction using MR side information**," accepted to *2021 Virtual IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS-MIC)*, October 16 – 23, 2021.

[C75-poster] Z. Ashouri, C. Hunter, B. Spencer, G. Wang, R. M. Dansereau, and R. de Kemp, "**Kernel-based Reconstruction of Cardiac PET Images Using MR Information**," *2020 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC, Boston, USA)*, October 31–November 7, 2020, pp. 1–2, doi: 10.1109/NSS/MIC42677.2020.9507993.

[C72] Z. Ashouri, C. Hunter, B. Spencer, G. Wang, R. M. Dansereau, and R. de Kemp, "**Dynamic PET image reconstruction using the wavelet kernel method**," *2019 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS-MIC, Manchester, UK)*, October 26 – November 2, 2019.

[C71-poster] Zahra Ashouri, Chad Hunter, Benjamin Spencer, Guobao Wang, Richard Dansereau and Robert de Kemp, "**Kernel-Based Dynamic Cardiac PET Image Reconstruction of C-11-Hydroxyephedrine,**" poster at the Ottawa Cardiovascular Research Day, May 13, 2019.

[C70-poster] Zahra Ashouri, Chad Hunter, Benjamin Spencer, Guobao Wang, Richard Dansereau and Robert de Kemp, "**Kernel-Based Dynamic Cardiac PET Image Reconstruction of C-11-Hydroxyephedrine,**" poster at *The 7th International Ottawa Hospital Conference (TOHS-OHC)*, April 12, 2019.

[C63] H. Chahrour, B. Balaji, S. Rajan, and R. M. Dansereau, "**Hybrid spread spectrum orthogonal waveforms for MIMO radar,**" accepted to *Canadian Tracking and Fusion Group Workshop (CTFG'2017, Ottawa, Canada)*, November 6-7, 2017.

[C52-poster] R. B. Wallace, R. M. Dansereau, and R. A. Goubran, "**Fusion algorithm for the detection of ECG characteristic points,**" poster at *2012 Healthcare Support through Information Technology Enhancements Annual Research Review (hSITE 2012, Montreal)*, June 4–5, 2012.

[C25] V. Badee, A. D. C. Chan, and R. M. Dansereau, "**Adaptive multichannel fetal ECG extraction and enhancement with fetal PCG triggering**," abstract in *16th World Conference of the World Society of Cardio-Thoracic Surgeons (WSCTS'2006 Ottawa)*, Aug. 17-20, 2006. (***Finalist for World Congress Award***)

[C8] R. Dansereau and W. Kinsner, "**Psychovisual correlations with multifractal measures for wavelet and wavelet packet progressive image transmission**," in *Proc. of the IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'2000)*, May 7-9, 2000, vol. 1, pp. 435-439.

[C7] R. Dansereau and W. Kinsner, "**Rényi generalized entropy analysis of images from a progressive wavelet transmission**," in *Proc. of IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'99 Edmonton)*, May 9-12, 1999, vol. 2, pp. 769-774.

[C6] R. Dansereau, W. Kinsner, and J.F. Peters, "**Fuzzy clocks as observers in communication networks with chaos: A fuzzy sets approach**," in *Proc. of IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'99 Edmonton)*, May 9-12, 1999, vol. 2, pp. 1092-1097.

[C5] R. Dansereau and W. Kinsner, "**Progressive transmission of images through fractal surface interpolation**," in *Proc. of IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'98 Waterloo)*, vol. 1, May 24-28, 1998, pp. 277-280.

[C4] R. Dansereau and W. Kinsner, "**Progressive transmission of images using wavelets: Evaluation using the Rényi generalized entropy**," in *Proc. of IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'98 Waterloo)*, May 24-28, 1998, vol. 1, pp. 281-284.

[C3] R. Dansereau and W. Kinsner, "**Image compression through fractal surface interpolation**," in *Proc. of WESCANEX'97 (Winnipeg)*, May 22-23, 1997, pp. 94-

99.

[C2] R. Dansereau and W. Kinsner, "**Perceptual image compression through fractal surface interpolation**," in *Proc. of IEEE Canadian Conf. on Elec. and Comp. Eng. (CCECE'96 Calgary)*, May 1996, vol. 2, pp. 899-902.

[C1] R. Dansereau, W. Kinsner, and S. Chow, "**A study of codebooks for compression of head-and-shoulder images**," in *Proc. of Math. Modelling and Scientific Comp. (Boston)*, July 1995, vol. 6, 7 pp.

THESES

[T2] R. Dansereau, "**Progressive image transmission using fractal and wavelet techniques with image complexity measures**," *Ph.D. Thesis*, University of Manitoba, Winnipeg, MB, Canada, March 2001.

[T1] R. Dansereau, "**Codebook image compression with neural networks**," *B.Sc. Thesis*, University of Manitoba, Winnipeg, MB, Canada, viii+196 pp., March 1995.

POSTERS

[P3] R. Dansereau, "**Progressive transmission of images**," Poster at *Internet Innovations Workshop (IIW#98)*, June 1998.

[P2] R. Dansereau, "**Image compression using wavelet techniques**," Poster at *Internet Innovations Workshop (IIW'97)*, May 1997.

[P1] R. Dansereau, "**Netscape plug-ins**," Poster at *Internet Innovations Workshop (IIW'96)*, May 1996.

RESEARCH GRANTS AND CONTRACTS

Year(s)	***Source***	***Title***	***Investigator(s) / Supervisor(s)***	***Amount per Year***	***Total***
2023	CUESEF	Autonomous Systems Labs	R. Dansereau (PI) and C. Shen	$2626.48	$2626.48
2022	CUESEF	Autonomous Vehicle Project	G. Korkolis and 18 undergraduates / R. Dansereau, C. Shen	$6665.13	$6665.13
2022	MITACS/ Home Health Systems	Aging in Place Medical Device (1)	R. Dansereau, S. Wilcox, Z. Kobti, M. Shannelly	$45,000	$45,000

Year(s)	*Source*	*Title*	*Investigator(s) / Supervisor(s)*	*Amount per Year*	*Total*
2022	MITACS/ Home Health Systems	Aging in Place Medical Device (2)	R. Dansereau	$15,000	$15,000
2019-2025 (5+1 years)	NSERC Discovery Grant	Signal Separation and Enhancement using Multichannel/Multi modal Side Information	R. Dansereau (PI)	$28,000	$168,000
2014-2019 (5 years)	NSERC Discovery Grant	Instrument separation and "Music minus one" suppression using side metadata	R. Dansereau (PI)	$31,000	$155,000
2014 (6 months)	NSERC Engage Plus / Anystone	Instrument separation and "Music minus one" suppression using side metadata	R. Dansereau (PI)	$17,750	$17,750
2013 (6 months)	NSERC Engage / Anystone	Instrument separation and "Music minus one" suppression using side metadata	R. Dansereau (PI)	$24,961	$24,961
2009-2014 (5 years)	NSERC Discovery Grant	Joint audio-visual signal processing for video conferencing	R. Dansereau (PI)	$25,000	$125,000
2009-2011 (2.5 years)	NSERC CRD / Nortel	Perceptual Scalable Video Coding with Network Managed Content Adaptation in Video Streaming and Conferencing	R. Dansereau(PI), C. Joslin, G. Chan		$109,000
2008 (1 year)	Nortel	Scalable Wavelet Video Coding	R. Dansereau(PI), C. Joslin	$21,800	$21,800
2007 (1 year)	Nortel	Scalable Wavelet Video Coding	R. Dansereau(PI), C. Joslin	$25,300	$25,300

Year(s)	*Source*	*Title*	*Investigator(s) / Supervisor(s)*	*Amount per Year*	*Total*
2006-2007 (2 years)	CITO	Voice Quality Enhancement in VoIP	R. Goubran (PI), R. Dansereau, M. El-Tanany	$60,000	$120,000
2005	Texas Instruments	Audio-Video Fusion Equipment Grant	R. Dansereau (PI)	$9,315	$9,315
2004-2009 (5 years)	NSERC Discovery Grant	Audio-Video Fusion for Improved Video Conferencing	R. Dansereau (PI)	$18,000	$90,000
2004-2005 (1 year)	NCIT	Interleaved Encryption in VoIP	R. Goubran (PI), R. Dansereau	$76,000	$76,000
2003-2005 (2 years)	CITO	Wideband Stereophonic VoIP	R. Goubran (PI), R. Dansereau, M. El-Tanany	$95,000	$190,000
2002-2004 (2 years)	NCIT & Nortel	Conferencing in VoIP	R. Goubran (PI), R. Dansereau, T. Aboulnasr, M. Bouchard	$114,000	$228,000
2001	Carleton University	Start-up Grant	R. Dansereau (PI)	$25,000	$25,000

ADMINISTRATIVE DUTIES

2022/07 – Present: **Associate Dean (Graduate Studies and Postdoctoral Affairs)** – Faculty of Engineering & Design
2021/07 – 2022/06: Sabbatical leave
2020/07 – 2021/06: Administrative leave
2015/07 – 2020/06: **Associate Dean (Student Affairs)**–Faculty of Engineering & Design
2015/07 – 2020/06: **Senate Undergraduate Studies Committee**
2015/07 – 2020/06: **Undergraduate Affairs Committee**
2009/12 – 2020/06: **Senate Academic Program Committee**

- Make recommendations and report to Senate on the execution of the University's strategic and academic plans.
- Receive reports from the Carleton University Committee on Quality Assurance regarding proposals for new undergraduate and graduate programs, and make recommendations to Senate regarding such reports.
- Receive reports from the Carleton University Committee on Quality Assurance regarding proposals for major modifications to undergraduate and

graduate programs, and make recommendations to Senate regarding such reports.
- Receive final assessment reports regarding the cyclical review of existing undergraduate and graduate programs from the Provost and make recommendations to Senate regarding such reports.
- Consider and make recommendations to Senate on the establishment, restructuring and dissolution of faculties, departments, schools, colleges and institutes that offer academic programs.

2009/12–2015/06: **Salary and Benefits Officer** for CUASA

2008/07–2009/09: Sabbatical leave

2007/09–2008/04: Parental leave

2005/07 – 2007/06: **Associate Chair for Undergraduate Studies** in the Dept. of Systems and Computer Engineering
- (2006-07) Oversaw accreditation of Computer Systems Engineering program
- (2004-05) Oversaw successful accreditation of Software Engineering program
- (2004-05) Oversaw successful accreditation of Communications Engineering program
- Member of the Committee on Academics and Standing (CAS) in the Faculty of Engineering and Design which hears student petitions and votes based on university rules and regulations, past precedence, and compassionate reasons
- Handle student academic problems such as prerequisite waivers, advanced standing requests, change of majors, and giving academic advice
- Monitor the students taking SYSC courses have met the required prerequisites
- Oversee calendar changes and changes to the following programs
  - Software Engineering
  - Computer Systems Engineering
  - Communications Engineering
  - Biomedical & Electrical Engineering

2005 – 2007: **Undergraduate Program Review Committee** (UPRC) as appointed by Senate at Carleton University
- Acted as internal reviewer for the Economics program
- Currently starting internal review for the Philosophy program

2006: **Dept. of SCE Chair Selection Advisory Committee**

2004/07 – 2007/06: **Committee on Academics and Standing** (CAS) at Carleton University
- Voting CAS member for the Faculty of Engineering and Design which hears student petitions and votes based on university rules and regulations, past precedence, and compassionate reasons

2002/07 – 2004/06: **Lab Coordinator** for the Dept. of SCE at Carleton University
- Handled scheduling and allocation of the labs for all SYSC courses
- Coordinated the purchase of hundreds of pieces of new lab equipment

2002: **Shad Valley @ Carleton** Assistant Coordinator and Engineering Representative
- Scheduled all daily events for participants for the four week camp
- Canvassed the campus for 2-4 lecturers per day from different departments and different areas of interest
- Coordinated the offering of dozens of student workshops for the four weeks

Other Duties:

- 2020, 2019, 2018, 2011, and 2010: **Chief judge and judge organizer for Ottawa Regional Science Fair**
    - Promotion of STEM and Carleton University to middle/high school students

HONOURS, DISTINCTIONS, AND AWARDS:

- Canadian Association of University Teachers Dedicated Service Award (2015)
- IEEE Senior Member (Elevated 2010/05)
- NSERC Scholarship (1997 - 1999)
- TRLabs Graduate Fellowship (1996 - 2000)
- Active Electronics Award for Excellence in Research (1998)
- The Duff Roblin Fellowship (1996 - 1997)
- "Canada Scholar" Scholarship (1990 - 1995)
- University of Manitoba Alumni Association Entrance Scholarship (1990)
- Vincent Massey Collegiate 25th Reunion Scholarship (1990)
- 1st in Manitoba for the International Computer Problem Solving Contest (1990)
- Manitoba Provincial Mathematics Honour Roll (1989 - 1990)

PROFESSIONAL SOCIETY MEMBERSHIPS

- 2014/09 – Present: P.Eng. with Professional Engineers Ontario
- 2014/04 – Present: IEEE Computer Society
- 2014/02 – Present: IEEE Signal Processing Society
- 2010/05 – Present: Senior Member of IEEE
- 2005 – 2014/12: P.Eng. with the Association of Professional Engineers and Geoscientists of the Province of Manitoba (APEGM)
- 2001/07 – 2010/04: Member of IEEE
- 2002/03 – 2003/12: IEEE Communications Society Membership
- 1997/01 – 2001/06 : Student Member of IEEE

COMMITTEES

2023/3 – Present: **Academic Editor** for **IET Signal Processing**
2017/2 – 2023/2: **Associate Editor** for **IET Signal Processing**
2019: Local Organizing Committee Chair for **IEEE GlobalSIP 2019**
2013 – 2014: Unit Standards Committee for Tenure & Promotion
2009/10 – 2016/06: Senate Academic Planning Committee
2009/12 – 2015/06: CUASA Steering Committee
2009/12 – 2015/06: CUASA Council Committee
2016: On Program Technical Committee for IEEE EMBS International Student Conference (ISC) 2016
2005 – 2006: CCECE'2006 DSP Track Chair
2003: On Program Committee for “Applications of Fractals in Computer Science, Signal and Image Processing Workshop (APPLIFRACT' 03 Las Vegas)”, June 2003.
2000 – 2001. ECE Student/Faculty Committee, Georgia Institute of Technology
1999 – 2000. Graduate Students Association By-Laws and Policies

Committee, U. of Manitoba
1999 – 2000. Graduate Students Association Awards Committee, U. of Manitoba
1998 – 2000. ECE Graduate Studies Committee, U. of Manitoba

Professional Development

- 2020/08/03 – 2020/10/19: Completed online course **Machine Learning** by Prof. Andrew Ng, Stanford University (through Coursera.org), completed all requirements on 2020/10/12. 11 week course around 30 hours of lectures, quizzes each week, and eight 3 hour Matlab assignments

Review of Papers

- Reviewer for IET Image Processing
- Reviewer for IEEE Transactions on Audio, Speech and Language Processing
- Reviewer for IEEE Transactions on Image Processing
- Reviewer for Research Letters in Signal Processing
- Reviewer for Computational and Mathematical Methods in Medicine
- Reviewer for IEEE Transactions on Signal Processing
- Reviewer for EURASIP Journal on Advances in Signal Processing
- Reviewer for Elsevier - Speech Communication
- Reviewer for IEE Proceedings Communications
- Reviewer for IEEE Transactions on Instrumentation and Measurement
- Reviewer for Electronic Letters
- Reviewer for IEEE International Conference on Electronics, Circuits, and Systems (ICECS)
- DSP Track Chair for Canadian Conference on Electrical and Computer Engineering
- Program Committee for “Applications of Fractals in Computer Science, Signal and Image Processing Workshop (APPLIFRACT' 03 Las Vegas)”, June 2003.

Examiner on Thesis Defence Committees (since 2010):

- Hamid Azad, M.A.Sc., University of Ottawa, Prof. Miodrag Bolic, Sep. 18, 2023.
- Joao Guilherme Nizer Rahmeier, Ph.D. Defence, Carleton University, Prof. Gupta and Prof. Smy, Sep. 12, 2023.
- Ankita Dey, Ph.D. Proposal, Carleton University, Prof. Sreeraman Rajan, Aug. 8, 2023.
- James Giroux, M.A.Sc., University of Ottawa, Prof. Martin Bouchard and Prof. Robert Laganière, July 26, 2023.
- Xuejun Han, Ph.D., Carleton University, Prof. Yuhong Guo, May 3, 2023.
- Ali Abdelbadie, M.A.Sc., Carleton University, Prof. Gohary, April 21, 2023.
- Otto Bonn Steger, M.Cognitive Science, Carleton University, Prof. John Logan, April 20, 2023.
- Lian Kang, M.A.Sc., University of Ottawa, Prof. Pierre Payeur, Jan. 10, 2023.
- Ehsan Rahimi, Ph.D., Carleton University, Prof. Joslin, Dec. 14, 2021.

- Fereshteh Fakhar Firouzeh (Behnaz), Ph.D., Carleton University, Prof. Rajan and Prof. Chinneck, Jun. 17, 2021.
- Sadiq Al-Insaif, Ph.D., University of Ottawa, Prof. Jochen Lang, May 13, 2021.
- Rosa Azami, Ph.D., Carleton University, Prof. Mould, Apr. 16, 2021.
- Behrooz Abbaszadeh, Ph.D., University of Ottawa, Prof. Yagoub, Jan. 29, 2021.
- Yi Feng, M.A.Sc., University of Ottawa, Prof. Jiying Zhao, Dec. 8, 2020.
- Jila Hosseinkhani, Ph.D., Carleton University, Prof. Joslin, Jan. 16, 2020.
- Luke McCooeye, M.A.Sc., Carleton University, Prof. Heath and Prof. Rowan , Aug. 27, 2019.
- Binghao Wang, M.A.Sc., University of Ottawa, Prof. Laganière, Dec. 19, 2018.
- Doma Hilewit, Ph.D., Carleton University, Prof. Matida and Prof. Nitzsche, Nov. 23, 2018.
- Lei Chen, Ph.D., University of Ottawa, Prof. Zhang, Sep. 6, 2018.
- Roy Chih Chung Wang, Ph.D., University of Ottawa, Prof. Dubois, Nov. 2, 2017.
- Ryan Kuiper, M.A.Sc., Carleton University, Prof. Wight, Sep. 27, 2017.
- Ce Peng, Ph.D., Carleton University, Prof. Dansereau, Sep. 13, 2017.
- Assem Assem, Ph.D., Carleton University, Prof. Dansereau, Aug. 14, 2017.
- Nima Palizban, M.A.Sc., Carleton University, Prof. Yanikomeroglu, Aug. 9, 2017, Chair of examination committee.
- Jing Wang, Ph.D., University of Ottawa, Prof. Bolic, April 7, 2017.
- Tung Nguyen, M.A.Sc., Carleton University, Prof. Dansereau, Jan. 10, 2017.
- Mina Rafi Nazari, Ph.D., University of Ottawa, Prof. Dubois, Dec. 19, 2016.
- Wenyi Wang, Ph.D., University of Ottawa, Prof. Jiying Zhang, Aug. 30, 2016.
- Mamoon Rashid, M.A.Sc., Carleton University, Prof. Dansereau, Dec. 23, 2015.
- Feng Su, M.A.Sc., Carleton University, Prof. Joslin, Sep. 10, 2015.
- Daphne Eu-Jhia Ong, M.A.Sc., Carleton University, Prof. Frize, Jul. 30, 2015.
- Ebrahim Farhangdoust , M.A.Sc., Carleton University, Prof. Banihashemi, Jul. 7, 2015.
- Shazad Abraham-Doman, M.A.Sc., Carleton University, Prof. Merrett, April 21, 2015.
- Dennis Arsenault, M.A.Sc. in HCI, Carleton University, Prof. Whitehead, August 27, 2014.
- Xiang Zheng, M.A.Sc., University of Ottawa, Prof. Dubois, June 4, 2014.
- Zahra Karimi-Tabar, M.A.Sc., Carleton University, Prof. Joslin, May 12, 2014.
- Jeffrey Campbell, M.A.Sc., Carleton University, Prof. Schwartz, May 1, 2014.
- Sindhu Radhakrishnan, M.A.Sc., Carleton University, Prof. Aitken, Apr. 29, 2014.
- Paul Inger, M.A.Sc., Carleton University, Prof. Aitken, Jan. 23, 2014.
- Jared Strydhorst, Ph.D., Carleton University, Prof. Wells (Physics), Sep. 3, 2013.
- Sharat Akhoury, M.A.Sc., University of Ottawa, Prof. Lagenière, Aug. 30, 2013.
- Swati Upadhyaya, M.A.Sc., University of Ottawa, Prof. WonSook Lee, Aug. 16, 2013.
- Ibrahim AlMohimeed, M.A.Sc., Carleton University, Prof. Ono, Aug. 15, 2013.
- Saeed Salehi Doolabi, Ph.D., University of Ottawa, Prof. Dubois, Mar. 21, 2013.
- Sha Wang, Ph.D., University of Ottawa, Prof. Zhang, Feb. 21, 2013.
- Andy Huang, M.A.Sc., Carleton University, Prof. Ono, Jan. 11, 2013.

- Shabana Baig, M.A.Sc., Carleton University, Prof. Chan and Prof. Dansereau, Dec. 19, 2012.
- Jason Belec, Ph.D., Carleton University, Prof. Clark, Sep. 10, 2012.
- Sina Firouzi, M.A.Sc., Carleton University, Prof. Joslin, Sep. 4, 2012.
- Parnia Farokhian, M.A.Sc., Carleton University, Prof. Joslin, Aug. 27, 2012.
- Graham Fraser, M.A.Sc., Carleton University, Prof. Chan, Aug. 13, 2012.
- Jie Zhu, Ph.D., Carleton University, Prof. Dansereau, Jun. 21, 2012.
- Nick Deloyer, M.A.Sc., Carleton University, Prof. Wight, Apr. 24, 2012.
- Susan Twelves, M.A.Sc., Carleton University, Prof. Frize, Apr. 19, 2012.
- Festus Iyuke, M.A.Sc., Carleton University, Prof. Green, Sep. 26, 2011.
- Pierre Dinnessen, M.A.Sc., Carleton University, Prof. Aitken, Sep. 14, 2011.
- Siarhei Yermakou, M.A.Sc., Carleton University, Prof. Banihashemi, Sep. 8, 2011.
- Yan Liu, Ph.D., University of Ottawa, Prof. Zhao, Sep. 7, 2011.
- Chirag Hingwala, M.A.Sc., Carleton University, Prof. Wight, Sep. 6, 2011.
- Gabriel Telles O'Neil, M.A.Sc., University of Ottawa, Prof. Lee, Jun. 17, 2011.
- Haishan Wang, M.A.Sc., Carleton University, Prof. Banihashemi, May 5, 2011.
- Ali Ghazisaiedi, M.A.Sc., Carleton University, Prof. Cuhadar, Prof. Payeur and Prof. Dansereau, Jan. 4, 2011.
- Helga Ross, M.A.Sc., Carleton University, Prof. Adler, Sep. 2, 2010.
- Tarek Helaly, Ph.D., Carleton University, Prof. Dansereau and Prof. El-Tanany, Jul. 21, 2010.
- Mohamed Fouad, Ph.D., Carleton University, Prof. Dansereau and Prof. Whitehead, Jul. 19, 2010.
- Saad Al-Ahmadi, Ph.D., Carleton University, Prof. Yanikomeroglu, Jul. 9, 2010.
- Camille Gomez Laberge, Ph.D., Carleton University, Prof. Adler and Dr. Hogan, May 13, 2010.
- Alistair Boyle, M.A.Sc., Carleton University, Prof. Adler, Apr. 15, 2010.
- Véronique Millette, M.A.Sc., University of Ottawa, Prof. Baddour and Prof. Labrosse, Jan. 29, 2010.

CURRICULUM VITAE

HIMAVARSHA DHULIPATI, Ph.D., Assistant Professor

Carleton University, Department of Electronics, 1125 Colonel By, Ottawa, K1S5B6
E-mail: himadhulipati@cunet.carleton.ca Phone:1-519-992-7601

EDUCATION

Doctor of Philosophy (PhD) **Sept 2014 – Sept 2019**

Electrical and Computer Engineering, University of Windsor, Canada

Dissertation Title: Modeling and Analysis of Multi–phase Permanent Magnet Synchronous Machine: Direct–drive Electric Vehicle Application

TEACHING AND RESEARCH EXPERTISE

- Modeling and parameter determination of electric machines
- Design and testing of electric machines and drives
- Analysis and optimization of electric machines
- Modeling and simulation of light– and heavy–duty electrified transportation vehicles
- Energy management and machine drives for renewable energy application

RESEARCH GRANTS

Grants Currently Held:

- Carleton University Research Development Grant (PI): Intelligent Algorithms-based Fault-Tolerant Detection Techniques for EV Application, Amount: $10,000, 2022-2024
- NSERC Discovery Grant (PI): Next Generation High-Performance Fault-Tolerant Electric Motors for Electrified Vehicles, Amount: $160,000, 2023-2028
- NSERC Early Career Researcher Launch Supplement (PI), Amount: $12,500, 2023-2028
- Carleton Start-up Fund (PI), Amount: $100,000, 2022-Present

Grants Application in Review:

- NSERC Alliance-Mitacs Grant (Co-PI): Advance Modular Powertrain Systems for Electric Vehicles, Amount: $1,803,700
- NSERC Alliance-FQRNT-NOVA(Co-PI): Design and Development of Low-Cost Traction Drive System for Electric Vehicles, Amount: $225,000
- NSERC Research Tools and Instruments (PI): Electric Powertrain Tester for Sustainable Mobility, Amount: $150,000
- New Frontiers in Research Fund Exploration (co-PI): Reimagining Upper Limb Prosthetics by Creating Human-like Muscles, Amount: $250,000

EMPLOYMENT EXPERIENCE

Assistant Professor, Department of Electronics, Carleton University
Tenure Status: Tenure Track **July 2022– Present**

- Conduct research on electric machine modeling, design and optimization for on-road and off-road electric vehicles and renewable energy applications, parameter determination, performance characterization and control of electric machines and publish the research outcomes in journals, articles, conferences etc.
- Supervise or co-supervise students registered in an undergraduate or graduate degree program or postdoctoral fellows
- Teach undergraduate and graduate courses in power engineering
- Assist with various departmental and university's administrative duties

Motor Drive Specialist- Tractive Unit Research and Development, Taiga Motors Inc.
May 2021– June 2022

- Lead the development of electric motor including modelling design and optimization for electric snowmobile and watercraft

Development of motor control algorithms to improve transient stability and high-speed performance of the off-road electric vehicles

- End of line performance testing of electric motor drives
- Integrated testing and tuning of motor control for improved efficiency and vehicle response
- Testing and tuning of drive system in dynamometer and vehicle environment
- Worked closely with tractive unit team to continuously improve vehicle performance

Research Engineer – Advanced Propulsion Systems, University of Windsor
Oct. 2019 – May 2021

- Conduct research and publish articles that highlight findings on modeling and analysis of electric machines, testing of electric machines and drives.
- Manage industrial projects
  - Communicate with academic and industrial partners
  - Project team developments
  - Report progress and results of research activities ensuring that relevant information in the implementation of projects are captured comprehensively and in a timely manner.
- Mentor and provide research direction to PhD and MASc Students
- Development of proposals for research funding

TEACHING EXPERIENCE

Assistant Professor, Carleton University **Sept 2022 – Present**

3rd year Undergraduate Course: Engineering Project ELEC 3907
3rd year Undergraduate Course: Power Electronics ELEC 3508

4th year Undergraduate Engineering Project: ELEC 4907
Graduate Course: Power Systems EGEN 5305

Substitute Instructor, University of Windsor **Jan. 2019 – May 2020**

4th year Undergraduate Course: Power Electronics

- Course content includes review of diodes, transistors, BJTs, MOSFETS, IGBTs, RLC circuits, etc.; diode rectifiers; Thyristor Converters; DC-DC Switch-Mode Converters; Switch-Mode DC-AC Inverters; Application of Power Electronic Systems
- Assist instructor by performing teaching and teaching related duties
- Adhere to the curriculum and lesson plans assigned by the regular instructor
- Assign homework and manage classroom activities

Graduate Teaching Assistant, University of Windsor **Sept. 2014 – Sept. 2019**

- Lead and guide class discussion sections, conduct tutorials, and laboratory sessions
- Demonstrate use of laboratory equipment and enforce laboratory rules; Perform experiments prior to assigning them to students
- Develop instructional materials such as syllabi, PowerPoint slides, answer keys, supplementary notes
- Prepare, proctor and evaluate examinations
- Evaluate lab reports, tutorials and assignments; Record grades
- Schedule and maintain regular office hours to meet with students

Undergraduate Courses:

- Electromechanical Systems (Fall 2014, Fall 2015, Fall 2017, Fall 2018)
- Power Electronics (Winter 2017)
- Electronics I (Winter 2018)
- Power Systems II (Summer 2015)
- Advanced Power Systems (Fall 2016)
- Advanced Power Systems II (Summer 2016)
- Engineering Mathematics (Summer 2017)

CONFERENCE & WORKSHOP

- IEEE Windsor and the University of Windsor sponsored an invited talk on opportunities and challenges in electric machines and drives, 2023
- Invited talk on Women in Engineering panel at IEEE Electrical Power and Energy Conference, 2022.
- Poster Presentation on "Non–Dominated Sorting Genetic Algorithm Based Investigation of Optimal Odd Slot Numbers for Stator Shifted Fractional–Slot Wound PMSMs", The Energy Conv. Congress and Exposition, Baltimore, USA, September 2019.
- Oral Presentation "Modeling and Analysis of Multi–phase PMSM for Direct–drive Electric Vehicle Application", Electric Extended range Clean and affordable Ontario MOBILITY Workshop and Conference, University of Windsor, April 2019.
- Poster Presentation on "Adagrad Algorithm based Optimal Slot–Pole Selection for Reduced Inductance Harmonics in Concentrated Wound Multiphase PMSM", The International Magnetic Conference, Singapore, April 2018.
- Oral Presentation "Multi–phase PMSM for Direct–drive Electric Vehicle Application", Electric Extended range Clean and affordable Ontario MOBILITY Workshop and Conference, McMaster University, May 2018.
- Oral Presentation "Skewing of Stator Windings for Reduction of Spatial Harmonics in Concentrated Wound PMSM", The 30th Annual Conference on Electrical and Computer Engineering, Windsor, Canada, May 2017.
- Oral Presentation on "A 3–D Sub–Domain Analytical Model to Calculate Magnetic Flux Density in Induction Machines with Semi–Closed Slots under No–Load Condition", The International Magnetic Conference, Miami, USA, November 2016.
- Poster Presentation on "Design and Space Harmonics Analysis of Interior Permanent Magnet Machine with Fractional Slot Concentrated Windings for EV Application", Year 2 Interim CRD Project Update Meeting, University of Windsor, Canada, August 2016.
- Organizing committee, Electric Extended range Clean and affordable Ontario MOBILITY Workshop and Conference, University of Windsor, April 2019.
- Research showcase, Ford Materials Engineering Workshop, Ford Motor Company, Windsor, Canada, 2017, 2018 and 2019.

COMMITTEE MEMBERSHIPS

Vice–chair, IEEE Women in Engineering, Windsor Section	**Jan. 2018 – Jan. 2019**
Member, IEEE	**Sept. 2019– present**
Student Member, IEEE	**Sept. 2014– Sept. 2019**

EDITORIAL ACTIVITIES

Track Chair, sessions: Electric Machines and Drives; Smart Grids, IEEE Electric Power and Energy Conference, EPEC 2022

Peer Reviewer, IEEE Transactions Journal on Industrial Application

Peer Reviewer, IEEE Transactions Journal on Transportation Electrification

Peer Reviewer, IEEE Transactions Journal on Vehicular Technology

Peer Reviewer, IEEE Transactions Journal on Energy Conversion

Peer Reviewer, IEEE Transactions Journal on Industrial Electronics

Peer Reviewer, IEEE Transactions Journal on Magnetics

SUPERVISION

PhD Students at Carleton University

- Mohammad Alsamad (2023-2027), co-supervisor, Thesis: Efficient PM-Assisted Synchronous Reluctance Machine for Electric Vehicles
- Souvik Das (2024-2028), admit in Fall 2024
- Nithish Mishra (2024-2028), admit in Fall 2024

MASc Students at Carleton University

- Kunal Vora, (2022-2024), Thesis: Deep Reinforcement Learning based MPPT Control for Grid Connected PV Systems
- Srishti Songriwal (2024-2026), admit in Summer 2024

Undergraduate Students at Carleton University

- Bofu Shi (2023), Summer I-CUERES Intern
- Mohammad Alqama (2024), Global Link MITACS Intern
- Nathan Rose (2023), NSERC USRA Intern

ACTIVITIES

- Department of Electronics Tenure and Promotion Committee (2022-present)
- Department of Electronics Faculty Hiring Committee (2022-present)
- Department of Electronics Chair Hiring Committee (2024)
- Faculty of Engineering and Design, Mechatronics Program Committee (2023)
- OGS Scholarship Reviewer (2023-2023)
- Peer Reviewer for NSERC Grants (2023)
- Internal examiner for one MASc defense and one PhD Comprehensive exam
- Chair for 4 MASc defense and 4 PhD proposal exams

PUBLICATIONS

Patents

1. A. Kundu, A. Balamurali, H. Dhulipati, N. C. Kar, G. Schlager and K.L.V. Iyer, "Motor Drive Topologies for Traction and Charging in Electrified Vehicles," U. S. Patent No. 62/861,020, 2022. Patent Status: Granted
2. S. Bruneau, P. Bruneau, A. Zabihinejad, H. Dhulipati, "Drive unit for electric vehicle". United States of America. 17/569,867. 2022. Patent Status: Granted

Peer–Reviewed Journal Publications

1. H. Dhulipati, S. Mukundan, Z. Li, E. Ghosh, J. Tjong, and N. C. Kar, "Torque Performance Enhancement in Consequent Pole PMSM Based on Magnet Pole Shape Optimization for Direct–Drive EV," *IEEE Trans. on Magnetics*, 2020.
2. H. Dhulipati, E. Ghosh, P. Korta, S. Mukundan, J. Tjong and N. C. Kar, "Multi–objective Design Optimization of Six–phase PMSM for Direct–drive EV using Coupled TS–FEA and Support Vector Machine Learning Algorithm", *IEEE Trans. on Energy Conversion*, 2019.
3. H. Dhulipati, S. Mukundan, C. Lai, K. Mukherjee, J. Tjong and N. C. Kar, "Multiple Reference Frame Theory based Simplified Electromagnetic Torque Computation for Concentrated Wound PMSM", *IEEE Transactions on Energy Conversion,* 2018.
4. S. Mukundan, H. Dhulipati, Z. Li, M. S. Toulabi, N. C. Kar, "Coupled Magnetic Circuit based Design of an IPMSM for Reduction of Circulating Currents in Asymmetrical Star-delta Windings," *IEEE Transactions on Transportation Electrification,* 2022.
5. A. Balamurali, G. Feng, A. Kundu, H. Dhulipati, and N.C. Kar, "Non–Invasive and Improved Torque and Efficiency Calculation Towards Current Advance Angle Determination for Maximum Efficiency Control of PMSM," *IEEE Trans. on Transportation Electrification*, 2019.
6. S. Mukundan, H. Dhulipati, J. Tjong, and N. C. Kar, "Parameter Determination of PMSM using Coupled Electromagnetic and Thermal Model Incorporating Current Harmonics", *IEEE Transactions on Magnetics*, 2018.
7. S. Mukundan, H. Dhulipati, C. Lai, K. Mukherjee and N. C. Kar, "Magnetic Circuit Based Design and Analysis of Fractional Slot Distributed Winding IPMSM for Traction and Integrated Charging Application", *IEEE Transactions on Energy Conversion*, September 2018.
8. K.L.V. Iyer, C. Lai, H. Dhulipati, S. Mukundan, K. Mukherjee, and N. C. Kar, "Investigation of a six–phase interior permanent magnet synchronous machine for integrated charging and propulsion in EVs," *SAE International Journal of Alternative Powertrains*, 2018.
9. K. L. V. Iyer, C. Lai, S. Mukundan, H. Dhulipati, K. Mukherjee, J. Tjong, and N. C. Kar, "A Novel MTPA theory–based Bottom–up Approach towards Parametric and Structural Design of Interior PMSM for Direct–drive Electric Vehicles," *International Transactions on Electrical Energy Systems* ,2018.
10. K. L. V. Iyer, C. Lai, S. Mukundan, H. Dhulipati, K. Mukherjee, and N. C. Kar, "Investigation of Challenges in Interior and Surface Permanent Magnet Synchronous Machines during Integrated Charging Operation in Electric Vehicles," *International Journal of Powertrain*, 2017.

11. K. L. V. Iyer, C. Lai, S. Mukundan, H. Dhulipati, K. Mukherjee, and N. C. Kar, "Investigation of Interior Permanent Magnet Motor with Dampers for Electric Vehicle Propulsion and Mitigation of Saliency Effect during Integrated Charging Operation," *IEEE Trans. on Vehicular Technology*, 2017.
12. A. Mollaeian, E. Ghosh, H. Dhulipati, J. Tjong, and N. C. Kar, "A 3–D Sub–Domain Analytical Model to Calculate Magnetic Flux Density in Induction Machines with Semi–Closed Slots under No–Load Condition," *IEEE Transactions on Magnetics*, 2016.

Submitted conference:

1. K. Vora, S. Liu and H. Dhulipati, "Impact of slot-pole combination on performance of interior PMSM," submitted to *IEEE International Conference on Industrial Cyber-Physical Systems,* St. Louis USA, May 2024.
2. K. Vora, H. Dhulipati and S. Liu, "Comparison of Pertub and Observe, Fuzzy Logic and Reinforcement Learning based MPPT controllers for Grid-connected PV Systems", submitted to *IEEE Energy Conversion Congress and Expo,* 2024

Published/Accepted Conference Papers

1. S. Mukundan, H. Dhulipati, E. Ghosh, J. Tjong, and N. C. Kar, "Supervised Machine Learning Based Multi–Level Optimization of Traction Interior PMSM Rotor for Reduced PM Utilization," , *IEEE Conference on Electromagnetic Field Computation* (*CEFC*), Pisa, Italy, November 2020.
2. B. Sato, Z. Ze, H. Dhulipati, and N. C. Kar, "Drive-Cycle Based Inductance Estimation of PMSM Using Imperialist Competitive Algorithm," *IEEE CEFC*, Pisa, Italy, November 2020.
3. S. Mukundan, P. Roy, Z. Li, H. Dhulipati, J. Tjong, and N. C. Kar, "Thermal Performance Investigation of Star–Delta Wound PMSMs Considering the Effects of Circulating Currents," *IEEE International Conference on Electrical Machines and Systems*, Hamamatsu, Japan, November 2020.
4. Z. Li, P. Song, B. Sato, W. Li, H. Dhulipati, and N. C. Kar, "Novel Current Injection based Multi-parameter Estimation Technique for Dual Three-phase PMSMs," *IEEE International Conference on Electrical Machines and Systems*, Hamamatsu, Japan, November 2020.
5. N. Remus, M. Toulabi, S. Mukundan, H. Dhulipati, W. Li, C. Novak, and N. C. Kar, "Electromagnetic Noise and Vibration in PMSM and Their Sources: An Overview," in proc. of the *IEEE Canadian Conference on Electrical and Computer Engineering*, London, Canada, 2020.
6. P. Roy, M. Towhidi, F. Ahmed, S. Mukundan, H. Dhulipati, and N. C. Kar, "A Novel Hybrid Technique for Thermal Analysis of Permanent Magnet Synchronous Motor Used in Electric Vehicle Application," in proc. of the *SAE World Congress Experience Conference*, Detroit, MI, April 21-23, 2020.
7. H. Dhulipati, S. Mukundan, L. Chauvin, C. Riczu, A. Edrisy, M. Kozdras, J. Bauman, S. Habibi, J. Tjong, and N.C. Kar, "Investigation of Aluminum and Copper Wound PMSM for Direct–drive Electric Vehicle Application," in proc. of *International Conference on Materials and Intelligent Manufacturing*, Incheon, S. Korea, August 2019.
8. H. Dhulipati, S. Mukundan, E. Ghosh, J. Tjong, and N.C. Kar, "Slot-pole Combination Selection for Concentrated Wound Consequent Pole PMSM with Reduced EMF and Inductance Harmonics," in proc. of *IEEE International Conference on Electrical Machines and Systems* (*ICEMS*), Harbin, China, August 2019.

9. S. Mukundan, M. Mehdi, H. Dhulipati, L. Chauvin, A. Edrisy, Y. He, J. Tjong, and N.C. Kar, "Performance Analysis of Non–Oriented Electrical Steel with Optimum Texture for High–Speed Traction Motors," in proc. of *International Conference on Materials and Intelligent Manufacturing*, Incheon, S. Korea, August 2019.
10. S. Mukundan, H. Dhulipati, L. Chauvin, A. Edrisy, J. Tjong, and N.C. Kar, "Comparative Performance Analysis of Copper and Aluminum Wound Fractional-slot PMSMs for High-speed Traction Application," in proc. of *IEEE ICEMS*, China, 2019.
11. A. Kundu, A. Balamurali, H. Dhulipati, P. Korta, L.V. Iyer, G. Schlager, and N.C. Kar "Performance Analysis of Split-Phase Nine-Switch Inverter with Reduced Power Losses for 800 Volts Traction Application," in proc. of *IEEE* 45^{th} *Annual Conference of the Industrial Electronics Society*, Lisbon, Portugal, October 2019.
12. P. Roy, A. Bourgault, F. Ahmed, M. Towhidi, S. Mukundan, H. Dhulipati, E. Ghosh, and N.C. Kar "Thermal Representation of Interior and Surface Mounted PMSMs for Electric Vehicle Application," in proc. of *IEEE 45th Annual Conference of the Industrial Electronics Society*, Lisbon, Portugal, October 2019.
13. S. Mukundan, H. Dhulipati, E. Ghosh, G Feng, and N. C. Kar, "Non-Dominated Sorting Genetic Algorithm Based Investigation of Optimal Odd Slot Numbers for Stator Shifted Fractional-Slot Wound PMSMs," in proc. of *IEEE Energy Conv. Congress and Exposition*, Baltimore, USA, September 2019.
14. S. Mukundan, H. Dhulipati, G. Feng, J. Tjong, and N. C. Kar, "Modeling and analysis of novel star-delta winding configuration with odd slot numbers for reduced space harmonics using winding function theory," in proc. of *IEEE Int. Electric Machines and Drives Conference*, San Diego, USA, 2019.
15. H. Dhulipati, S. Mukundan, W. Li, and N. C. Kar, "Investigation of Phase Angle Displacements in Six-phase PMSM with Non-overlapping Windings for Reduced MMF Harmonics," in proc of I*EEE International Conference on Electrical Machines and Systems*, South Korea, 2018.
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18. A. Balamurali, C. Lai, H. Dhulipati, V. Loukanov, and N. C. Kar, "Improved Analytical Eddy Current Loss Modelling Considering Carrier Harmonics towards Maximum Efficiency Control of PMSM- Drive Systems," in proc. of *IEEE Int. Magnetics Conference*, Singapore, 2018.
19. H. Dhulipati, E. Ghosh, S. Mukundan, J. Tjong, and N. C. Kar, "Adagrad Algorithm based Optimal Slot-Pole Selection for Reduced Inductance Harmonics in Concentrated Wound Multiphase PMSM," in proc. of IEEE In. Mag. Conf., Singapore, 2018.
20. H. Dhulipati, S. Mukundan, K. L. V. Iyer, and N. C. Kar, "Skewing of Stator Windings for Reduction of Spatial Harmonics in Concentrated Wound PMSM," in proc of *IEEE Canadian Conference on Electrical and Computer Engineering*, May 2017.
21. S. Mukundan, H. Dhulipati, K. L. V. Iyer, K. Mukherjee, and N. C. Kar, "Comparison of Inductance Determination Methods of PMSMs for EV Application," in proc of *IEEE Canadian Conference on Electrical and Computer Engineering*, May 2017.

22. S. Mukundan, H. Dhulipati, K. L. V. Iyer, C. Lai, K. Mukherjee, and N. C. Kar, "Comparative Performance Analysis of 3-phase IPMSM Rotor Configurations with Dampers for Integrated Charging Application in EV," in proc. of *IEEE Conf. on Ind. Electronics Society*, Beijing, China, November 2017.
23. A. Mollaeian, E. Ghosh, H. Dhulipati, J. Tjong, and N. C. Kar, "A 3-D Sub-Domain Analytical Model to Calculate Magnetic Flux Density in Induction Machines with Semi-Closed Slots under No-Load Condition," in proc. of *IEEE Conf. on Elec. Field Computation*, Florida, 2016.
24. H. Dhulipati, K. L. V. Iyer, S. Mukundan, K. Mukherjee, J. Tjong, and N. C. Kar, "Investigation of 6-Phase Surface PM Machine with Concentrated Windings for Reduction in Space Harmonics, Leakage Inductance and Magnet Loss in Direct- Drive EV," in proc. of *IEEE International Conference on Electrical Machines*, Switzerland, 2016.
25. S. Mukundan, K. L. V. Iyer, H. Dhulipati, K. Mukherjee, J. Tjong, and N. C. Kar, "Response Surface Methodology based Optimization of Surface PM Machine Incorporating Stator Slotting and PM Sizing Effects to Extend the Operating Limits for Direct-drive EV Application," in proc. of *IEEE International Conference on Electrical Machines*, Switzerland, 2016.
26. K. L. V. Iyer, H. Dhulipati, S. Mukundan, K. Mukherjee, J. Tjong, and N. C. Kar, "Design Approach Incorporating MTPA and Winding Function Theories for On-board Direct-Drive Surface PM Machines with Concentrated Windings in EVs," in proc. of *IEEE Int. Con. on Elec. Machines,* Switzerland, 2016.
27. K. L. V. Iyer, S. Mukundan, H. Dhulipati, K. Mukherjee, B. Minaker, and N. C. Kar, (2015) "Design Considerations for Permanent Magnet Machine Drives for Direct-Drive Electric Vehicles," in proc. of *IEEE International Electric Machines and Drives Conference*, Idaho, USA, 2015.

EUR ING DR ALEX ELLERY

BSc (Hons), MSc, PhD, P.Eng, C.Eng, FIET, FIMechE, FBCS, FRAeS, C.Phys, FInstP, C.Math, FIMA, C.Mgr, FRSB, FRAS, FBIS
Full Professor (Tenured) - **Canada Research Professor**

Centre for Self-Replication Research (CESER)

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General Areas of Interest – Space Robotics & ISRU in the Broadest Context

- Space Manipulator Control for On-Orbit Satellite Servicing, Space Debris Mitigation and Extrasolar Planet Detection
- Planetary Rovers especially Rover Chassis Design, Traction Analysis & Autonomous Navigation/Path Planning
- Robotic Science Facility for Autonomous Rover Exploration & Roboticised Astrobiological Instrumentation
- Robotic Drilling & Mining in Extraterrestrial Environments
- Planetary Landers especially Micro-Penetrators
- Nano-Spacecraft Design especially Rover-On-A-Chip and 3D Printed Cubesats
- Artificial Intelligence through Hybrid Bayesian/Neural Nets for Spacecraft Autonomy and Cyber-Immunity
- In-Situ Resource Utilisation of Extraterrestrial Materials
- Extraterrestrial Manufacturing especially Additive Manufacturing
- Universal Construction and Self-Replicating Machines
- Biomimetic Approaches for Space Applications especially Brain Emulation and EDAC based on Biological Development
- Climate Change Mitigation using Solar Power Satellites and Solar Shields

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I. ACADEMIC QUALIFICATIONS

Duration	Award	Institution
Oct 1990 – Jun 1995	**PhD Astronautics & Space Engineering**	College of Aeronautics, **Cranfield Institute of Technology**, Bedfordshire, UK "Dynamics & control of a freeflying space robot with mounted manipulators for on-orbit satellite servicing"
Jun 1993 – Sep 1993	**Certificate in Space Studies**	**International Space University** (ISU) Summer School, University of Alabama, Huntsville, USA
Oct 1989 – Sep 1990	**MSc Astronomy**	Astronomy Centre, **University of Sussex**, Brighton, UK
Oct 1984 – Jul 1988	**BSc (Hons) Physics**	Department of Physics, **University of Ulster**, Northern Ireland, UK

II. PROFESSIONAL INSTITUTION MEMBERSHIPS

Grade	Institution	Entry Membership Election Year
Licenced (**P.Eng** – Engineering Physics)	Professional Engineer Ontario	2018
Fellow	Royal Society of Biology	2019
Fellow	British Computer Society	2019
Fellow	Institution of Mechanical Engineers	2015
Fellow (**C.Math**)	Institute of Mathematics & its Applications	2003
Fellow (**C.Eng**/**Eur Ing**/**C.Mgr**)	Institution of Engineering & Technology	1998
Fellow (**C.Phys**)	Institute of Physics	1995
Fellow	Royal Aeronautical Society	1993
Fellow	British Interplanetary Society	1993
Fellow	Royal Astronomical Society	1991

Fellowship is the highest grade of professional membership and requires demonstrable evidence of significant contributions to the field of expertise.

III. PROFESSIONAL EXPERIENCE

Duration	Position	Institution
Jan 2007 - present	Full Professor (2018) (Tenured) – **Canada Research Professor** (Canada Research Chair in Space Robotics & Space	Department of Mechanical & Aerospace Engineering, **Carleton University**, Ottawa, Canada Head of Centre for Self-Replication Research (CESER)

	Technology 2007-2017)	
Apr 2004 – Dec 2006	Lecturer in Spacecraft Engineering	Surrey Space Centre, School of Electronics & Physical Sciences, **University of Surrey**, Guildford, UK Head of Robotics Research Group
Aug 2001 – Apr 2004	Senior Lecturer in Spacecraft Engineering	School of Engineering, **Kingston University**, London, UK
Sept 2000 – Jul 2001	Project Manager of Herschel Space Observatory & Planck Space Telescope instrument groups	Astrophysics Laboratory, Queen Mary College, **University of London**, London, UK
Jul 1997 – Aug 2000	Software Engineer (Consultant)	Space Division, **Logica UK Ltd**, London, UK
Jan 1996 – Jun 1997	Senior Clinical Scientist (Neurotology)	Department of Neurotology, **Royal National Throat Nose & Ear Hospital**, Greys Inn Rd, London, UK
Oct 1988 – Sep 1989	Systems Design Engineer	**Vickers Shipbuilding & Engineering Ltd** (VSEL), Barrow-in-Furness, UK

IV. EVIDENCE OF ESTEEM

AWARDS

- **Canada Resarch Professor (**since 2017)
- **Canada Research Chair** in Space Robotics & Space Technology (2007-2017), a prestigious Canadian award recognising leadership in academic research
- **Donald Michie Trophy** from British Computer Society for a paper entitled "Practical limits to transfer learning of neural network controllers from Earth to space environments" *Proc 42nd SGAI Int Conf on Artificial Intelligence - Lecture Notes in Artificial Intelligence* **13652**, 3-16 (2022)
- **5th Best Paper Prize** at 23rd World Energy Congress (WEC), Istanbul, Turkey (2016) awarded by World Energy Council (WEC was attended by Vladimir Putin of Russia and Tayyip Erdogan of Turkey)
- Best papers of sessions of International Astronautics Congress (IAC) for 2015 (one paper) and 2017 (two papers)
- **George Stephenson Medal** and William Sweet Smith prize from Institution of Mechanical Engineers (2005) for a paper entitled "An engineering approach to the dynamic control of space robotic on-orbit servicers" *Proc Inst Mechanical Engineers Part G: J Aerospace Engineering* Vol 218, 79-98 (2004)

Figure 1. Andrew Ives, President of IMechE (2005) *left*, presents Dr Alex Ellery *right* with the Stephenson medal [from Agenda vol 4 (8), page 2]

RECENT INVITED TALKS

- Keynote "Sustainability of life on the Moon: developing a lunar industrial ecology for in-situ resource utilisation" at CASI Aero 23 (14-16 Nov 2023), Brookstreet Hotel, Ottawa (https://casi.ca/aero2023/)
- 3-hour pre-symposium seminar "Self-Replicating Machines" at Interstellar Symposium 2023, McGill University, Montreal (Jul 2023)
- Invited speaker for Florida Atlantic University's virtual *Synthesising existence: Alife, AI and the Fermi paradox* (Jun 2023) – "Roadmap to the Stars via Self-Replicating Machines" - https://mpcrlab.com/news/13-Apr-2023-AI-Workshop-Series/
- Invited speaker at Wichita State Uni *Interstellar course* (Apr 2023)
- Space Forward Podcast – Episode 15: "Unleashing Self-Replicating Robots for a Sustainable Lunar Industrial Ecology" with Alex Ellery (https://www.youtube.com/watch?v=xe7z3R_jgz0)
- https://itspmagazinepodcast.com/episodes/von-neumann-probes-with-professor-alex-ellery-stories-from-space-podcast-with-matthew-s-williams-Y5_MVa19
- *https://www.universetoday.com/156778/before-we-develop-self-replicating-machines-to-explore-the-universe-we-should-figure-out-how-to-turn-them-off-again/*
- *https://www.universetoday.com/156730/well-be-building-self-replicating-probes-to-explore-the-milky-way-sooner-than-you-think-why-havent-etis/*
- Invited speaker "Sustainable ISRU" Space Resources Week Luxembourg 2022 and 2023 (V)
- Invited speaker "Lunar resource manufacture SPS – how much is feasible?" 1st ESA Space-based Solar Power for Net Zero Workshop 2021 (V)
- Invited speaker to NASA Space Portal Commercial Space Lecture series (Jun 2021) "Self-replicating machines are the only means through which to spread through the solar system"
- Invited speaker at NASA Space Apps Toronto – "Are self replicating machines a technology of today or tomorrow?" (Oct 2021)
- Invited speaker for 1st Greek Space Science & Technology Conference (May 2021)
- Invited speaker for IMechE North American branch "Building self-replicating machines to colonise the Moon" (Mar 2021) - https://www.youtube.com/watch?v=HXXrmf7faEA
- Invited speaker for Canada SEDS conf (Ascension) on on self-replicating machines (Feb 2021)
- Invited keynote speaker for GECCO (Genetic & Evolutionary Computation Conference) 2020 "Information return on investment condition in self-replicating machines" (Jul 2020)
- Invited speaker at Lunar In-Situ Resources Utilisation Workshop, ESTEC (3-5 Jul 2018)
- Invited speaker for 20-minute Pint of Science talk Ottawa (15 May 2018)
- Invited speaker for 5 minutes of science (2017): https://www.youtube.com/watch?v=cucNhR9IIU8

- Invited speaker to NASA Jet Propulsion Laboratory on "Building a Self-Replicating machine Ex Nihilo on the Moon" (Nov 2017)
- Invited speaker for SEDS Canada, Flight Research Lab, NRC, Ottawa (26 July 2017)
- Invited speaker at the 12th Military Space Situational Awareness Summit London UK on "Artificially intelligent spacecraft as a defence strategy against hostile cyber-intervention" (26-27 Apr 2017) - http://www.smi-online.co.uk/milspace2017-docs.asp
- Invited speaker (2014 and 2015) in additive manufacturing for the RAPID Canada Conference day of the Canadian Manufacturing Technology Show, Mississauga, ON
- Présenter at Lunar ISRU Workshop 2019, Lunar & Planetary Institute, Columbia, MD

EDITORIAL ROLES

- Editorial board (associate editor) of the *International Journal of Astrobiology* (2002-2015) and (2019-current)
- Editorial board of *Frontiers in Space Technology* (2022) - *J Field Robotics* (2022-current) and (2006-2010) - *Int J Advanced Robotic Systems* (2004-2006)
- Guest editor for special issue on von Neumann Probes for *International Journal of Astrobiology*
- Guest editor for special issue on Biomimetic Design & Techniques for Space Applications for the journal *Biomimetics* (2019)
- Guest editor for special issue on Space Robotics for journal *Robotics* (2019)
- Guest editor for special issue on Robotic Astrobiology for *International Journal of Astrobiology* (2017)
- Guest editor for a special issue on Space Robotics for *International Journal of Advanced Robotic Systems* (2014)
- Editorial board for Praxis Publisher's Astronomy & Space Science Series reviewing proposed space-related book titles (2003-2007)
- Co-editor (with Ulrich Nehmzow, Chris Melhuish, Mark Witkowski and Eddie Moxey) of the *Robotics & Autonomous Systems* journal special issue Towards Autonomous Robotic Systems (2007) vol 55 (9)

REVIEWING ACTIVITIES

- External reviewer for University of Western Ontario's Professional Masters course in Space Studies (2021)
- Reviewer for NASA's Postdoctoral Program (NPP) on astrobiology instrumentation especially rover-deployed Raman spectroscopy (2012-2017)
- Expert Evaluator in Space Robotics (a European strategic space technology) for the European Commission Horizon 2020 programme grant applications (2016, 2018, 2020 and 2022)
- Mitacs research institute College of Reviewers; I have been a regular reviewer for NSERC grants and Canada Research Chair applications
- Reviewer for the *ASCE Earth & Space Conference*, *Int Symp Artificial Intelligence, Robotics & Automation in Space (iSAIRAS), IEEE International Conference on Robotics & Automation (ICRA)* and *IEEE Int Conf Automation Science & Engineering (CASE)*; Review committee for the *Towards Autonomous Robotic Systems (TAROS)* annual conference (annual UK mobile robotics conference) for 2006-2010
- Reviewer for several journals in space engineering, space science, robotics, biomimetics and astrobiology - *Planetary & Space Sciences, Advances in Space Research, Aeronautical Journal, Robotics & Autonomous Systems, International Journal Advanced Robotic Systems, Control Engineering Practice, International Journal of Astrobiology, Journal of Field*

Robotics, Bioinspiration & Biomimetics, Acta Astronautica, Journal British Interplanetary Society journals.

CONFERENCE ORGANISATION

- Conference co-chair for 8th Interstellar Symposium, McGill University, Montreal (9-13 Jul 2023)
- Programme committee for special session on *Biologically Inspired Robotics at Adaptation in Intelligent Systems & Biology (AISB) Conference*, University of Bristol (2006)
- Host and conference co-chair for the annual UK Robotics conference TAROS (*Towards Autonomous Robotic Systems*) at the University of Surrey in August 2006
- Host and conference organiser for a two-day symposium at University of Surrey in 2005 on "Low-cost robotic planetary exploration: a UK vision" under the auspices of the Space & Planetary Robotics Network to showcase UK research activities in this area to invitees from UK industry, ESA representatives, and research council representatives
- I have presented at number of conferences which publish extended abstracts rather than full papers including European Geophysical Society Conference (2003) Nice France, 4th European Mars Conference (2004) Milton Keynes UK, Space Resources Roundtable/Planetary & Terrestrial Mining Sciences Symposium (2015, 2017 and 2021) Montreal Canada, Our Common Future Under Climate Change (2015) Paris France, European Astrobiology Network Association Conference (2016) Athens Greece, COSPAR (2022) virtual presentations - "In-situ resource utilisation – a sustainable approach to stewardship of the Moon" and "Could they have been in the asteroid belt? The subtleties of technosignatures"
- I have chaired numerous sessions at space, robotics, space robotics and biomimetics/astrobiology conferences

MEMBERSHIP OF CONSORTIA/ACADEMIC PARTNERSHIPS

- Member of scientific board of the Canadian Space Mining Corporation (2018-2022)
- Member of academic board for the NASA Lunar University (since 2020)
- Member of American Society of Civil Engineers (ASCE) Regolith Operation Mobility & Robotics Technical Committee (2016-2018)
- Canadian RESOLVE (subsequently Lunar Resource Prospector) science definition team (2013) representing the Canadian science contribution to the NASA RPM mission until Canadian contribution cancelled (2015) followed by mission cancellation (2017)
- Collaborator on the NSERC CREATE team on TEPS (Technologies for Exo-Planetary Science) led by York University and the NSERC CREATE team on CATP (Canadian Astrobiology Training Programme) led by McGill University (ended in 2015)
- Chair of Canadian Micro-Penetrator Consortium (2011-2019) following my hosting a two-day workshop on Micro-Penetrators at the Canadian Space Agency
- Member of the Canadian Astrobiology Working Group - I was the astrobiology discipline co-chair on the Steering Committee at the (1-3 Dec 2008) Proc 6th Canadian Space Exploration Workshop (CSEW6) and was the primary author of the astrobiology section to the CSA's Canadian Scientific Priorities for the Global Exploration Strategy (2009) and subsequently championed micro-penetrators for astrobiological exploration of Enceladus/Europa at CSEW 2016 with Prof Lyle White at McGill.
- Former Chairman of the Astrobiology Society of Britain for 2005/2006 which is affiliated to the International Astrobiology Network led by NASA Institute of Astrobiology
- Co-founder of UK Penetrator Consortium (2003) which has developed the only European micro-penetrator led my Mullard Space Science Laboratory

- Co-founder and deputy chair of UK Space & Planetary Robotics Network (SPRN) in 2002-2006
- Steering committee of the UK BiroNet (Biomimetic Robotics Network) in 2005/2006
- Co-ordinator of EPSRC TREATAE (Transfer of Engineering & Analytical Technology to Astrobiological Exploration) Network activities in Sampling on Planetary Surfaces in 2004-2006
- Member of SALE (Subsurface Antarctic Lake Ellsworth) drilling consortium until 2007 on emigrating to Canada

EXTRACURRICULAR TEACHING

- International Space University (ISU) staff co-chair (2007) for DOCTOR (developing on-orbit servicing concepts, technology options and roadmap) design project and lecturer (2014) in Space Robotics to the ISU summer school, Beijing, China and Montreal, Canada respectively - I hold an adjunct professorship at ISU. From 2010-2014, I served on the Canadian Foundation for the ISU which selects Canadian candidates for the two ISU academic programmes
- Invited two-day course lecturer on On-Orbit Servicing at the University of Delft Master of Space Systems Engineering (SpaceTech**)** course in Lindau Germany (2006) for international leaders in space business

V. CONSULTANCIES

Task	Client	Duration	Contract award
Autonomous Spacecraft Planning using Hybrid Neural Networks	DRDC	2018-2019	$25,000
Expert Evaluator (Space Robotics)	EU	2016, 2018, 2020 and 2022	$15,000 x 4
Lunar Resource Prospector Mission (RPM) science proposal definition	CSA	2014-2015	$25,000
Micro-Penetrator Feasibility & Concepts Analysis	CSA	2012-2013	$25,000
Lunar Origins & Resources Experiment (LORE)	MPB Montreal	2010-2011	$25,000
Autonomous Navigation and Traction Analysis (LEMUR – lunar exploration manned utility rover)	MacDonald Dettwiler Associates (MDA), Brampton	2008-2009	$15,000
On-orbit servicing – the way forward	DLR Oberfaffenhoffen, Germany	2003-2004	€15,000

VI. RESEARCH GRANTS

Total Integrated Research Grant Awards: $4.268 M

Grants awarded at Carleton University

Project	Awarding/Collaborating Body	Award Duration	Grant Award Allocated
CREATE Additive Manufacturing (led by York University)	NSERC	2021-2026	$15,000.y for 5 y = $75,000
Open Space Innovation Award	ESA	2020-2024	$51,000
Space Debris Identification (led by Magellan)	CSA	2022-present as PI	$25,000
Lunar Micro-Penetrator (led by Magellan)	CSA	2019-2021 as PI	$40,000
Enceladus Micro-Penetrator Study (led by Magellan)	CSA	2018-2019 (1 year) as PI	$25,000
MICRO-LIFE (FAST) extension	CSA	2020-2022 (3 years)	$100,000
MICRO-LIFE (FAST) astrobiology instrumentation	CSA	2017-2020 (3 years) as coPI (current)	$370,500
In-Situ Resource Utilisation	NSERC	4 months (summer annually 2013-2017) as PI	$5000/y per student x 2 = $40,000
Self-Replicating 3D Printer	MITACS	3 months (summer annually since 2014) as PI	$15,000/y x 10 years = $150,000
Robotic Astrobiology	NSERC Discovery (current)	2016 as PI	$25,000 x 6 years = $150,000
Rover Path Planning	NSERC Engage/Neptec	2012 (6 months) as PI	$25,000
Canadian Astrobiology Training Program	NSERC CREATE	2012-2016 as coI	$25,000 x 4 years = $100,000
Probabilistic Vision	ESA	2012 (4 months) as PI	$42,000
Mars Methane Analogue Mission	CSA	2011 (1.5 years) as coPI	$52,000
Scent of Science: Autonomous Source Localisation	ESA	2011-2012 (4 months) as PI	$42,000
MITACS	MPB Montreal	2011-2012 as PI	$55,000
Mars Yard infrastructure award	Carleton University	2011 as PI (lump)	$30,000
Kapvik Micro-Rover Development	CSA	2010 (2 years) as PI	$330,000
Lunar Dust	MPB/CSA	2009 (1.5 years)	$16,000

Experiment		as coPI	
Bio-inspired robot control	NSERC Discovery	2010 as PI	$22,000 x 5 years = $110,000
LORE instrument	MPB/CSA	2009 (2 years) as coI	$30,000
Bio-inspired space robot control	NSERC Discovery	2007 as PI	$18,000 x 2 years = $36,000
Robotics laboratory infrastructure	CFI-Ontario Provincial Government	2008 (lump) as PI	$443,630
CRC support	OVP Carleton University	2007 as PI	$35,000 x 3 years = $105,000
Startup fund	OVP Carleton University	2007 (lump) as PI	$30,000 (lump)
Canada Research Chair	Government of Cabada	2007-2017	$100,000 x 10 years = $1 M
TOTAL			**$3.473 M**

Grants awarded in UK

Project	**Awarding Body**	**Co-Investigators**	**Duration**	**Allocated Award Total**
ExoMars optic flow-based navigation feasibility study (PI)	PPARC (UK)	EADS Astrium UK (lead), Surrey Space Centre	2006 (6 months) as PI	£15,000
Rover chassis evaluation tool (coI)	European Space Agency (ESA)	Contraves Space Switzerland (lead), Surrey Space Centre, DLR Germany, EPFL Switzerland	2004-2006 (3 years) as coPI	€78,000
Bionics and space systems design (PI)	ESA	Surrey Space Centre (lead), University of Bath, University of Sussex, Open University, EADS Astrium UK	2003-2004 (1 year) as PI	€150,000
ExoMars rover and Pasteur payload Phase A study	ESA	EADS Astrium UK (lead), Surrey Space Centre UK, DLR, von Hoerner & Sulger GmbH, EPFL Switzerland, LAAS France	2004 (1 year) as coI	£30,000
Elastic loop mobility system study	ESA	Kingston University	2002 (4 months) as PI	€28,000
Mars entry descent and landing systems	EPSRC/SSTL	Kingston University/University of Surrey	2002-2005 (3 years) as PI	£60,000
Robotic vehicle	SRIF	Kingston University	2004	£30,000

traction experiment			(lump) as PI	
TOTAL				**£360K**

VII. TEACHING DEVELOPMENT

One of the earliest lessons I had in teaching was the Balancing Studies course at Kingston University, an ill-conceived final year course for all engineering students across the school (around 150 students). It was designed to plug any gaps in engineering students' knowledge by teaching essentially remedial physics to every type of 4th year engineering student in the faculty – mechanical, electrical/electronic, control, aerospace, and production engineering. It was ill-conceived because it was too late to teach these topics to too diverse a group. The first year I taught it, it was an unmitigated disaster – discipline was difficult to enforce, students were bored and unmotivated, and I didn't know why I was teaching this course as it served no useful function. I wrestled with trying to figure out what I could teach final year engineers near the end of their studies that might be useful to them in their future careers. The following year, I decided to teach critical thinking through the scientific method using a socratic approach covering topics as diverse as myths, spiritual worlds, deities, psychic phenomena and extraterrestrial intelligence in the context of belief versus the power of physical evidence. It was a fanatastic success. I was told by several students that it was the most rewarding and fascinating course they had sat at Kingston. The lesson? Students must be engaged to learn. I have tried to introduce the three rhythms of education into my lecture courses as espoused in Alfred North Whitehead's *Aims of Education* (1926) – a sense of wonder (what he referred to as "romance"), disciplined rigour (which he referred to as "precision"), and application of knowledge (which he referred to as "generalization").

I have taught a range of courses from foundation to master's level throughout my academic career. They have focussed primarily on spacecraft engineering and robotics, though they have also included more generic courses such as electronics, control and instrumentation (mostly as a result of teaching in mechanical engineering departments where such subjects are typically assigned to roboticists!). I have also taught robotics from a mechanical perspective (my robotics courses have concentrated on manipulator kinematics, dynamics, trajectory interpolation and control). According to the historian Geoffrey Elton in *The Practice of History* (1967), "The university must train the mind, not fill the untrained mind with multi-coloured information and undigested ideas, and only the proper study of an identifiable discipline according to the rules and practices of that discipline can accomplish that fundamental purpose." He was wrong (or as physicists like to retort with the ultimate insult: not even wrong). In my view, a major part of the job of an engineer is to convert undigested ideas into practical solutions. As a roboticist, I am highly critical of the notion that mechanical and electronic engineering are separate disciplines and never the twain shall meet – roboticists cannot afford to pigeon-hole their mentality in this fashion. Furthermore, given the systems aspects of today's complex engineering, engineers must be cross-trained and equipped with skills in mechanical, electronic, control and software engineering (sometimes called mechatronics) - today, vehicles like aeroplanes or spacecraft are built around their avionics. Furthermore, engineers must be versed in instrumentation in order to devise and build experimental apparatus. The demarcation attitude, promulgated by the likes of PEO which enforces separation of mechanical and electronic engineering, is destructive and

regressive (much like the PEO's insistence that design is separable from analysis in engineering – analysis without design is physics and design without analysis is landscape gardening!).

I believe in the primacy of the lecture as the teaching tool of choice – the use of ICT/media can be valuable but not shoe-horned into a programme for its own sake. I do not believe that MOOCS will replace the traditional lecture (as evidenced by their high drop-out rates) as social interaction is a major contributor to the effectiveness of lectures – Alfred North Whitehead similarly stressed the value of the social dimension of communal learning with one's peers. This has been reinforced by the COVID experience of online lecture delivery as deficient. There is a theory that all academic engineers should be able to teach all aspects of the first two years of an engineering degree. This may well be so, but it misses the point. Inevitably, lectures taught by academic engineers with expertise in that subject will always be richer, deeper, more challenging and insightful than those without. There is also a theory that all courses should be "standardised" to ensure that any graduate lecturer can teach them from standardised course material. This is an utter nonsense as well as a recipe for student boredom – students might as well be given the assigned text and work through it themselves. The value of the university lecturer – indeed, the *only* value of the university lecturer – lies in his/her personal experience and expertise and how it can enlighten the subject at hand and be delivered in an instructive manner. I use anecdotal examples all the time in my lectures and the students usually respond to that. I use every opportunity to introduce my own research into my lectures to inject freshness and relevance into them. I have almost 100% student attendance in all my lectures.

Due to my primary training as a spacecraft engineer, I have taught all aspects of spacecraft engineering including orbit mechanics and attitude dynamics as well as spacecraft bus and payload systems (rather curiously, orbital mechanics and attitude dynamics are not requirements for space engineering qualification according to PEO yet cartography is!). Space technology is one of the "Eight Great Technologies" (David Willetts MP, Policy Exchange, London, 2013). I have taught space engineering courses in three universities across two continents including graduate courses. I believe this has given me some insight into how such courses should be developed. My spacecraft engineering courses are given from the perspective of designing a spacecraft within the constraints of mass, propellant, power and data budgets and how those budgets require detailed analysis to feed into the design. All design decisions must be analysed as early as possible to prevent mass creep, the bane of the spacecraft engineer. I have written several textbooks to support my teaching as my experience has been that most textbooks either do not exist (such as my *Introduction to Space Robotics* and *Planetary Rovers* books) or do not offer the spectrum of skills I believe is necessary for a space engineer (my unpublished *Space Technology for Astrobiology Missions*). For instance, electronics in most space engineering textbooks is weak or non-existent, almost certainly the result of space engineering evolving from aerospace engineering capabilities in mechanical engineering departments. This is unsustainable – modern vehicles, be they aircraft or spacecraft, are ever more reliant on avionics (to wit, the vast expansion of drones in military and civil applications and the advent of autonomous vehicles about to traverse our roads).

Whilst at the University of Surrey, I was involved in the introduction of a remarkable teaching tool that I used in my teaching labs to support my spacecraft engineering courses – the EyasSAT nanospacecraft model spacecraft developed at the US Air Force Academy [Barnhart D, Vladimirova T, Ellery A, Lappas V, Sweeting M (2006) "Utilising the EyasSAT concept in space systems engineering courses at the University of Surrey" *International Astronautics Congress*, Valencia, Spain, IAC-06-E1.4.04]. I proposed this teaching tool to Carleton University where it has been an unprecedented success as one of the defining features of Carleton University's B.Eng in Aerospace Engineering with Space Systems course. We have 12 EyesSAT stations in our

undergraduate space engineering lab. The value of practical hands-on training is difficult to over-state – computer simulation and theory are no substitutes for developing practical engineering acumen, a philosophy that I practice through the extensive assignment of projects in my courses. I am a great believer that all engineering students should have the opportunity to manufacture things using traditional and non-traditional tools, especially with the ready availability of 3D printers. Student response to such opportunities are almost universally positive (though there are always dissenters disinterested in such opportunities).

One of the most important duties to which we as university professors are bound is the maintenance of professional standards. In many respects, this is contrary to another duty that is the treatment of students as customers who are paying for a product (the award of a degree). I regard my duty to the profession as a higher duty than that to assuage the baser obligations of commercial interests. There are three types of student – industrious with flexible thinking (who make good engineers) – industrious but procedurally-oriented (who make good technicians) – and the indolent (and the worst variant thereof, the barrack room lawyer). The latter I do not tolerate especially in fourth year when students are about to embark on a profession in which idleness equates to irresponsibility and, potentially, negligence of which surely the iron ring is meant to be a reminder (I was greatly privileged to be asked to give a student his ring during the ring ceremony). The technician mentality also tends to struggle with my teaching style which emphasises breaking the comfortable bounds of spoon-feeding to which students have become accustomed – I believe, in the fourth year, that expanding students' exposure to open problems, allows them to explore and understand the constraints of time and effort within the bounds of their own abilities (for many, this exploration of their abilities is a revelation to them). Furthermore, in my lectures, I provide extensive material and emphasise the most salient topics. Of course, not all students respond well to this – some want formulae and to work through example problems *ad infinitum* without having to exercise much thought. Their goal is passing exams but education is not just about passing exams. As evidence of the efficacy of my approach, I frequently have several students wishing to work in my lab during the summer or to do directed studies under my supervision – I look for enthusiasm with hands-on capabilities (evidenced by their project assignments) rather than academic prowess (in my opinion, a rarer skill). Several of them have gone onto graduate studies (not necessarily with me or at Carleton – two of my MASc students are now at JPL after PhDs from other institutions. I constantly have enquiries about directed studies under my supervision and volunteers to work in my lab over the summer for abysmal pay. One MITACS (visiting) student from Tunisia wrote in an email to me: "Hello Professor Alex, I want to thank you another time for the opportunity of working on such an interesting project with very helpful and kind teammates and in a very modern lab, and especially under the supervision of a well known and respected professor of your level. I was always willing to work on futuristic projects and innovative ideas, that was my main reason for choosing your project. And even though I didn't achieve all the objectives we were trying to reach, I am still very proud to be part of such an interesting project and happy for the work done so far…. ".

As recommended in *Educating the Engineer of 2020: Adapting Engineering Education to the New Century* (2005) by the US National Academy of Engineering, I place great store on interdisciplinary individual design projects and including real world case studies within my courses. For their assessed assignments, I do not give students project ideas but ask them to propose a relevant project of their own choice within a fluid definition of the course's scope – initially, this scares students as they are not used to such freedoms. These fears are exacerbated because the terms of reference I provide are deliberately vague beyond the guideline that it should impress me. By opening the scope, students can pursue something that interests them. By not imposing specific controls, I am not artificially imposing limits on their exploration – this is a characteristic of planetary missions where there are so many unknowns and little or no previous

human experience. I find that I get the best out of most students this way (the enthusiastic ones anyway). The most important thing they learn is building confidence in their competence as engineers and exercising their ingenuity as engineers. I have seen some amazing project results – all students who have attended my courses reckon they mature in my courses as engineers even if they have not performed particularly well. I have encouraged my undergraduate students to build payload instruments themselves (as part of a space instrumentation course I teach) – the most remarkable instrument was built by a RCAF officer cadet undergraduate who constructed a working Raman spectrometer (for which I re-imbursed him at $2000 – a bargain when even a low-end Raman spectrometer costs upward of $12,000). Similarly, for my vehicles course (based on planetary rovers), I have seen some diverse and fascinating constructions including two ion engines (which I also have kept) and, most impressively, a working coilgun. Of course, this approach works most effectively in final year and graduate courses and would not be suitable for earlier years of undergraduate teaching.

I take the view that engineers are problem-solvers despite their specific training, be it as a mechanical, electrical or any other type of engineer. We are faced with some of the greatest challenges that confront our species. As engineers, we must rise to this challenge, for it is from engineers that solutions will emerge – there is no other profession fit for this task. We cannot afford to tackle these problems piecemeal – to use a hackneyed political term that so rarely characterises political ideas, it requires "joined-up" thinking. We must be grooming the next generation of engineers to be capable of tackling the big problems that will face their society and for this they will require broad as well as deep engineering knowledge.

Carleton University Courses Taught:

Course	Level	Semester	Period
Space Robotics	Graduate	Winter	2021-present
Spacecraft Design II (Payloads)	4th year	Fall	2010-present
Vehicle Engineering II	4th year	Winter	2010-present
Orbit Mechanics	3rd year	Fall	2019
Spacecraft Design Lab	3rd/4th year	Fall	2007-2011
Spacecraft Design I (Space Systems)	3rd year	Fall	2009-2011 and 2017
Space Robotics	Graduate	Winter	2007-2010
Spacecraft Design	4th year	Fall	2007-2009
Measurement & Data Systems	4th year	Winter	2007
Spacecraft Design Project*	4th year	Fall and Winter	2007-2011 and 2017-present

* For 3 years, I was the lead engineer for the 4th year capstone spacecraft project based on my proposal – a lunar micro-penetrator design with an emphasis on physical prototyping

University of Surrey Courses Taught:**

Space Robotics	Graduate	Spring	2004-2006
Space Mission Design	3rd year	Winter	2004-2006
Electronics Laboratory	2nd year	Winter and Spring	2004-2006
Multidisciplinary Design Project	4th year	Winter and Spring	2005-2006
Tutorials	1st and 2nd year	Winter and Spring	2004-2006

**at Surrey University, I had a custodial role to several 1st and 2nd year undergraduates

Kingston University Courses Taught*:**

Robotics Engineering	Graduate	Winter	2001-2004

Electronics & Control Engineering	2nd year	Spring	2002-2003
Introduction to Astronautics	3rd year	Winter	2001-2004
Space Vehicle Design	4th year	Winter	2003-2004
Space Applications	4th year	Spring	2003-2004
Mechatronics	4th year	Spring	2001-2002
Balancing Studies	4th year	Winter	2001-2003
Technology Mathematics I	1st year	Spring	2001-2002

*** I developed the syllabus for a 4th year module "Nanotechnology" for the course catalogue

QMC University of London Courses Taught:

Electromagnetism Tutorial	1st year	Winter	2000

Supervision of Graduate Students:

Name	Graduate level****	Start	Funding source	Thesis topic
Kevin Sankar	MASc	Sep 2023	Self-funded	3D printing motor system
Anjana Valsalan	MASc	Sep 2023	Self-funded	3D printing magnetron
Alex Gmerek	MASc	Jan 2022	NSERC Discovery	Planetary instrumentation (TDLAS)
Anchal Gupta	MASc	Sep 2022	Self-funded	RatSLAM for lunar rovers
Amin Motahari	MASc (awarded)	Sep 2021	Self-funded	Orbital manufacturing facility
Xavier Wall	PhD	Sep 2021	NSERC CREATE	Lunar FFC process/aluminium 3D printing facility
Bertrand Thibodeau (with Prof Brian Cousens)	MASc (awarded)	Jan 2021	RCAF	Chemical pre-processing of lunar anorthite
Rohit Gaikwand	MASc (awarded)	Jan 2021	Scholarship	Development of in-house multi-headed 3D printer
Satinder Shergill	PhD – one year placement from Cranfield University UK (awarded)	Jan 2020	Cranfield University	Comminution and beneficiation of anorthite (co-supervision with Dr Jenny Kingston)
Yue Sun	PhD - one year placement from Harbin Institute of Technology China (awarded)	Feb 2018	HIT China	Bio-inspired plume tracking delta-v trajectories for an Enceladus penetrator
Shubhank Sondhiya	MASc (awarded)	Sep 2018	CSA	Robotic molecular biologist for planetary exploration
Nidhi Kamra	MASc (awarded)	Jan 2020	P/T	Analogue neural network with backpropagation circuitry
Collins Ogundipe	PhD	Jan 2018	Nigerian Space	Multi-layer control of on-orbit servicing manipulators for robust

(current)			Agency	grappling and ORU exchange
Alex Tettenborn (current)	PhD	Jan 2016	RA	Autonomous rock recognition using Gabor filtering
Abdurr Elaskri	MASc (awarded)	Sep 2015-Aug 2021	Libyan scholarship fund	3D printing of mechatronic components
Elizabeth Banken	MSc – one year placement from Rhine-Waal University of Applied Sciences (awarded)	Jan 2019	RWUAS	Lunar hydroponic greenhouse productivity study (co-supervision with Prof William Megill)
Adam Vigneron	MASc (awarded)	Sep 2011	Bristol Aerospace	HEO navigation and attitude reference control (co-supervision with Prof Anton de Ruiter)
Jordan Ross	PhD (transferred to Dalhousie Uni in year 2)	Sep 2014	RA	Manipulator control for on-orbit servicing using feedforward modelling
Pablo Molina	MASc (awarded)	Sep 2012	RA	Rover 3D SLAM using streovision and velocimetry
Jordan Ross	MASc (awarded)	Apr 2012	RA	Automated rover camera control using forward predictive control
Yingying Ye	MASc (awarded)	Apr 2012	RA	Rover reactive navigation using evolved neural networks
Cameron Frazier (with Prof Natalie Baddour)	MASc (awarded)	Jan 2012	RA	Rover path planning using tailored potential fields
Chris Nicol (with Prof Ed Cloutis)	MASc (awarded)	Sep 2011	NSERC CREATE	Mars methane plume tracing using biomimetic approaches
Helia Sharif (with Prof Claire Samson)	MASc (awarded)	Jan 2010	RA	Automatic geological classification of rocks using Bayesian nets
Matt Cross	MASc (awarded)	Jan 2010	CSA	Rover motor control and automated traction control with soil parameter extraction
Rob Hewitt (with Prof Anton de Ruiter)	MASc (awarded)	Sep 2009	CSA	Rover fastSLAM for autonomous navigation by LIDAR
Tim Setterfield	MASc (awarded)	Sep 2009	CSA	Rover chassis characterisation and automated traction control
Marc Gallant (with Prof Josh Marshall)	MASc (awarded)	Sep 2009	CSA	Rover path re-planning with science target recognition
Robert Scott	PhD (awarded)	Jan	DRDC	Kalman filtering to track on orbit

		2008		servicing spacecraft
Brian Lynch (with Prof Fred Nitzsche)	PhD (awarded)	Sep 2007	CSA	Shape memory alloy actuators for robotic manipulators
Mark Swartz	MASc (awarded)	Sep 2007	RA	Neural network-augmented Kalman filters for Mars rover slip estimation
Adam Mack (with Prof Bruce Burlton)	MASc (awarded)	Sep 2007	Bristol Aerospace	Onboard satellite operations autonomy
Gregory Scott	PhD – awarded 2010 (Surrey)	Oct 2003	EPSRC	Traction analysis for legged rovers
Elie Allouis	PhD - awarded 2006 (Surrey)	Oct 2003	EPSRC CASE	Entry descent and landing systems for Mars
Nildeep Patel	PhD - awarded 2005 (Surrey)	Jan 2002	EPSRC	Mobility analysis for Mars rovers
TOTAL COMPLETED	5 x PhD + 16 x MASc			

****Canadian MASc is a two year research degree

Supervision of Post-Doctoral Research Fellows (PDRF)

Name	Duration	Institution	Role
Dr Brian Lynch	2017-2018	Carleton University	PDRF in sampling drill development
Dr Brian Lynch	2013-2014	Carleton University	PDRF in in-situ resources utilisation research
Dr Ala Qadi	2010-2012	Carleton University	PDRF on Kapvik project
Dr Yang Gao (now Prof)	2004-2006	University of Surrey	PDRF in biomimetics research
Dr Mini Saaj (now Prof)	2004-2006	University of Surrey	PDRF in rover traction research

Mentoring of Assistant Professors

Name	Duration	Institution	Role
Prof Josh Marshall	2008-2010	Carleton University	Joint supervision of MASc projects
Prof Anton de Ruiter	2011-2013	Carleton University	Joint supervision of MASc projects

VIII. ADMINISTRATIVE DUTIES

In the UK, the general day-to-day administrative load was more taxing than in Canada due to the centralisation of university administration following Parkinson's Law [C Northcote Parkinson (1957) "Parkinson's Law and other studies in administration" *Ballantine Books*, New York]. Canadian universities are spared the more irksome burdens of continuous quality assurance, research reviews, teaching reviews, examination auditing, etc. However, there is the five year accreditation review by Professional Engineer Ontario for which I am partially responsible for some of the course content and standards in the B.Eng in Aerospace Engineering stream D (space

systems design). I contributed to the design of this stream and have delivered the core courses for it which came on-stream two years after I was hired. In particular, I reviewed all the major North American space engineering courses comparing them to my own experiences at the University of Surrey, Kingston University, Cranfield University and the International Space University. Indeed, I was hired at both Kingston University and University of Surrey for new space engineering courses and had contributed to their design. However, as with all things, the constraints imposed by the degree structure at Carleton (a fixed year 1 and year 2 syllabi) limited flexibility necessitating compromises. The students in Aerospace Engineering essentially experience no aerospace flavour until year 3. However, I believe that the stream D course is comparable to the best anywhere. At Carleton, whilst a Canada Research Chair (CRC), my recent administrative load was relatively light to concentrate more on research to compensate for the heavier administrative and teaching load in my first few years and subsequent to the 10-year CRC term. Most of my administration involves supervising a research team and a well-equipped space robotics laboratory. Furthermore, I contribute to wider policy issues within my field of space engineering such as representing the university at space policy meetings and workshops at the Canadian Space Agency. I have served on the Departmental Staffing committee (twice) during the reviewing, interviewing and hiring of new members of staff (2007-2009 and 2022). This was a heavy administrative load involving ranking applications, attending interviews and consulting with other staff. One of the key attributes for Carleton is hiring the right person who will fit into the current team and contribute positively and enthusiastically - being likeable and cooperative were some of the most important qualifications. I also had until recently, additional administrative responsibilities such as being a member of the Canadian Foundation for the International Space University that, on behalf of the Canadian Space Agency, administered and awarded annual scholarships to the International Space University (ISU) summer school and MSc degree courses (Space Studies and Space Management) in Strasbourg France. I was on the Tenure & Promotions Committee in 2017/2018 to gain insights into professorial career development. I have done the rounds of various departmental committees - Aerospace Curriculum Committee, Dynamics & Controls Curriculum Committee, Graduate Scholarships Committee, Capstone Projects Committee...These are not roles I particularly relish.

An important part of our responsibility in scientific and engineering research is to communicate with the public at large who fund our activities and to whom we serve as part of society. I have been involved in media activities in the UK and Carleton University though its time-consuming nature has restricted my recent attention to it of late. I am one of the "Experts on Call" on the Carleton Newsroom that is available for journalists to call for telephone interviews – this happens on a fairly frequent basis but recently I have scaled my availability back. I have also done a number of radio and TV interviews in both Canada (CBC) and in the UK (BBC). Some highlighted examples include a CBC radio interview across four Canadian cities on Mars exploration (2010), a televised presentation to John Wilkinson then-Minister of Research & Innovation (2008), a CBC Radio interview on the All in a Day show (2009), a televised interview on BBC World's Click (2002), etc. I was recently invited to give a Pint for Science talk in Ottawa which was rather enjoyable. My more recent activities in this important area of public engagement has focussed on my current in-progress writing a popular engineering book *Manna from Heaven: How to Save Our Planet* concerning the development of in-situ resource utilisation and self-replication technology for space-based geoengineering and solar power satellites for clean energy generation. This is part of my general philosophy that engineering is central to society and that many of society's ills require engineering solutions.

I believe that engineering has suffered a diminished status since the great Victorian age (apart from a brief flourishing during the Apollo programme) when engineers were regarded as visionaries and pioneers. It is essentual to increase public recognition of engineering in society

and enhance engineers' social status, and recent interest in STEM has gone some way towards this. Yet the public at large has limited contact with engineers. There is little conception of the social value of engineering in society compared with doctors, lawyers, teachers and accountants with whom people have contact in their day-to-day lives. Engineering originated in the trades and there is a perception that engineers are little more than overly-educated tradesmen. The reasons for the decline of engineers' status are many and varied, many citing cynicism towards technological progress following World War I. Despite the fact that the core of engineering training is fundamentally mathematics and science supplemented by business, management and law, scientists are held in higher esteem than engineers [US National Academy of Engineering (2005) "Educating the Engineer of 2020: Adapting Engineering Education to the New Century" *National Academies Press*, Washington DC]. One problem is that we engineers do not communicate our work to the general public as well as scientists – during the Victorian age, engineers gave public lectures. It is imperative that we communicate to the public to enhance the social standing of engineering in the community to ensure that the importance of engineering is understood and valued. Although there has been recent interest in developing strategies to encourage young people into STEM, these efforts are specifically targeted at the education system and not society as a whole. Popular science writing and inspiring television documentaries have been all the rage for a number of years – Brian Cox, Carl Sagan, Richard Dawkins, Susan Greenfield and Jim Al-Khalili are a random selection from a host of science popularisers. I am hard-pressed to think of any academic or industrial engineers who are as well known (only Bill Nigh comes to mind but he covers science rather than his original trade, engineering). Part of the problem is that there is little credit to be gained from such activities in academic or industrial engineering. Nevertheless, it is something in which the engineering community should be engaged and I believe the brunt of responsibility should lie with academic engineers. The pressure to sensationalise into "wow-wee" TV can confound and tarnish academic engineers' reputations however. I have written three recent articles for *The Conversation* as a step towards public engagement. I have established my credentials through three engineering textbooks – *An Introduction to Space Robotics* (2000), *Planetary Rovers* (2016), and *Space Technology for Astrobiology Missions* (unpublished). On that basis, I am currently working on two popular engineering book titles – *Manna from Heaven* and its sequel *The Tenth Avatar* (the latter is already contracted to Springer Publishers), both of which explore engineering and technology and their implications for the future. I believe that such popular engineering books will enhance engineering exposure in broader society.

IX. RESEARCH PROFILE

In this section, I present my publications and research activities in a narrative form. I am a space engineer whose specialist field is robotics - my research is entirely devoted to space engineering with an emphasis on robotics in its broadest context. Robotics is a strategic technology for space exploration [1,2,3,4,5] which covers several specific areas including autonomous exploration spacecraft [6], on-orbit servicing manipulation [7] and planetary rovers [8] among others. More

[1] Ellery A (2001) "A robotics perspective on human spaceflight" *Earth Moon & Planets* **87**, 173-190
[2] Ellery A (2002) "Multi-disciplinary field of space robotics comes of age in the UK" *IEE Professional Networks Online Library* (Robotics & Mechatronics)
[3] Ellery A (2002) "Space robotics – a broad church" *Ignition* **1** (3), 4-5
[4] Ellery A (2003) "Humans versus robots for space exploration and development" *Space Policy* **19**, 87-91
[5] Ellery A (2014) "Editorial: Special Issue on Space Robotics" *Int J Advanced Robotics Systems* (28 Feb 2014)
[6] Ellery A (2004) "Space robotics part 1: what is a robotic spacecraft?" *International J Advanced Robotic Systems* **1** (2) 118-121

recently, I have engaged in a new stream that integrates these other streams in an over-arching programme of in-situ resource utilisation (ISRU) and derivatives cocepts such as self-replicating machines. I work in all areas of space robotics and I try to tackle difficult core problems rather than easier peripheral problems. My specialist field – space robotics – is highly multidisciplinary which offers opportunities for research in a wide span of directions. Indeed, I believe that cross-disciplinary research projects are the richest regions for innovation and enjoy the opportunity to work at the boundaries of biomimetics and astrobiology in particular. For planetary rovers, robotics serves the deployment of scientific instruments – this requires close collaboration with scientists and an understanding of scientific goals. One continually emerging theme across much of my research is bio-inspiration, which can be appropriate in often subtle ways. I undertook a long study for ESA on the application of biomimetics to space exploration culminating in reports of over 1000 pages [9,10,11]. This included a study on a walking robot for Mars exploration [12] and a bio-inspired drill (addressed later). The main lesson from biology is that it does not carve up the world into mechanical and control engineering régimes - in biological animals, morphological structures have co-evolved with their control structures.

Spacecraft Autonomy

I undertook a consultancy project for DRDC on cyber-protection of spacecraft [13,14,15] based on some of my earlier investigations into hybrid Bayesian network symbol extraction from neural networks [16]. Because neural nets are not logic-based, they should be immune to logic bombs, but neural networks are opaque to validation and verufication. Hybridising them with Bayesian networks offers the potential for incorporating/extracting symbolic logic. If it can be achieved, this technology can be applied to spacecraft autonomy in FPGA format to impart cyber-immunity against non-state aggressors yet integrate logic within its weight configuration [17]. This work is continuing with a cyber-protection private company.

Space Manipulators

I cut my teeth on space-based manipulator dynamics and control and their use in on-orbit servicing. On-orbit servicing introduces increased spacecraft availability to supplement the use of high reliability components [18] and offers a potentially commercial application of space robotics

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[7] Ellery A (2004) "Space robotics part 2: space-based manipulators" *International J Advanced Robotic Systems* **1** (3), 213-216

[8] Ellery A (2004) "Space robotics part 3: robotic rovers for planetary exploration" *International J Advanced Robotic Systems* **1** (4), 303-307

[9] Menon C, Ayre M & Ellery A (2006) "Biomimetics - a new approach to space systems design" *ESA Bulletin* **125** (Feb), 21-26

[10] Ellery A et al (2004) "Bionics & Space Systems Design 1 – Overview of Biomimetics Technology" ESA-ESTEC Technical Note 1 (ESA Contract no 18203/04/NL/PA)

[11] Ellery A et al (2005) "Bionics & Space Systems Design 3 – Application of Biomimetics to Space Technology" ESA-ESTEC Technical Note 3 (ESA Contract no 18203/04/NL/PA)

[12] Ellery A, Scott G et al (2005) "Bionics & Space Systems Design 4 – Case Study 1 Mars Walker" ESA-ESTEC Technical Note 4 (ESA Contract no 18203/04/NL/PA)

[13] Ellery A (2018) "Autonomous Mission Planning: Part 1 – Review of Current & Past AI Techniques" DRDC Space Situational Awareness Report 1

[14] Ellery A (2019) "Artificial intelligence techniques – hybrid symbolic neutral network systems" DRDC Scientific Report 2, Ottawa Research Centre

[15] Ellery A (2019) "Deep learning systems" DRDC Scientific Report 3, Ottawa Research Centre

[16] Ellery A (2015) "Artificial intelligence through symbolic connectionism – a biomimetic rapprochement" in *Biomimetic Technologies: Principles & Applications* (ed. Ngo D), Elsevier Publishing

[17] Ellery A (2019) "Hybrid artificial intelligence as a defence against cyber-interference of military satellites" *Int Astronautics Congress*, Washington DC, IAC-19,D5.4.6.x49642

[18] Ellery A, Kreisel J, Summer B (2008) "The case for robotic on-orbit servicing of spacecraft: spacecraft reliability is a myth" *Acta Astronautica* **63**, 632-648

[19]. On-orbit servicing missions can be observed telescopically from the ground with characteristic observable signatures [20,21,22]. The use of manipulators mounted onto spacecraft for on-orbit servicing imposes greater complexities in the kinematics, dynamics and control of the manipulators due to the reaction forces and torques generated by the manipulator(s) on the spacecraft. During my PhD, I was concerned with the dynamic control of manipulators mounted onto spacecraft conducting grappling tasks [23]. I developed a method in which the inverse kinematic equations could incorporate dynamic parameters to accommodate the lack of a ground reference point by using a locally inertial reference frame (Fig 2) [24]. Linear compensation can be accommodated through lumped link parameters and the adoption of control moment gyroscopes for attitude stabilisation. This allowed the use of a Newton-Euler formulation of the dynamics with a computational complexity of O(n) and the computed torque control algorithm enhanced with adaptive control gains. During grasping, the reaction moments on the spacecraft platform are significant requiring the use of control moment gyroscopes rather than reaction wheels for spacecraft attitude stabilisation [25]. A subsequently published aspect of this work was awarded the George Stephenson medal and the William Sweet Smith prize by the IMechE [26]. Gravity gradient torques may also be exploited to minimise the use propellant [27].

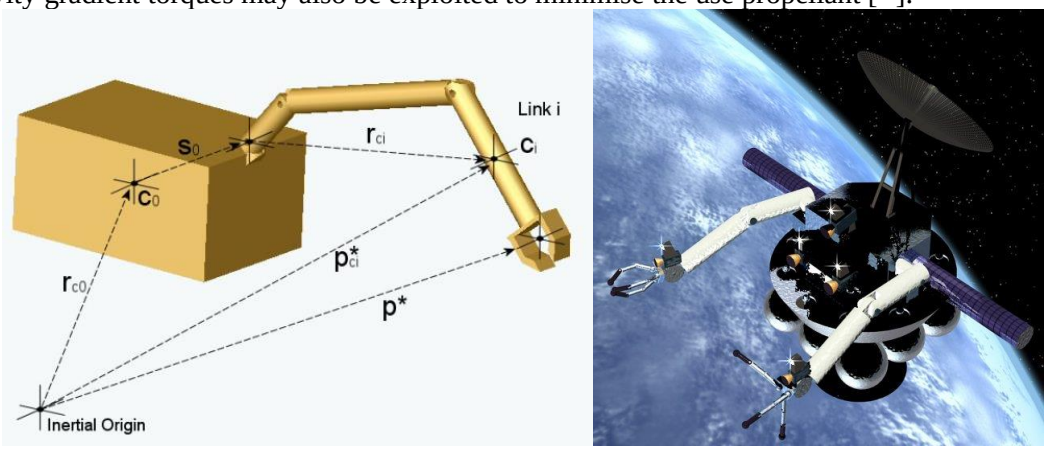

Fig 2. Freeflyer manipulator reference frames; freeflyer manipulator concept

I have also made occasional excursions into propulsion systems for robotic on-orvbit servicers [28,29]. The same technique [30] was applied to a submersible-based manipulator system with

[19] Ellery A, Welch C (2002) "A proposed public-private partnership for the funding of robotic in-orbit servicers" *Proc Space 2002 and Robotics 2002*, Alburquerque, New Mexico, 07291734ELLE

[20] Scott R, Ellery A, Levesque M (2011) "Non-resolved detection of objects performing on-orbit servicing in geostationary orbit" *AMOS Technical Conf*, paper no BJW-RLS-CM

[21] Scott R & Ellery A (2015) "An approach to ground-based space surveillance of geostationary on-orbit servicing operations" *Acta Astronautica* **112**, 56-68

[22] Scott R & Ellery A (2016) "Speckle imaging for optical tracking of on-orbit servicing in geostationary orbit" *AIAA J Spacecraft & Rockets* **53** (3), 433-447

[23] Ellery A (2002) "Technology of robotic in-orbit servicing" *Proc 1st Bilateral DLR-CSA Workshop on On-Orbit Servicing of Space Infrastructure Elements via Automation & Robotics Technologies* (OOS 2002), Waldrunnen, Cologne-Bonn, Germany, 1.11.30

[24] Ellery A (1994) "Resolved motion control of space manipulators" *Proc 45th International Astronautics Congress*, Tel Aviv, Israel, ST-94-W2-574

[25] Ellery A (2004) "Robotic in-orbit servicers - the need for control moment gyroscopes for attitude control" *Aeronautical J of Royal Aeronautical Society* **108** (1082), 207-214

[26] Ellery A (2004) "An engineering approach to the dynamic control of space robotic on-orbit servicers" *Proc Inst Mechanical Engineers Part G: J Aerospace Engineering* **218**, 79-98

[27] Lynch B, Ellery A (2015) "Spacecraft propulsion using angular momentum transfer based on gravity gradient effects" *J Spacecraft & Rockets* **52** (2), 481-495

[28] Ellery A, Welch C, Leveque N (2002) "Advanced Telerobotic Actuation System (ATLAS) in-orbit servicer propulsion options" *World Space Congress*, Houston, Texas, IAC-02-U.2.08

applications to Europa exploration [31]. This showed the adaptability of the approach to incorporating fluid constraints on the manipulator dynamics. Although the application of robotics to astronomy has been considered through the robotic deployment of modular detector arrays [32], we have applied the same techniques developed for controlling manipulators on spacecraft to the maintenance of inter-satellite distance to submicron accuracy using manipulator motions without the expenditure of fuel [33]. This approach will permit the adoption of interferometric constellations of spacecraft with highly stable virtual platforms to enable high resolution infrared imaging of extrasolar planets, particularly terrestrial-type planets in the habitable zone of stars (Fig 3). The same technique can be applied to the detection and measurement of gravitational wave emissions from colliding black holes.

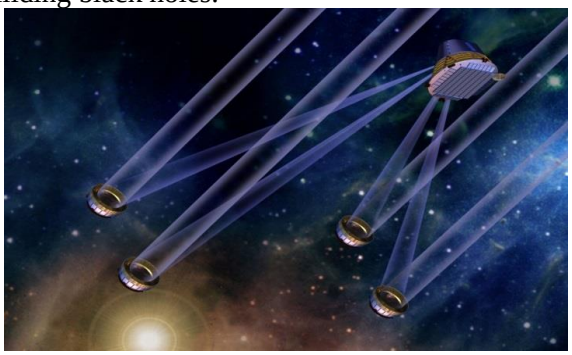

Fig 3. Darwin interferometer constellation

During my PhD, it became apparent that the implementation of closed loop force control in grasping space objects was problematic due to time delays in force feedback yielding instabilities. We developed forward predictive models to enable visual tracking of scientific targets by rover-mounted automated cameras irrespective of the movements of the rover platform. Adaptive forward models based on neural networks are necessary due to the lack of inertial measurement in the cameras for feedback (joint sensors only). This is a biomimetic approach based on an ocular reflex response. We have demonstrated the superiority of this approach on a 7 degree-of-freedom Barratt arm (Fig 4) [34].

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[29] Leveque N, Welch C, Ellery A, Curley A (2003) "Trajectory simulations for thrust-vectored electric propulsion missions" *International Electric Propulsion Conf*, IEPC-3-0050

[30] Lynch B, Ellery A (2008) "Kinematics and dynamics of spacecraft robotic manipulators" *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 89

[31] Lynch B & Ellery A (2014) "Efficient control of an AUV vehicle-manipulator system: an application for the exploration of Europa" *IEEE J Oceanic Engineering* **39** (3), 552-570

[32] Ellery A (2003) "Robotics in the service of astronomy" *Astronomy & Geophysics J of Royal Astronomical Society* **44** (3), 3.23-3.25

[33] Ogundipe C, Ellery A (2019) "Imaging terrestrial extrasolar planets using submicron interferometric platforms" *Int Astronautics Congress*, Washington DC, IAC-19,A7.3.4.x50556

[34] Ross J & Ellery A (2017) "Panoramic camera tracking on planetary rovers using feedforward control" *Int J Advanced Robotic Systems* (May/Jun), 1-9

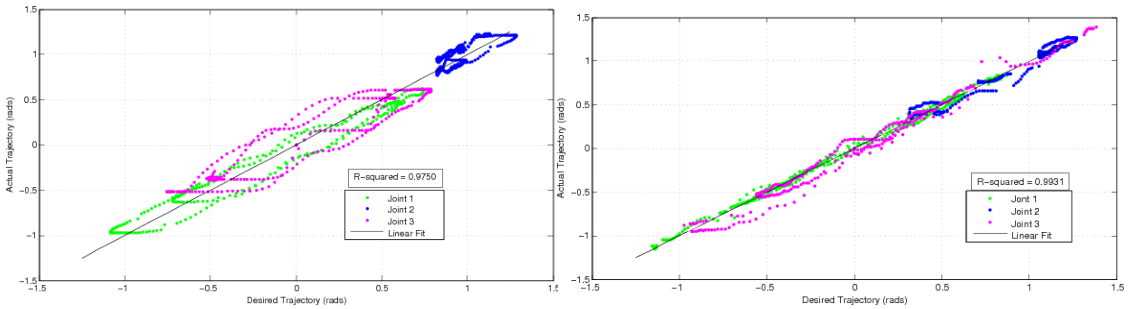

Fig 4. 7 degree-of-freedom Barratt manipulator; manipulator-mounted camera trajectory without and with feedfoward predictive model

It is known that human cerebellar forward models are capable of compensating for 500 ms time delays as predictive controllers in geostationary orbit and beyond. We have implemented neural network-based forward models for controlling space-based manipulators for the acquisition of large debris pieces [35,36,37]. This involves much more complex forward models than the forward models used for automated camera control in that they require models which incorporate applied forces and torques at the end effector. We discovered that it is not feasible to transfer neural models of terrrestrial manipulators to space-based manipulators despite their similar dynamic forms so the space-based manipulator required dedicated training [38]. Eventually, we shall include the implementation of preflexes (modelling the viscoelastic properties of muscles) at the manipulator joints to provide zero-delay rapid and robust responses. Sigmoid-shaped compliance can potentially emulate "soft" robots without physical compliant material. This may exploit the direct drives on the Barratt manipulator eliminating the need for noisy end-effector force/torque sensing. This three-layer approach to manipulator control – force feedback, cerebellar-like forward models and viscoelastic compliance – promises a robust approach to manipulation to overcome the severe limits on manipulation speed for increased productivity rates. This bio-inspired manipulator control strategy should enable tactile handling, taping and folding of thermal blankets and other challenging materials during salvaging of debris spacecraft.

Planetary Rovers

The majority of my research work has been on planetary rovers from traction analysis and chassis design to autonomous rover navigation. I began investigating Bekker-Wong theory of terramechanics and its application to Mars rovers. In particular, I explored the performance of the elastic loop mobility system, a promising pre-stressed concept for tracked vehicles without bogie wheels for ESA (Fig 5) [39,40,41,42]. I then participated in ESA's ExoMars Rover Phase A study

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35 Ellery A (2019) "Tutorial review on space manipulators for space debris mitigation" *Robotics* **8** (2), 34

36 Ellery A (2020) "Tutorial review of bio-inspired approaches to robotic manipulation for space debris salvage" *Biomimetics J* 5 (2), 19

37 Ogundipe C, Ellery A (2020) "Biomimetic control of spaceborne manipulator for debris removal and on-orbit servicing" *Proc Int Symp Artificial Intelligence, Robotics and Automation in Space*, paper no 5019

38 Ogundipe C, Ellery A (2022) "Practical limits to transfer learning of neural network controllers from Earth to space environments" *Proc 42nd SGAI Int Conf on Artificial Intelligence - Lecture Notes in Artificial Intelligence* **13652**, 3-16

39 Patel N, Ellery A, Welch C, Curley A (2002) "Preliminary analysis of mobility systems for a Mars micro-rover" *World Space Congress*, Houston, Texas, IAC-02-U.2.08

40 Patel N, Ellery A, Welch C, Curley A, van Winnendael M (2002) "Elastic loop mobility system: an alternative for rover mobility on Mars" *Proc 7th ESA Workshop on Advanced Space Technologies for Robotics & Automation (ASTRA)*, WPP 204, ESTEC, Noordwijk, Holland, 2.2.1

41 Ellery A (2003) "Elastic loop mobility/traction system study for Mars micro-rovers" ESA-ESTEC Final Report (ESA Contract no 16221/02/NL/MV)

42 Patel N, Ellery A, Welch C, Curley A, van Winnendael M (2003) "Elastic loop mobility system (ELMS): concept, innovation and performance evaluation for a robotic Mars rover" *International Astronautics Congress*, Bremen, Germany, IAC-03-IAA.1.1.05

and follow-on ExoMars rover studies responsible for several aspects of the ExoMars rover [43]: (i) traction analysis [44,45] of 19 different chassis designs before selecting the RCL-D chassis [46,47]; (ii) panoramic camera for navigation functions and (iii) optic flow-based navigation.

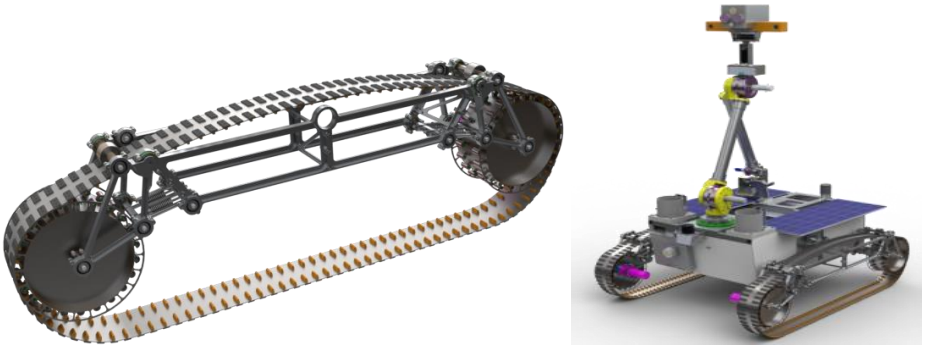

Fig 5. Elastic loop mobility system for the Kapvik micro-rover

We also developed a Rover Chassis Evaluation Tool software simulator for ESA with a European group of partners [48,49,50]. We used this tool and other analytical tools to assess a variety of Mars rover chassis designs [51,52,53] including ExoMars [54] and legged rovers [55,56,57,58]. Later, I did

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43 Ellery A & the Rover Team (2006) "ExoMars rover and Pasteur payload Phase A study: an approach to experimental astrobiology" *International J Astrobiology* **5** (3), 221-241

44 Ellery A (2003) "Ground-robot interaction - the basis for mobility in planetary micro-rovers" *Towards Intelligent Mobile Robots (TIMR 03) - 4th British Conference on Mobile Robotics*, University of West of England, Bristol, Paper no. 8

45 Ellery A (2005) "Robot-environment interaction - the basis for mobility in planetary micro-rovers" *Robotics & Autonomous Systems* **51**, 29-39

46 Ellery A, Patel N, Richter L, Bertrand R, Dalcomo Y (2005) "ExoMars rover dynamics analysis and design" *Proc 8th Int Symposium Artificial Intelligence Robotics & Automation in Space (iSAIRAS)*, Munich, Germany

47 Ellery A, Richter L, Bertrand R (2005) "Chassis design and performance analysis for the European ExoMars rover" *Trans CSME* **29** (4), 507-518

48 Patel N, Ellery A, Sweeting M (2004) "Rover mobility performance evaluation tool (RMPET): a systematic tool for rover chassis evaluation via the application of Bekker theory" *Proc Advanced Space Technologies for Robotics & Automation*, European Space Agency, ESTEC, Noordwijk, Holland

49 Michaud S, Richter L, Patel N, Thuer T, Huelsing T, Joudrier L, Seigwart S, Ellery A (2006) "RCET: Rover chassis evaluation tools" *Proc ASTRA*, ESA-ESTEC, Noordwijk, Holland

50 Richter L, Ellery A, Gao Y, Michaud S, Schultz N, Weiss S (2006) "A predictive wheel-soil interaction model for planetary rovers validated in testbed and against MER Mars rover performance data" *Proc 10th Int Society for Terrain-Vehicle Systems (ISTVS)*, Budapest, Hungary, pp. 343

51 Patel N, Ellery A, Sweeting M (2004) "Comparative locomotion study for Mars micro-rovers and mini-rovers" *Proc 55th IAC (International Astronautics Congress) Conference*, Vancouver, Canada

52 Patel N, Ellery A (2004) "Performance evaluation of autonomous Mars mini-rovers" *Proc Towards Autonomous Robotic Systems (TAROS 04): 5th British Conference on (Mobile) Robotics*, Rep No CSM-415, University of Essex, Colchester, Paper no. 18

53 Patel N, Scott G, Ellery A (2004) "Application of Bekker theory for planetary exploration through wheeled, tracked and legged vehicle locomotion" *Space 2004 Conf*, San Diego, California, USA, AIAA-2004-6091

54 Favaedi Y, Ellery A (2006) "3D simulation evaluation for the ExoMars rover" *Proc Towards Autonomous Robotics (TAROS 06)*, University of Surrey, Guildford, 46-55 (ed. M Witkowski, E Moxey, A Ellery), 48-55

55 Scott G, Ellery A (2004) "Biomimicry as applied to space robotics with specific reference to the Martian environment" *Proc Towards Autonomous Robotic Systems (TAROS 04) - 5th British Conference on (Mobile) Robotics*, Rep No CSM-415, University of Essex, Colchester, Paper no. 21

56 Scott G, Ellery A, Husbands P, Vincent J, Eckersley S, Cockell C, Dembo P (2004) "Bionics & Space Systems Design Project Progress Report for ESA Advanced Concepts Team" *Proc Advanced Space Technologies for Robotics & Automation*, ESTEC, Noordwijk, Holland

57 Scott G, Ellery A (2005) "Design of a biomimetic walking Mars explorer for the ESA Bionics & Space Systems Design contract (AO/1-4469/03/NL/Sfe)" *Proc Towards Autonomous Robotics (TAROS)*, Imperial College London (ed. U Nehmzow, C Melhuish, M Witkowski), 213-219

some work with MDA Brampton on their LEMUR (lunar exploration manned utility rover) performing traction analysis and an assessment of autonomous navigation [59,60]. Although planetary rover development is an engineering discipline, its role in the deployment of scientific instruments requires an understanding of scientific goals. I was on the science team for the ExoMars PanCam (led by MSSL) responsible for its design compatibility with a backup navigation function [61,62]. We benchmarked the computation times for several optic flow algorithms which were to patch between static map imaging [63,64,65]. During this time, I investigated the concept of a Mars micro-rover as a post-Beagle 2 successor mission – Vanguard. Vanguard was based on a 30 kg microrover platform with a highly integrated scientific instrument suite designed to perform astrobiological measurements [66,67,68,69,70 ,71,72]. This involved a close collaboration with a small group of scientists (especially Dr David Wynn-Williams of the British Antarctic Survey) in developing infrared Raman spectrometers which could be integrated as part of a multi-instrument suite into the micro-rover [73,74] imposing the requirement for subsurface drilling beneath the weathered surface layer [75]. The concept of integrating Raman spectroscopy, infrared spectroscopy, confocal microscopy and laser plasma spectroscopy is still of great interest today. The Vanguard design stressed minimisation of robotic

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[58] Scott G, Ellery A (2005) "Using Bekker theory as the primary performance metric for measuring the benefits of legged locomotion over traditional wheeled vehicles for planetary robotic explorers" *Proc Space 2005*, Long Beach, California, AIAA-2005-6736

[59] Ellery A & Marshall J (2008) "Traction design options for a lunar exploration manned utility rover" MDA Technical Report LEMUR-CU02

[60] Marshall J & Ellery A (2008) "Scalable autonomy options for the lunar exploration manned utility rover" MDA Technical Report LEMUR-CU01

[61] Paar G, Griffiths A, Barnes D, Coates A, Jaumann R, Oberst J, Gao Y, Ellery A, Li R (2006) "Panoramic 3D vision on the ExoMars rover" *European Planetary Science Congress*, Berlin, Germany, pp. 295

[62] Griffiths A, Ellery A & the Camera Team (2006) "Context for the ExoMars rover: the panoramic camera (pancam) instrument" *International J Astrobiology* **5** (3), 269-275

[63] Gao Y, Ellery A (2006) "Autonomous navigation based on optic flow for the ExoMars rover" *Proc ESA Advanced Space Technologies for Robotics & Automation (ASTRA)*, ESA-ESTEC, Noordwijk, Holland

[64] Ellery A (2007) "Optic-flow based autonomous navigation for the ExoMars rover" PPARC Final Report (CREST programme)

[65] Ellery A (2008) "Optic flow-based navigation for the ExoMars rover" *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 110

[66] Ellery A, Wynn-Williams D (2002) "Vanguard: a new development in experimental astrobiology" *Astronomy & Geophysics J of Royal Astronomical Society* **43** (2), 2.22-2.24

[67] Ellery A, Cockell C, Edwards H, Dickensheets D, Welch C (2002) "Vanguard - a proposed European astrobiology experiment on Mars" *Int J Astrobiology* **1** (3), 191-199

[68] Ellery A, Ball A, Cockell C, Coste P, Dickensheets D, Edwards H, Hu H, Lammer H, Lorenz R, McKee G, Richter L, Welch C, Winfield A (2002) "Vanguard - a proposal for a European post-Beagle 2 robotic Mars mission" *Proc 7th ESA Workshop on Advanced Space Technologies for Robotics & Automation (ASTRA)*, WPP 204, Cologne, Germany, 2.1.2

[69] Ellery A, Welch C, Curley A, Wynn-Williams D, Dickensheets D, Edwards H (2002) "Design options for a new European astrobiology-focussed Mars mission – Vanguard" *World Space Congress*, Houston, Texas, IAC-02-Q.3.2.04

[70] Ellery A, Ball A, Coste P, Dickensheets D, Hu H, Lorenz R, Nehmzow U, McKee G, Richter L, Winfield A (2003) "A robotic triad for Mars surface and sub-surface exploration" *Proc 7th Int Symp on Artificial Intelligence, Robotics and Automation in Space*, Nara, Japan, paper no. 2-1-3

[71] Ellery A, Ball A, Cockell C, Dickensheets D, Edwards H, Kolb C, Lammer H, Patel M, Richter L (2004) "Vanguard - a European robotic astrobiology-focussed Mars sub-surface mission proposal" *Acta Astronautica* **56** (3), 397-407

[72] Ellery A, Richter L, Parnell J, Baker A (2006) "Low cost approach to the exploration of Mars through a robotic technology demonstrator mission" *Acta Astronautica* **59** (8-11), 742-749

[73] Ellery A, Wynn-Williams D, Parnell J, Edwards H, Dickensheets D (2004) "The role of Raman spectroscopy as an astrobiological tool" *J Raman Spectroscopy* **35**, 441-457

[74] Ellery A, Wynn-Williams D (2003) "Why Raman spectroscopy on Mars? A case of the right tool for the right job" *Astrobiology* **3** (3), 565-579

[75] Ellery A, Kolb C, Lammer H, Parnell J, Edwards H, Richter L, Patel M, Romstedt J, Dickensheets D, Steel A, Cockell C (2004) "Astrobiological instrumentation on Mars - the only way is down" *Int J Astrobiology* **1** (4) 365-380

handling of samples so the instrumentation suite was based on non-contact sensors. The adoption of laser-based instruments was an important design choice as it dictated the planetary surface operations in eliminating physical sample recovery. Although the Vanguard micro-rover was subsequently superceded by the ExoMars mission, it was the precursor to the Kapvik micro-rover which I later proposed to the CSA.

Kapvik is a 30 kg flight-qualifiable end-to-end micro-rover for multiple planetary environments that was designed with COTS comonents but which requires little modification for flight (Fig 6) [76,77]. Although administered by MPB Montreal, an optics company with space instrument expertise but no prior robotics expertise, Kapvik was my concept based on Vanguard which was developed, designed and built by my research team at Carleton University. Furthermore, it was designed and built from scratch with a clear path to flight qualification, rather than retro-fitted from a pre-existing platform. My team's core contributions to Kapvik were the design and performance specifications, rover traction analysis, the detailed design, manufacture (in-house) and assembly of the rover chassis, main electronics box, body structure and all mechanical elements (except the robotic arm), camera/ultraviolet imager pan-tilt system, the avionics architecture design including motor controllers, avionics packaging and wiring harness routing, and adoption of FPGA computers, and much of the autonomous navigation system software including an unscented Kalman filter for multisensor fusion, vision processing and laser rangefinder processing.

[76] Qadi A, Cross M, Ellery A, Nicol C (2012) "Smart reconfigurable all-terrain multi-mission planetary micro-rover, design and control" *Proc 16th CASI Conf ASTRO*, Quebec City, no 84

[77] Cross M, Nicol C, Qadi A, Ellery A (2013) "Application of COTS components for Martian exploration" *J British Interplanetary Society* **66** (5/6), 161-166

Fig 6. Kapvik micro-rover: Kapvik undergoing cliff abseiling tests; Kapvik undergoing traction tests in a sandbox; Kapvik on display in front of Canada's Minister for Industry Christian Paradis; Kapvik on deployment at Canadian Space Agency's Mars Yard

Kapvik had several key features that I had proposed. The Kapvik arm, although built by our project partners, was based on my design combining the functions of a manipulator and a camera mast. The Kapvik chassis is designed to be modular and fully exchangeable to allow different chassis designs to be implemented including our detailed design for an elastic loop mobility system (not built) which is likely to be required for more rugged planetary terrains such as the high priority lunar south pole Aitken basin. The Kapvik chassis is based on an instrumented wheeled rocker-bogie design [78,79] which incorporated integrated load sensors above each wheel station for slip-based automated traction control [80,81,82]. We developed a means to estimate soil cohesion and soil friction angle through wheel-soil terrain interaction during rover traverse (Fig 7) [83,84].

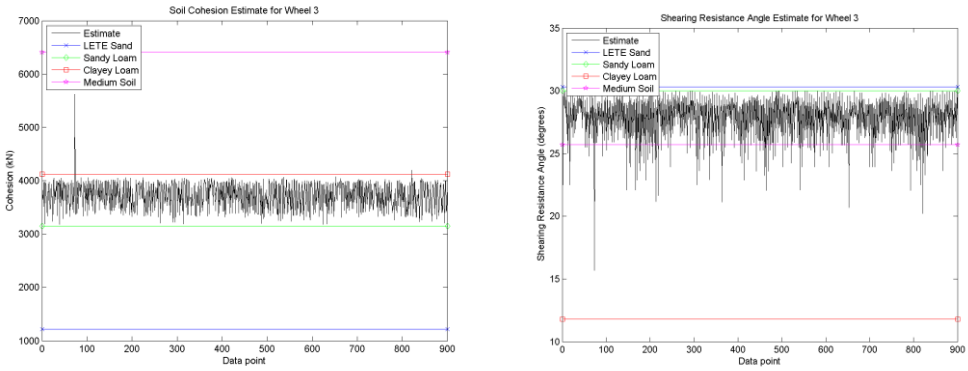

Fig 7. Extracted soil cohesion and friction angle during rover traverse at Petrie Island field trials

This capability was being developed for the online detection of water ice in the lunar regolith with the NASA RESOLVE mission. This was to be developed into a full capability – SHADE (soil hazard detection) algorithm – that integrated the above wheel-soil measurements with a predictive visual component based on wavelet/Gabor analysis within a delayed Kalman filter framework for the the lunar Resource Prospector mission (RPM) carrying the RESOLVE payload until it was cancelled in 2016 [85].

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78 Setterfield T, Ellery A (2010) "Potential chassis designs for Kapvik, a Canadian reconfigurable planetary microrover" *Proc ASTRO Conf*, Toronto, paper 16

79 Setterfield T, Frasier C & Ellery A (2013) "Mechanical design and testing of an instrumented rocker-bogie mobility system for the Kapvik micro-rover" *J British Interplanetary Society* **67**, 96-104

80 McLean D, Ellery A (2008) "Survey of traction control systems for planetary rovers" *CSME Forum (CCToMM)*, Ottawa University, Canada

81 Swartz M, Ellery A (2008) "Towards adaptive localisation for rover navigation using multilayer feedforward neural networks" *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 74

82 Setterfield T, Ellery A (2013) "Terrain response estimation using an instrumented rocker-bogie mobility system" *IEEE Trans Robotics* **29** (1), 172-188

83 Cross M, Ellery A, Qadi A (2013) "Estimating terrain parameters for a rigid wheel rover using neural networks" *J Terramechanics* **50** (3), 165-174

84 Nicol C, Ellery A, Cloutis E (2014) "Online estimation of soil parameters using the Kapvik microrover" *Proc 12th Int Symp Artificial Intelligence Robotics & Automation in Space*, paper 8a-3

85 Hipkin V, Haltigin T, Ellery A, Moores J, Samson C, Timusk M (2013) "Lunar Polar Volatiles/ISRU Mission" Canadian Space Agency RESOLVE Science Definition Document

We developed autonav algorithms for lidar-based 2D self-localisation and mapping (FastSLAM 2.0) [86,87,88] for Kapvik but tested on our Husky rover platform in field trials (Fig 8). The FastSLAM technique was augmented by a extended Kalman filter-trained neural network to cope with the thorny problem of data association [89].

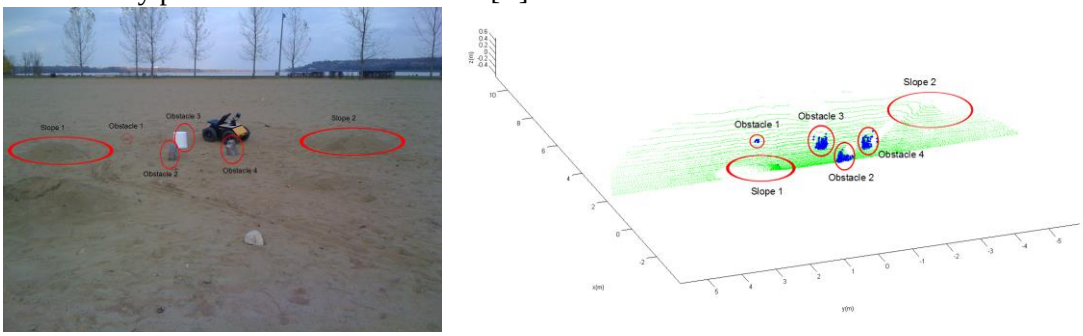

Figure 8. FastSLAM 2.0-based navigation at Petrie Island, Ottawa

From our 2D FastSLAM algorithms and the current stereovision algorithms, we have developed stereoscopic vision-based 3D SLAM algorithms for sparse outdoor environments as the basis for a rover-on-a-chip concept [90]. Path planning algorithms adopted included D* and potential field-based approaches - our tailored potential fields to enable threading of the rover through narrow gaps [91,92,93] (Fig 9) including combined manipulator-rover path planning [94].

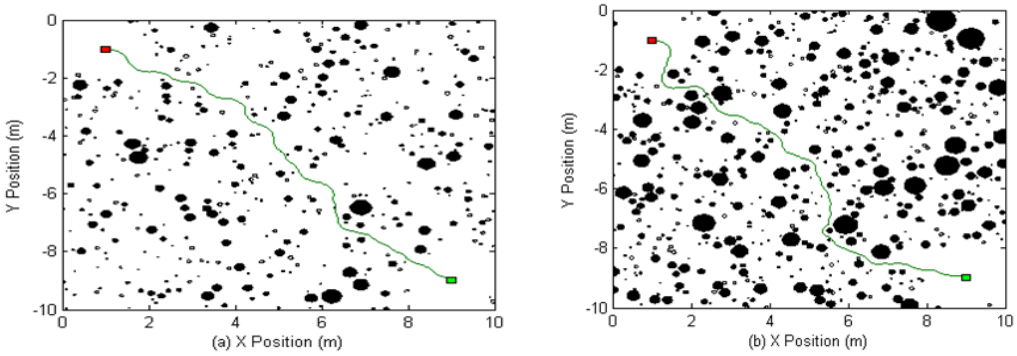

Fig 9. Potential field autonavigation through simulated Viking Lander site rock-fields

CBC televised Kapvik during its successful field trials at Petrie Island in Nov 2011 prior to its delivery to CSA. We achieved this with a budget of only $330k over 2.5 years and at all times,

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86 Hewitt R, Ellery A, de Ruiter A (2012) "FastSLAM on a planetary micro-rover prototype" *Proc 16th CASI Conf ASTRO*, Quebec

87 Hewitt R, Ellery A, de Ruiter A (2012) "Efficient navigation and mapping techniques for the Kapvik analogue micro-rover*" Proc Global Space Exploration Conf*, Washington DC, GLEX-2012.P.8.p1x12478

88 Hewitt R, Ellery A, de Ruiter A (2018) "Training a terrain traversibility classifier for a planetary rover through simulation" *Int J Advanced Robotic Systems* (Sep/Oct), 1-14

89 Hewitt R, de Ruiter A, Ellery A (2010) "Hybridizing neural networks and Kalman filters for robotic exploration*" Proc 15th CASI Conf ASTRO*, Toronto

90 Molina Cabrera P & Ellery A (2015) "Towards a visual simultaneous localisation and mapping system for computationally constrained systems" (unpublished)

91 Mack A, Ellery A (2009) "A method of real-time obstacle detection and avoidance using cameras for autonomous planetary rovers" *Towards Autonomous Robotic Systems (TAROS 09)*, Londonderry, 112-118

92 Mack A, Ellery A (2010) "The potential steering function and its application to planetary exploration rovers" *Proc 15th CASI Conf ASTRO*, Toronto

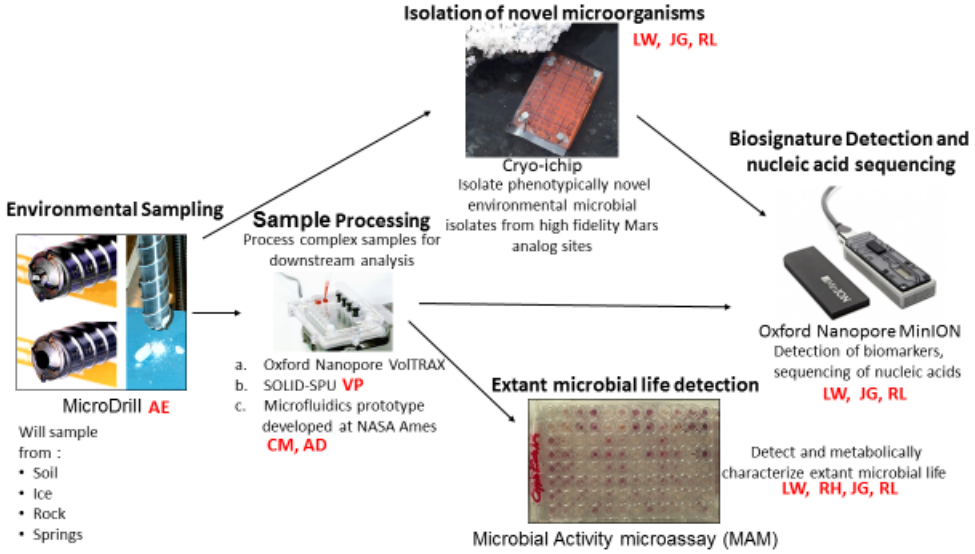
93 Frazier C, Baddour N, Ellery A (2014) "Assisted teleoperation and autonomous operation for planetary rovers using re-active vector equilibrium (RAVE) navigation" *Proc 65th Int Astronautics Congress*, IAC-14.A5.3-B3.6.6

94 Lynch B, Ellery A, Nitzsche F (2008) "Two-dimensional robotic vehicle path planning based on artificial potential fields" *CSME Forum (CCToMM)*, Ottawa University, Canada

we were on budget and on time successfully demonstrating the viability of academic delivery of complex flight hardware and software. Six years after its delivery to the CSA, Kapvik is their only still-operational micro-rover having undertaken deeper and longer tests than its original design specification. We have also addressed several issues regarding rover operations in an underground lunar mine prospecting for buried M-type asteroidal material [95].

Planetary Drills

We are currently working with McGill University on a 3 year project to roboticise two astrobiology instruments for field testing in the high Arctic. The two instruments are newly-developed compact instruments – a nanopore instrument capable of detecting and characterising nucleic acids and a microbial micro-assay capable of identifying specific amino acids and proteins. Our job to three-fold : (i) build a coring drill to extract an ice sample; (ii) develop the microfluidics channels to convey the melted sample to the cryo-ichip which isolates microbial samples including flushing for multiple samples; (iii) package the instrument into an assembly suitable for deployment on a rover (Fig 10).



[95] Ellery A (2022) "Some key explorations in planetary rover autonomy for ISRU roles on the Moon" *Proc ASCE Earth & Space Conf*, Colorado School of Mines, Denver, 207-222

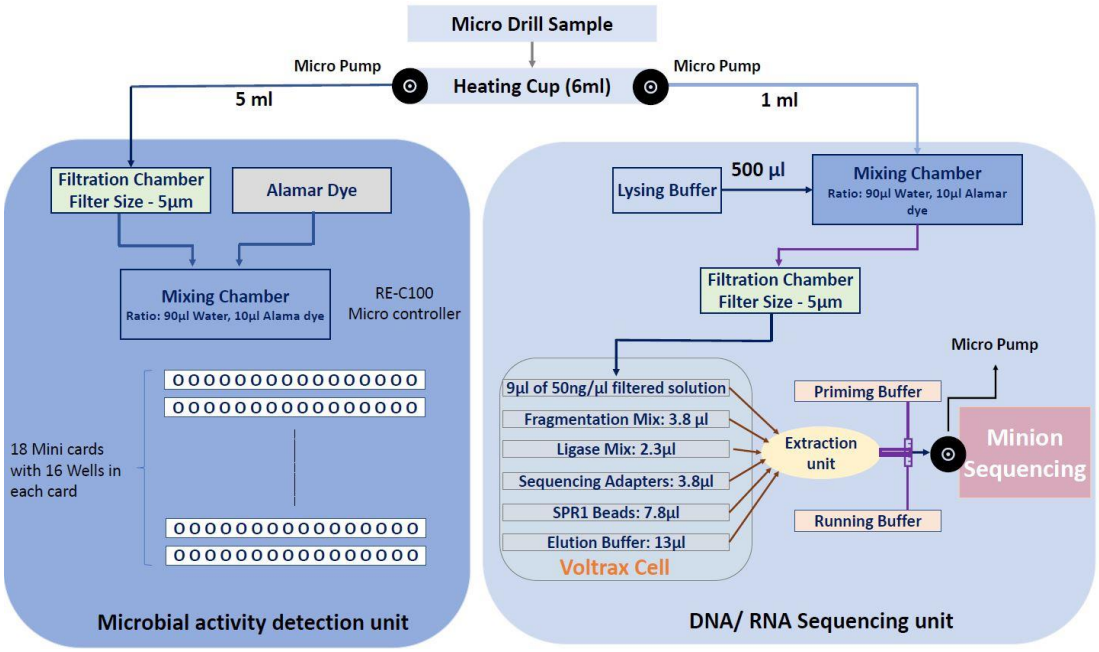


Fig 10. MicroLife detection instrument architecture

This project is in an extended phase and we have been refining the ice coring drill through testing in several Arctic field trials (Fig 11).

Fig 11. MicroLife ice coring drill

We are examining miniaturisation of the penetrator drill using a bio-inspired mechanism based on the ovipositor of the wood-wasp (Fig 12). Experimental studies had been performed by my group at Surrey Space Centre [96,97,98,99,100101,102,103]. A detailed design was later developed for packaging the drill compactly at Carleton for Mars rover application [104,105,106,107].

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96 Gao Y, Ellery A, Vincent J, Eckersley S (2005) "Biologically-inspired penetration/drilling/sampling system for in-situ astrobiological studies" *Proc Towards Autonomous Robotics (TAROS)*, Imperial College London (ed. U Nehmzow, C Melhuish, M Witkowski), 51-56

97 Menon C, Lan N, Ellery A, Zangani D, Manning C, Vincent J, Bilhaut L, Gao Y, Carioso S, Eckersley S (2006) "Bio-inspired micro-drills for future planetary exploration" *Proc CANEUS*, Toulouse, France, CANEUS-2006-11022

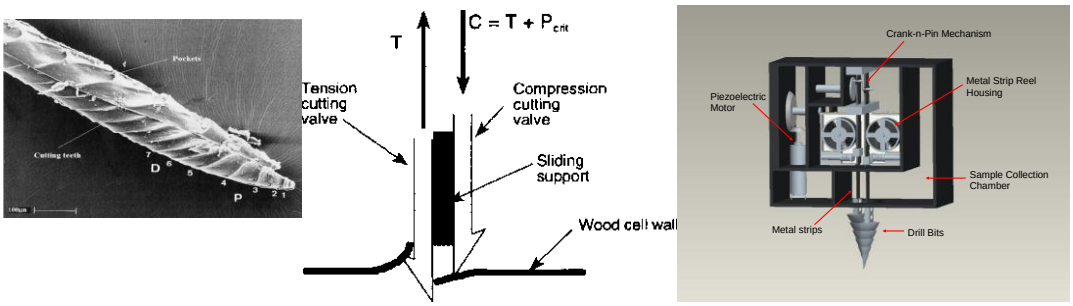

Fig 12. Wood wasp ovipositor, its mechanism and bio-inspired drill

This development work is ongoing.

Penetrators

My non-robotics space research has primarily focussed on micro-penetrators and impact-tolerant packages of scientific instruments. At Kingston University and then Surrey Space Centre, the Vanguard entry descent and landing system was analysed using a software simulation tool that we developed exploring the use of ballutes (sponsored by SSTL) [[108],[109],[110],[111]]. Indeed, the simulation software was used to attempt to localise the landing region of the crashed Beagle 2 probe. I founded the UK Micro-Penetrator Consortium involving SSC, SSTL, MSSL and Qinetiq in 2002 which now leads penetrator activity in Europe. I had also been involved in the early phases of the UK's Subglacial Antarctic Lake Ellsworth (SALE) thermal drilling experiment to deploy an ice penetrator probe 3 km below the surface ice (I was responsible for the probe's

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[99] Ellery A, Gao Y et al (2005) "Bionics & Space Systems Design 4 – Case Study 2 Biomimetic Drill" ESA-ESTEC Technical Note 4 (ESA Contract no 18203/04/NL/PA)

[100] Gao Y, Ellery A, Jaddou M, Vincent J (2006) "Deployable wood wasp drill for planetary subsurface sampling" *IEEE Proc. Aerospace Conf*, Big Sky, MT, USA

[101] Gao Y, Ellery A, Jaddou M, Vincent J (2006) "Bio-inspired drill for planetary subsurface sampling: literature survey, conceptual design and feasibility study" *Proc Adaptation in Intelligent Systems & Biology (AISB) Conf* **2**, University of Bristol, 71-77

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[105] Ellery A, Ball A, Cockell C, Coste P, Dickensheets D, Edwards H, Hu H, Kolb C, Lammer H, Lorenz R, McKee G, Richter L, Winfield A, Welch C (2002) "Robotic astrobiology - the need for sub-surface penetration of Mars" *Proc 2nd European Workshop on Exo/Astro-Biology* (ESA SP-518), Graz, Austria, 313-317

[106] Hopkins T, Ellery A (2008) "Drilling model and applications of space drilling" *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 79

[107] Hopkins T, Ellery A (2008) "Rotary and percussive drilling penetration rate prediction model verification" *CSME Forum (AM)*, Ottawa University, Canada

[108] Allouis E, Ellery A, Welch C (2006) "Entry descent and landing systems for small planetary missions: parametric comparison of parachutes and inflatable systems for the proposed Vanguard Mars mission" *Acta Astronautica* **59**, 911-922

[109] Allouis E, Ellery A, Welch C (2003) "Entry descent and landing systems for small planetary landers: a parametric comparison of parachutes and inflatables for the proposed Vanguard Mars mission" *Proc 5th IAA Int Conf on Low-Cost Planetary Missions* (ESA SP 542), ESTEC, Noordwijk, Holland, 289-296

[110] Allouis E, Ellery A, Welch C (2003) "Parachutes and inflatable structures: parametric comparison of EDL systems for the proposed Vanguard Mars mission" *International Astronautics Congress*, Bremen, Germany, IAC-03-Q.3B.04

[111] Allouis E, Ellery A, Sweeting M (2005) "Planetary exploration: SPADES – a new integrated entry system design tool" *International Astronautics Congress*, Kukoaka, Japan, IAC-05-D1.3

internal avionics architecture) [112]. I performed the initial robotic lunar exploration studies for SSTL which culminated in the UK MoonLite mission concept which incorporated four penetrators for delivery to the lunar south pole [113,114]. MoonLite has been cancelled and the European JUICE mission to Europa dropped the penetrator from its payload manifest. At Carleton, I led the CSA's internal study on the concept of the micro-penetrator for planetary exploration which culminated in a two-day workshop and a visit to the UK to meet the UK's Penetrator consortium [115,116,117]. I was appointed chair of the new Canadian Micro-Penetrator Consortium in 2011 and more recently, we have been working on two penetrator concepts. The first is a Canadian micro-penetrator with astrobiology instruments based on nanopore technology led by Magellan. We are explored the use of viffing (vector in forward flight) to define a descent profile from Saturn orbit of a micro-penetrator [118] to land onto the surface of Enceladus [119] by measuring the water plume concentration to estimate the water plume structure and target the geyser source. There are three descent profiles – spiral, nested box and decaying planar oscillation – each with different Δv (fuel) cost traded against water plume modelling accuracy [120,121] (Fig 13).

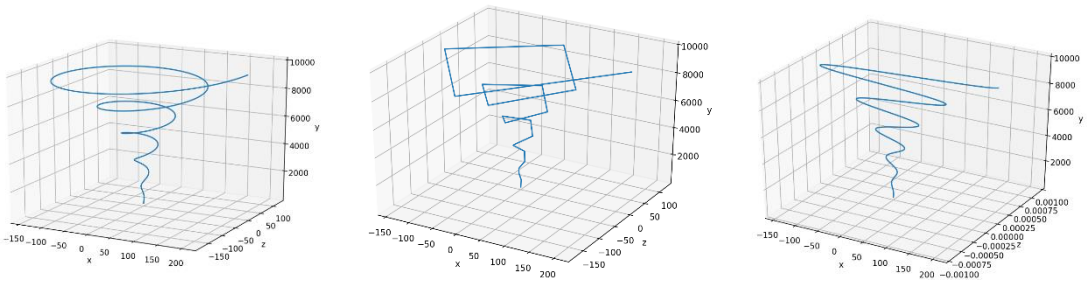

Fig 13. Viffing trajectories - spiral, nested boxes and decaying planar oscillation

SLIM (source localisation and mapping) is a variation on SLAM (self-localisation and mapping) that locates the source of odours from stochastic Gaussian models of plumes updated by measurements of vapour concentrations. SLIM can accommodate wisps in a manner that gradient descent algorithms cannot. We have explored this as the means to target a penetrator spacecraft to the tiger stripes at the south pole of Enceladus which are the sources of water plumes from a postulated near-surface ocean [122].

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112 Siegert M, Ellery A & the Lake Ellsworth Consortium (2006) "Exploration of Ellsworth subglacial lake: a concept for the development, organization and execution of an experiment to explore, measure and sample the environment of a West Antarctic subglacial lake" *Reviews in Environmental Science & Biotechnology* **6** (1-3), 161-179

113 Smith A, Gowen R, Coates A, Crawford I, Scott R, Church P, Ellery A, Gao Y, Pike T (2007) "Lunar exploration with penetrators" *J Astronautical Sciences* **28** (Apr Supp)

114 Smith A, Gowen R, Coates A, Crawford I, Scott R, Church P, Ellery A, Gao Y, Pike T (2006) "Lunar exploration with penetrators" *Proc 8th ILEWG Conf*, Beijing

115 A. Ellery (2011) "Review and Feasibility of Micro-Penetrators for Planetary Exploration" CSA Technical Report MPC-CU1

116 A. Ellery (2011) "Astrobiology by Micro-Penetrator: The Case for Enceladus" CSA Technical Report MPC-CU2

117 Skulinova M, Zheng W, Ellery A, Hu Y-R, Soucy Y (2012) "Enceladus micro-penetrator mission concept" *Proc 16th CASI Conf ASTRO*, Quebec City

118 D Grove & A Ellery (2008) "Designing a modular penetrator to accommodate multiple mission scenarios" *International Astronautics Congress* (IAC), Glasgow, UK

119 Nicol C, Ellery A, Cloutis E (2012) "Targeting Enceladus' plume – the viffing penetrator approach" *63rd International Astronautical Congress*, October 2012; Naples, Italy; paper 13061

120 Sun Y, Ellery A, Huang X (2019) "Targetting Enceladus' geyser vents using penetrators employing biomimetic plume sniffing" *Int Astronautics Congress*, Washington DC, IAC-19,A3.5.6x.49716

121 Sun Y, Ellery A, Huang X (2019) "Targeting the geysers on Enceladus by viffing descent through the icy plumes" *Advances in Space Research* **65** (7), 1863-1876

122 Sun Y, Ellery A, Huang X (2021) "Plume source localisation on Enceladus by a sequential Monte Carlo method" *AIAA J Spacecraft & Rockets* 58 (4), 1.A34982

Robotic Science

Mars rover missions are controlled through a 3-4 day communications cycle which is wasteful and limits the scientific return of these missions – autonomous methods reduce the reliance on the ground control station. Rover operations are divided into two main phases: (i) traverse of which autonomous techniques have been described above, and (ii) science data acquisition to understand Mars and its geological history [123] – this is the province of autonomous science. The firsr choice for a Mars rover is to select promising sites for astrobiological investigation while respecting engineering constraints [124]. Kapvik has been deployed in scientific exploration trials such as magnetometric mapping and methane measurements [125,126,127]. We participated as rover specialists in Mars Methane rover analogue field trials using EX-DOC at the Jeffrey's asbestos mine (that includes serpentine which emits methane) in Quebec with a large scientific team [128,129,130,131,132,133,134]. The goal was to demonstrate aspects of rover-mediated science data acquisition in a realistic environment. We have also investigated biomimetic tracking of methane plumes by a rover to search for the emission sources of Martian methane [135,136, 137] (Fig 14).

123 Changela H, Chatzitheodoridis E, Ellery A, et al (2021) "Mars: new insights and unresolved questions" *Int J Astrobiology* 20 (6), 394-426

124 Parnell J, Cockell C, Edwards H, Ellery A (2003) "The range of life habitats in volcanic terrains on Mars" *Proc 3rd European Workshop on Exo/Astro-Biology* (SP-545), Madrid, Spain, 81-84

125 Qadi A, Samson C, Ellery A et al (2015) "Mars methane analogue mission: mission simulation and rover operations at Jeffrey mine deployment" *Advances in Space Research* **55** (10), 2414-2426

126 Hay A, Samson C, Ellery A (2018) "Robotic magnetic mapping with the Kapvik planetary micro-rover" *Int J Astrobiology* 1-10. doi:10.1017/S1473550417000209

127 Hay A, Samson C, Tuck L, Ellery A (2018) "Magnetic surveying with an unmanned ground vehicle" in press with *J Unmanned Vehicle Systems*

128 Kruzelecky R, Qadi A, Ellery A et al (2012) "Mars methane mission: A field deployment in a Mars analogue environment" *16th Canadian Astronautics Conference (ASTRO 2012);* April 2012; Quebec City, QC, Canada

129 Qadi, A, Nicol C, Mack A, Ellery A (2012) "Design and experiments for a Mars methane analogue mission rover operations" *63rd International Astronautical Congress,* October 2012; Naples, Italy; paper 15336

130 Qadi A, Ellery A et al (2012) "Mars methane analogue mission rover operations at Jeffery mine deployment" Proc *16th CASI Conf ASTRO,* Quebec City, no 189

131 Cloutis E, Qadi A, Ellery A et al (2012) "Mars methane analogue mission - results of first field deployment" *Proc 16th CASI Conf ASTRO,* Quebec City

132 Cloutis E, Qadi A, Ellery A et al (2012) "Mars methane analogue mission (M3): results of the 2011 field deployment" Proc *43rd Lunar and Planetary Science Conf,* Woodlands, Texas, abstract no 1569

133 Cloutis E, Qadi A, Ellery A et al (2013) "Mars methane analogue mission (M3): results of the 2012 field deployment" *Lunar & Planetary Science Conf 44,* abstract no 1579

134 Cloutis E, Whyte L, Qadi A**,** Ellery A et al (2013) "How to search for methane on Mars: Results of rover field trials at Mars analogue sites" *Geological Association of Canada – Mineralogical Association of Canada Joint Annual Meeting;* May 2013; Winnipeg, MB, Canada; paper #SS17-01

135 Nicol C, Ellery A, Cloutis E (2012) "Sniffing as a strategy for detecting life on Mars" *Proc Global Space Exploration Conf,* GLEX-2012.08.1.8x12332

136 Ellery A, Nicol C, Cloutis E (2012) "Scent of Science: Model Creation for Odour Based Control of Robotic Vehicles" ESA Advanced Concepts Team Report 11-6301

137 Nicol C, Ellery A, Cloutis E (2018) "Martian methane plume models for defining Mars rover methane source search strategies" *Int J Astrobiology* S1473550418000046

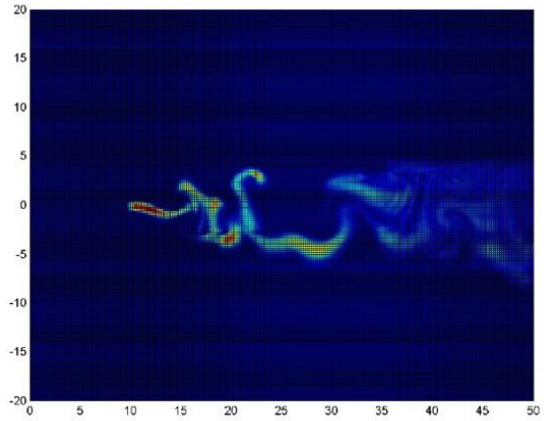

Fig 14. Mars methane plume with wisps

The science phase of rover missions may also be implemented autonomously through a robotic science/astrobiology facility [138,139]. Geological features are of primary interest to planetary scientists but colour is not used currently as dust covering on rocks on the Moon and Mars makes colour unreliable necessitating the use of visual texture analysis. We have investigated the use of Haralick parameters to perform visual texture analysis of rocks [140] then classified them using Bayesian nets [141]. This has demonstrated an 80% success rate in autonomous classification of rocks under certain restricted conditions [142]. Haralick parameters were chosen because of their reliance on entropy and information-based measures of salience that are suited to automated camera slewing during rover traverses to search for opportunistic targets. This is the imaging component of active vision to complement our earlier work in feedforward camera control to foveate on regions of the visual field with high information content but eliminate local minima with a random component. This would essentially incorporate science acquisition during the rover traverse [143,144,145] – currently, rover traverses are not conducted with a science acquisition mode. We have also been examining the use of Gabor filter banks [146] and wavelets [147] which have demonstrated the ability to track sedimentary bedding formations and extracting folds, faults and texture analysis of rocks with Bayesian classifiers. Curiously the more sophisticated Gabor filtering yields only a 70% successful classification rate compared with Haralick parameters. The Bayesian network must be enhanced to accommodate online learning. To that end, we are attempting to merge Bayesian networks with neural networks to enhance the performance of the

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138 Ellery A (2018) "Editorial for Special Issue on Robotic Astrobiology" *Int J Astrobiology* **17**, 201-202

139 Ellery A (2018) "Robotic astrobiology – prospects for enhancing scientific productivity for Mars rover missons" *Int J Astrobiology* **17**, 1-15. doi:10.1017/S1473550417000180

140 Sharif H, Ellery A, Samson C (2012) "Strategies for sampling of planetary materials based on images" *Proc Global Space Exploration Conf*, GLEX-2012.03.P .6x12403

141 Sharif H, Samson C, Ellery A (2012) "Autonomous rock identification based on image processing techniques" *Proc CASI Conf ASTRO*, no 129

142 Sharif H, Samson C & Ellery A (2015) "Autonomous rock classification using Bayesian image analysis for rover-based planetary exploration" *Computers & Geosciences* **83**, 153-167

143 Gallant M, Ellery A, Marshall J (2011) "Science-influenced mobile robot guidance using Bayesian networks" *Proc 24th Canadian Conf on Electrical & Computer Engineering*, Canada

144 Gallant M, Ellery A, Marshall J (2013) "Rover-based autonomous science by probabilistic identification and evaluation" *J Intelligent & Robotic Systems* **72** (3), 591-613

145 Gallant M, Ellery A, Marshall J (2010) "Exploring salience as an approach to rover-based planetary exploration" *Proc ASTRO Conf*, Toronto, Canada

146 Tettenborn A & Ellery A (2017) "Onboard autonomous geological identification of rocks for planetary rovers" *Proc Advanced Space Technology for Robotics & Automation (ASTRA)*, Leiden, Holland

147 Tettenborn A & Ellery A (2018) "Comparison of Gabor filters and wavelet transform methods for extraction of lithological features" *Proc Int Symp Artificial Intelligence Robotics & Automation in Space*, Madrid, Spain, paper no. P9

Bayesuian network through learning [148]. If further developments are successful, it will introduce greater autonomous decision-making capabilities to rovers augmented by expert-like systems that can learn to select scientific targets [149]. We have developed two scientific instruments: (i) a prototype Raman spectrometer for laboratory mineral analysis; (ii) a prototype tuned diode laser absorption spectrometer (TDLAS) for detecting in-situ water on the Moon [150].

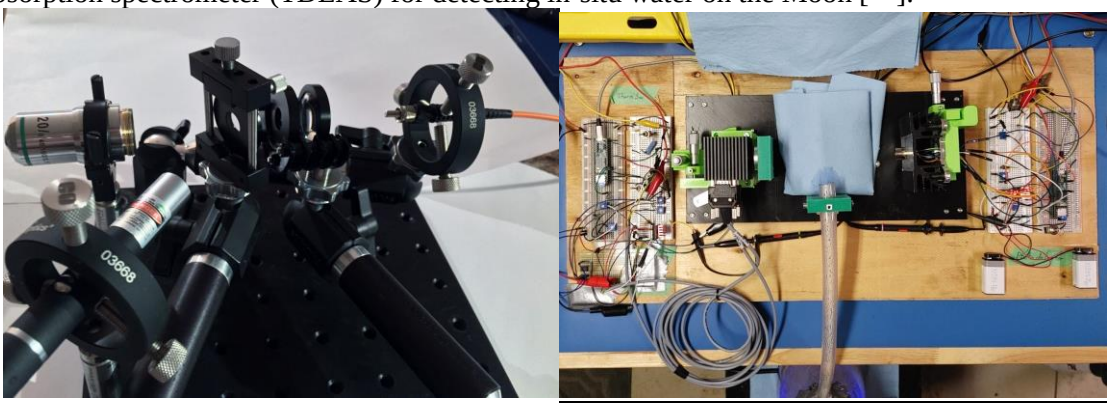

Fig 15. In-house Raman spectrometer; (b) in-house benchtop TDLAS

We have built a microfluidics distribution systems for MicroLife, μ-MAMA (Fig 13). The proposed micro-life subsystem includes a micropump as the drive mechanism of the fluid from a heating cup to a filtration chamber. The pump flow rate required for this application is in the microliter (μl) range with a maximum flow rate of approximately 40-60 μl. We are using the RP-TX series micropump manufactured by Takasago Electric Inc. We used AlamarBlue reagent as a resazurin-based solution that acts as an indicator of the reducing power of living cells to quantify viability. The AlamarBlue reagent and the sample are thoroughly mixed in a ratio of 10:90 μl using an in-house lysing device based on a slider-crank oscillates at 4000 rpm for about 60-90 seconds. We have examined the utility of μ-MAMA in the context of astrobiollogical investigation of Enceladus [151].

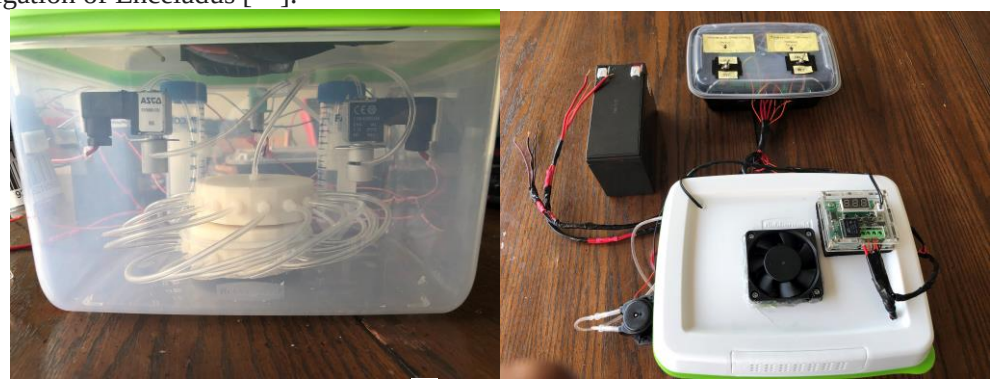

Fig 16. μ-MAMA instrument

We are also examining the prospect of miniaturising and robustifying this instrument package for accommodation into an Enceladus penetrator.

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148 Tettenborn A, Ellery A (2021) "AI methods of autonomous geological target selection in the hunt for signs of extraterrestrial life" *Lecture Notes in AI* **13101**, 103-116, Cambridge, UK (V)

149 Ellery A (2010) "Selective snapshot of state-of-the-art artificial intelligence and robotics with reference to the Icarus starship" *J British Interplanetary Society* **62**, 427-439

150 Gmerek A, Ellery A, Cloutis E, Thibodeau B (2022) "Proof-of-concept tabletop TDLAS instrument for the detection of H_2O in lunar regolith for the Canadian MAPLE project" *Proc 73rd Int Astronautics Congress*, Paris, IAC-22.A3.IPB.46.x67980

151 Sondhiya S, Ellery A (2019) "Direct astrobiological sampling of Enceladus' subsurface vents for the MicroLife instrument suite" *Int Astronautics Congress*, Washington DC, IAC-19,A1.6.9.x50396

In-Situ Resource Utilisation, Additive Manufacturing & Self-Replication

My newest research stream has grown dramatically – in-situ resource utilisation (ISRU) and its ultimate expression, the development of a self-replicating machine. Although asteroids are attractive targets for the mining of resources [152,153], the Moon offers certain advantages [154]. In particular, a wide range of metal alloys can be leveraged from lunar minerals [155]. My ISRU activities began with the MPB Ltd's LORE (lunar origins and resource exploitation) multi-spectrometer (UV/VIS/IR) instrument for which my group was responsible for the design of the shape memory alloy micro-actuators mechanism to control a micro-mirror to steer the optical signals from a drill-mounted fibre-optic cable. LORE was designed to detect the lunar mineral ilmenite which represents a potential source of oxygen and iron/titanium alloy (for flight on JAXA's Selene-2 but it was not selected) [156,157]. We also designed, constructed and operated an experimental setup for MPB Ltd to test dust seals on the LORE instrument to ensure that no dust contamination would occur to any internal mechanisms [158,159]. We were selected as part of the science definition team for the Canadian contribution to the American RESOLVE (regolith and environment science with oxygen and lunar volatiles extraction) payload of its Resource Prospector mission (RPM). Our role our measurements of soil cohesion and friction angle to detect water ice in lunar regolith to locate drilling sites. Howeveer, RPM was cancelled.

Expansion into space is hindered by prohibitive launch costs. The current commercial ticket price to the Moon's surface is $750k/kg which is prohibitive. The only solution is to industrialise the Moon using local in-situ resources (Fig 17).

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152 Ellery A (2012) "Invited Commentary: Asteroid Ho!" *J British Interplanetary Society* **65** (2/3), 1-2

153 Ellery A, Lowing P, Mellor I, Conti M, Wanjara P, Bernier F, Kirby M, Carpenter K, Dillon P, Dawes W, Sibille L, Mueller R (2018) "Towards in-situ manufacture of magnetic devices from rare earth materials mined from asteroids" *Proc Int Symp Artificial Intelligence Robotics & Automation in Space*, Madrid, Spain, paper no. 10c-1

154 Ellery A, Crawford I, Burchell M, Cloutis E (2018) "Quo Vadis? The Moon may offer superior in-situ resource utilisation prospects than asteroids" submitted to *16th Reinventing Space Conf*, London, UK

155 Ellery A (2018) "Lunar in-situ resource utilisation – the key to human salvation on Earth" *ASCE Earth & Space Conf*, Cleveland, Ohio (10-13 Apr 2018)

156 Kruzelecky R, Wong B, Zou J, Haddad E, Jamroz W, Cloutis E, Strong K, Ellery A, Ghafoor N, Ravindran G (2010) "LORE: Lunar Origins & Resource Explorer" *AAS 10-4677*

157 Kruzelecky R, Ellery A et al (2012) "LORE: lunar origins resource explorer science payload" *Proc GLEX Conf*, Washington DC, GLEX-2012.02.1.8x12372

158 Kruzeklecky R, Wong B, Aissa B, Haddad E, Jamroz W, Cloutis E, Rosca I, Hoa S, Therriault D, Ellery A (2010) "MoonDust lunar dust simulation and mitigation" *AIAA-2010-764033*

159 Kruzelecky R, Cloutis E, Hoa S, Therriault D, Ellery A, Xian Jiang X et al (2011) "Project MoonDust: characterisation and mitigation of lunar dust" *Proc 41st Int Conf Environmental Systems*, AIAA 2011-5184

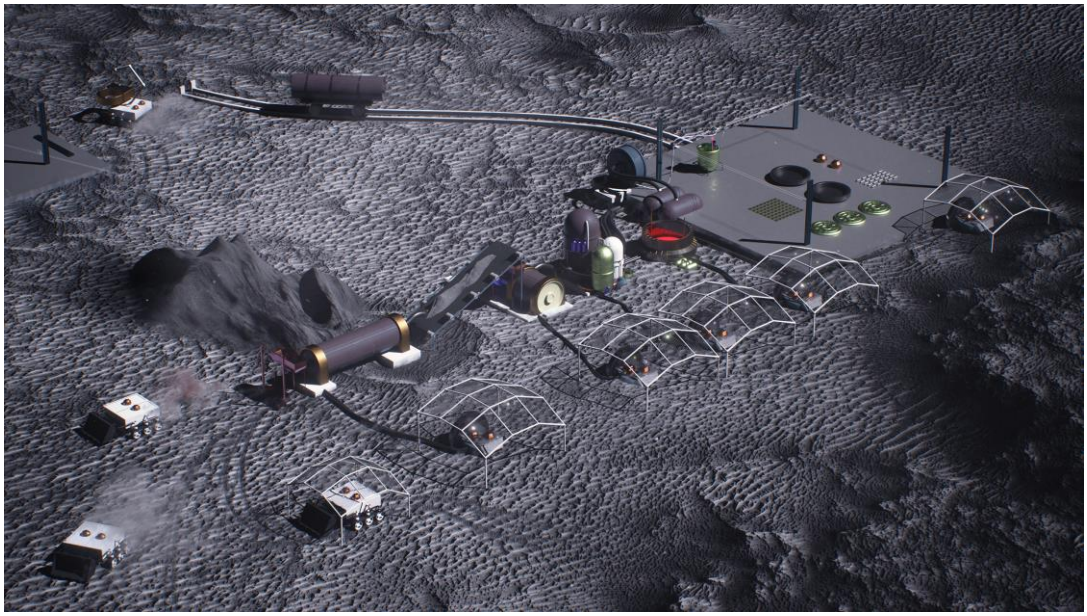

Fig 17. Lunar industrialisation

This cannot be achieved without severing the Earth supply chain. Without industrial infrastructure transported to the Moon at enormous capital cost, the industrialisation process must be grown in-situ. The self-replicating machine [160] exhibits two highly desirable characteristics: (i) its self-replication property gives it exponential growth in productive capacity toward zero specific cost [161,162,163]; (ii) its universal construction property gives it effectively infinite productive reconfigurability [164]. The most critical constraints for self-replication are matter, energy and information closure which impose strict sustainability criteria [165]. The first step to réalisation of a self-replicating machine is to devise a lunar demandite list of material functionality [166]. Demandite must be sufficient to construct a generic spacecraft using only resources on the Moon including buried asteroidal material (Fig 18).

160 Ellery A (2016) "Are self-replicating machines feasible?" *AIAA J Spacecraft & Rockets* 53 (2), 317-327

161 Ellery A (2018) "Extraterrestrial 3D printing and in-situ resource utilisation to sidestep launch costs" *J British Interplanetary Society* **70** (9), 337-343

162 Ellery A (2017) "Space exploration through self-replication technology compensates for discounting in NPV cost-benefit analysis – a business case?" *New Space J* **5** (3), 141-154

163 Ellery A (2020) "The prepper's way of space exploration with zero specific cost" *Proc AIAA ASCEND Conf*, AIAA 2020-4168
(https://arc.aiaa.org/eprint/YUWMJHF57GSIPYJBST4S/full/10.2514/6.2020-4168)

164 Ellery A (2021) "Universal construction on the Moon" *RISpace*, London, UK (V)

165 Ellery A (2020) "Sustainable lunar exploration through self-replicating robots" *Proc Int Symp Artificial Intelligence, Robotics and Automation in Space*, paper no 5006

166 Ellery A (2022) "Lunar demandite – you gotta make this using nothing but that" *Proc ASCE Earth & Space Conf*, Colorado School of Mines, Denver, 743-758

Functionality (mass fraction)	Lunar-Derived Material
Tensile structures (25%)	Wrought iron Aluminium
Compressive structures (+50%)	Cast iron Regolith + binder
Elastic structures (trace)	Steel springs/flexures Silicone elastomers
Hard structures (3%)	Alumina
Thermal conductor straps (1%)	Fernico (e.g. kovar) Nickel Aluminum
Thermal radiators (3%)	Aluminium
Thermal insulation (3%)	Glass (SiO_2 fibre) Ceramics such as SiO_2
High thermal tolerance (4%)	Tungsten Alumina
Electrical conduction wire (7%)	Aluminium Fernico (e.g. kovar) Nickel
Electrical insulation (1%)	Glass fibre Ceramics (SiO_2, $Al_2O_3$and TiO_2) Silicone plastics Silicon steel for motors
Active electronics devices (vacuum tubes) (12%)	Kovar Nickel Tungsten Fused silica glass
Magnetic materials for actuators (5%)	Ferrite Silicon steel Permalloy
Sensory transducers (5%)	Resistance wire Quartz Selenium
Optical structures (11%)	Polished nickel/aluminium Fused silica glass lenses
Lubricants (trace)	Silicone oils Water
Power system (20%)	Fresnel lens + thermionic conversion Flywheels
Combustible fuels (+250%)	Oxygen Hydrogen

Fig 18. Demandite list of functional materials for spacecraft subsystems with propoertional allocations

The second step is to construct an efficient lunar industrial ecology employing closed feedback loops that processes raw lunar material into pure compounds while minimising waste [[167]] (Fig 19).

[167] Ellery A (2020) "Sustainable in-situ resource utilisation on the Moon" *Planetary & Space Science* **184** (4), 104870

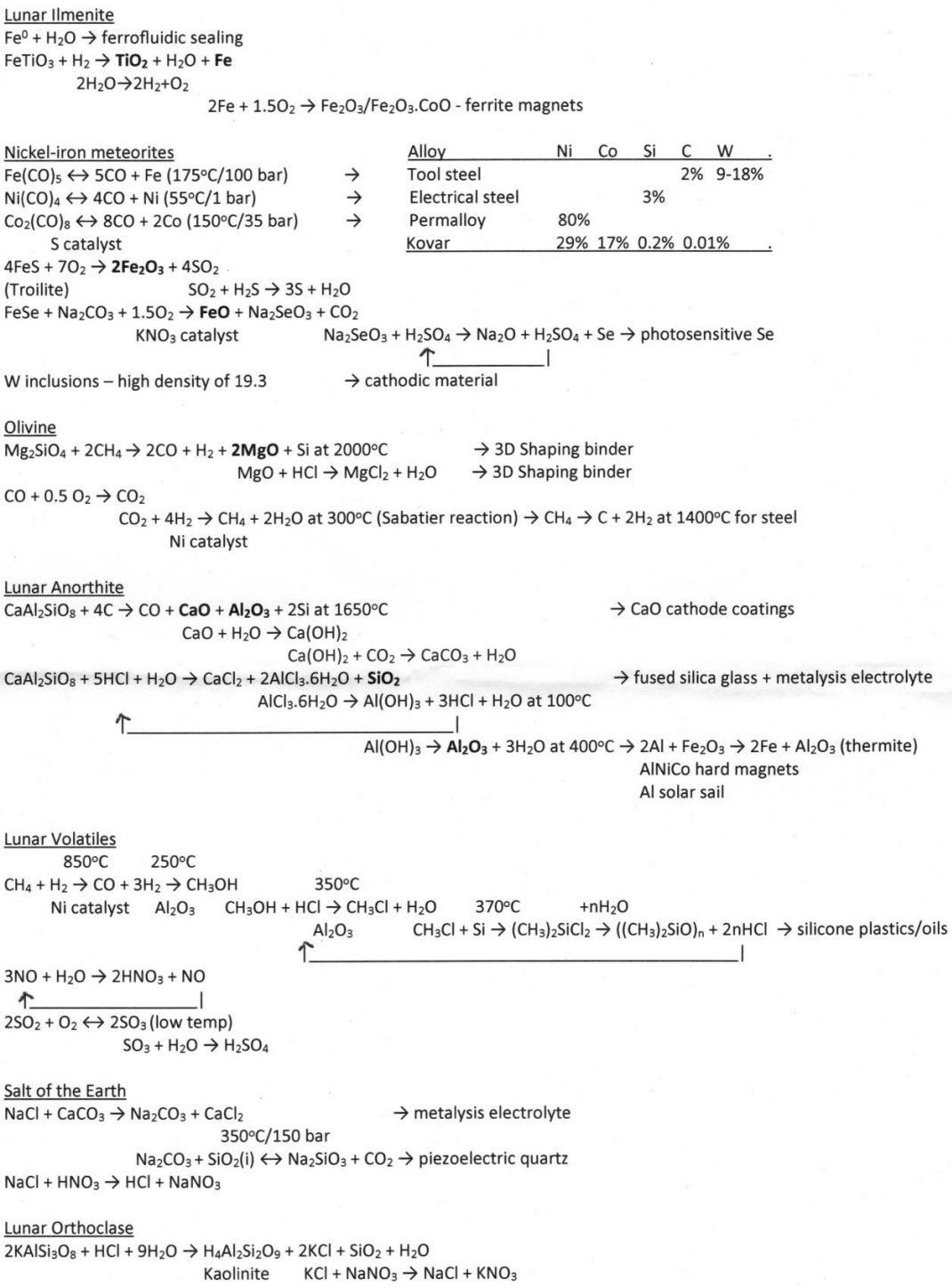

Fig 19. Lunar industrial ecology

The universal construction property requires complex reconfigurability in this industrial ecology [168,169]. All oxides are subjected to a single process, the FFC electrochemical process, to reduce

168 Ellery A (2021) "Bio-inspired "metabolism" for a lunar industrial ecology based on genetic regulatory networks" *RISpace*, London, UK (V)

169 Ellery A (2021) "Are there biomimetic lessons from genetic regulatory networks for developing a lunar industrial ecology?" *Biomimetics J* **6** (3), 50

oxides to multiple high purity metal powders (Fig 20) [170,171,172]. This is the key to sustainable in-situ resource utilisation [173].

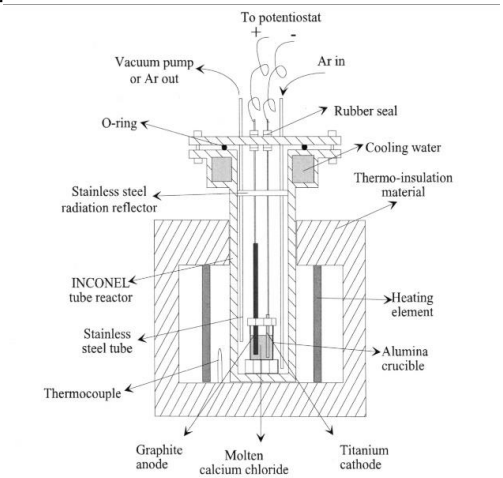

Fig 20. Metalysis FFC process

The extracted purified sintered raw material consitutes feedstock to suites of 3D printers to manufacture parts, components and systems. 3D printing may constitute a universal constructor mechanism (which equates to a self-replicating machine) [174,175,176]. Based on von Neumann's robotic self-replicator model, we require two fundamental components to realise all mechatronic systems – vacuum tubes for both computational electronics and some sensors and electric motors for general actuation. Inspired by the RepRap 3D printer which can print its own plastic parts, we adopted 3D printing as the central manufacturing technology for universal construction. To demonstrate universal construction [177], it suffices to demonstrate construction of sensors, actuators and electronics to realise robotic systems using the lunar material repertoire

[170] Ellery A, Lowing P, Wanjara P, Kirby M, Mellor I, Doughty G (2017) "FFC Cambridge process with metal 3D printing as universal in-situ resource utilisation" *Proc Advanced Space Technology for Robotics & Automation (ASTRA)*, Leiden, Holland

[171] Ellery A, Lowing P, Wanjara P, Kirby M, Mellor I, Doughty G (2017) "FFC Cambridge process and metallic 3D printing for deep in-situ resource utilisation – a match made on the Moon" *Proc Int Astronautics Congress*, Adelaide, Australia, IAC-17-D4.5.4x39364

[172] Ellery A, Mellor I, Wanjara P, Conti M (2022) "Metalysis FFC process as a strategic lunar in-situ resource utilisation technology" *New Space J* **10** (2), 224-238

[173] Ellery A (2018) "Sustainability through leveraging of extraterrestrial resources" *IEEE Conf Technologies for Sustainability* 8671386

[174] Ellery A (2015) "Prospects for a self-replication infrastructure on the Moon using in-situ resources and 3D printing technology" *Proc Space Resources Roundtable XVI/Planetary & Terrestrial Mining Sciences Symp*, Montreal, paper 11

[175] Ellery A (2015) "Notes on extraterrestrial applications of 3D-printing with regard to self-replicating machines" *Proc IEEE Int Conf Automation Science & Engineering (CASE)*, Gothenburg, 930-935

[176] Ellery A (2016) "Progress towards 3D printed mechatronic systems" *Proc IEEE Int Conf Industrial Technology with Symp on 3D Printing*, Tapei, Taiwan, pp. 1129-1133

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[178,179,180,181] (Fig 21). This would effectively complete self-replication of the RepRap beyond its plastic parts [182,183].

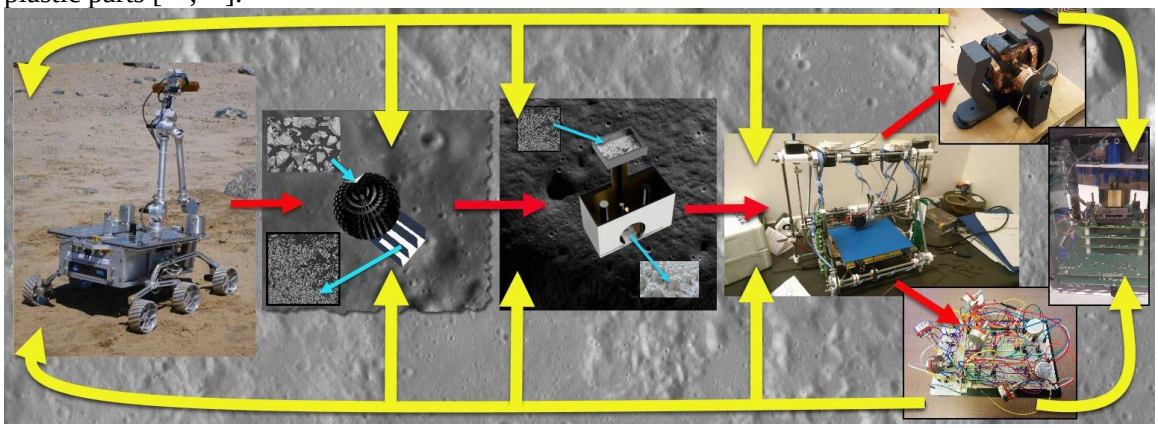

Fig 21. Sensors, electronics and motors are fundamental components of all kinematic machines

After initially considering and rejecting soft actuators [184,185], we underwent a number of different electric motor prototypes [186,], and then successfully 3D printed a complete electric motor using multiple 3D printing methods [187] (Fig 22).

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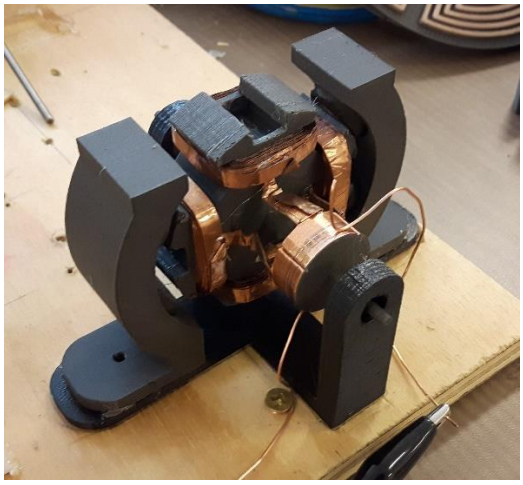

Fig 22. 3D printed electric motor

Electric motors provide the basis for building an assortment of kinematic machines including 3D printers and self-assembling systems. We have used of our earlier 3D printed motor versions (with standard wire coils) to demonstrate simple self-assembly based on a 3D printed TRIGON-type panel [188] (Fig 23).

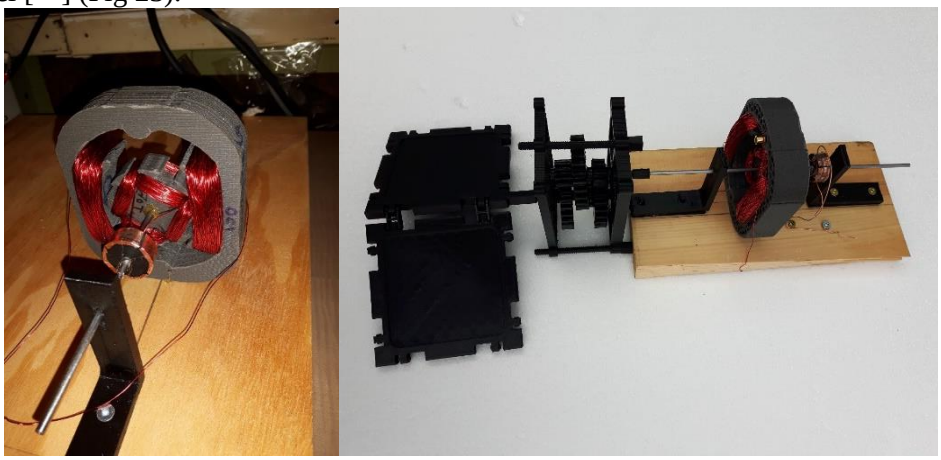

Fig 23. 3D printed soft magnet rotor and stator motor with wire coils connected via 3D printed gearing to a 3D printed deployable TRIGON panel

The next issue is the problem of 3D printing electronic controllers. After discarding printable polymer-based electronics as a computational medium, vacuum tubes were selected due to the challenges in manufacturing transistors on the Moon [189]. To reduce the hardware footprint of Turing-complete hardware based on vacuum tubes, analogue neural networks were adopted as the basic computational architecture which we have implemented as neural circuitry for controlling a desktop rover from off-the-shelf components (op-amps) [190] (Fig 24).

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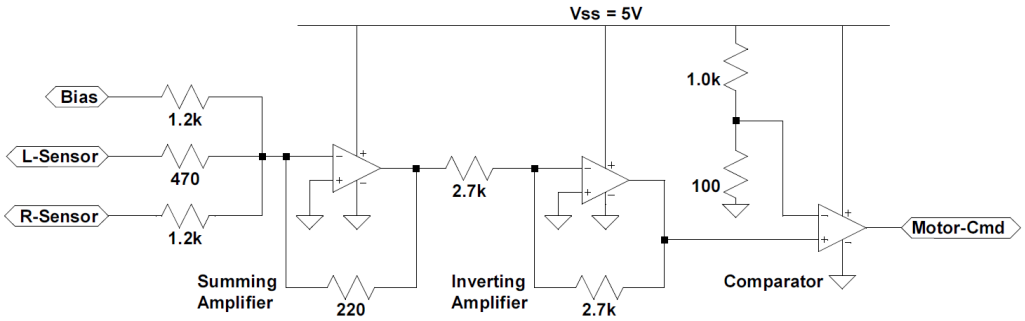

Figure 24. Single neuron analogue neural circuit

We have determined that this architecture can be scaled to address autonomous navigation through an arbitrary rockfield [191]. We have also successfully implemented the backpropagation learning algorithm in circuitry [192,193] (Fig 25).

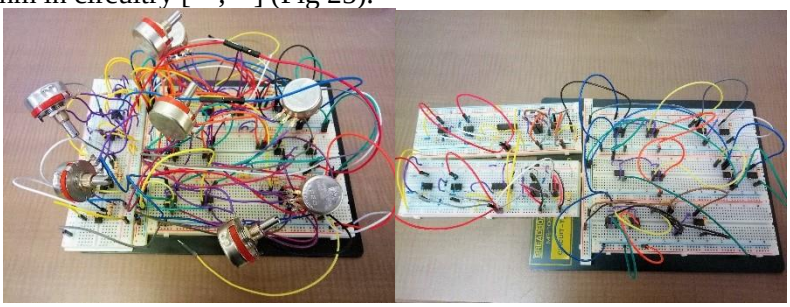

Fig 25. Forward and backward backpropagation circuits

We have yet to 3D print a vacuum tube but have been characterising a macroscopic vacuum tube, the magnetron for eventual printing. Vacuum tubes also provide the basis for arrays of photomultiplier tubes augmented with motorised active vision to enhance their resolution [194] thus completing the sensors-electronics-motor triumvirate of robotics.

We have been developing our in-house high rigidity 3D printer to simultaneously print metal and silicone plastic – 3D printer is complete with motors, gantry and work bed but the printing and milling heads are still under development (Fig 26). We have demonstrated the use of Fresnel lenses to melt aluminium-zinc (to prevent oxidation) using only solar energy and the laying of alumnium tracks onto silicone plastic substrates demonstrating the principle of simultaneous 3D printing of aluminium and silicone plastics for both electrical and mechanical applications.

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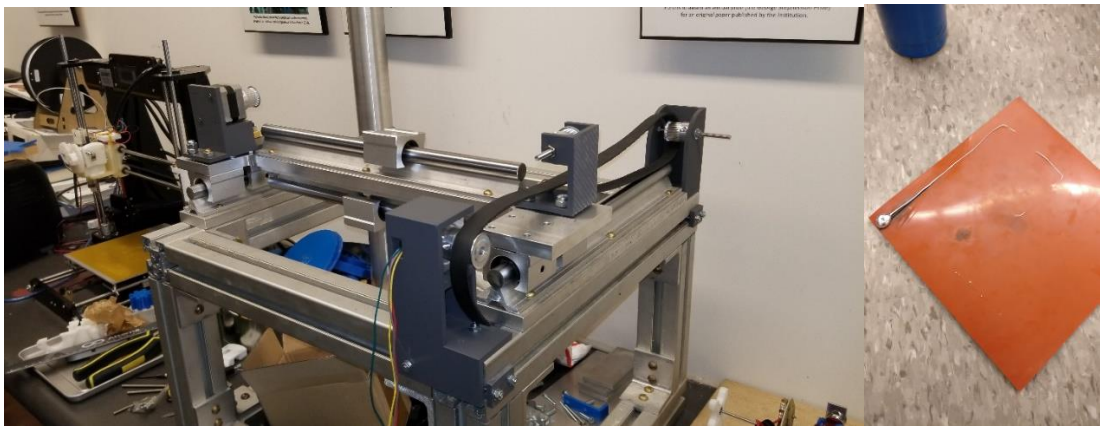

Figure 26. (a) High rigidity 3D printer; (b) Fresnel-lens melted aluminium tracks on silicone substrates

Any lunar infrastructure will require energy resources – solar concentrator-thermionic conversion for solar energy generation and flywheels for energy storage utilise the same components required for mechatronics including sensors and motors respectively (an example of exaptation) [195,196]. One way to exploit universal construction is to build a lunar base using 3D printing methods [197,198]. As well as habitat construction, some lunar resources can supplement closed ecological life support systems [199,200]. 3D printing offers sophisticated in-situ medical and life support [201]. The raison d'etre for industrialising the Moon is to circumvent the launch costs of building solar power satellites to provide clean energy to Earth [202,203,204,205,206] and, if necessary, implement space-based geoengineering technologies [207,208,209]. This combined approach could

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potentially solve climate change problems in the near and long-term [210]. Human exploration of Mars is the end goal for space exploration [211,212,213,214]. Self-replicating machines can be sent to Mars to construct a Martian infrastructure [215]. It also offers an effective solution to asteroid impact mitigation [216,217]. Finally, it offers the potential for implementing peta-projects on Earth at low cost [218]. The self-replicating machine introduces some unique biomimetic issues [219,220,221,222,223] by implementing a uniquely-biological characteristic. In effect, it may be considered a lifeform that adopts engineering materials rather than organic materials [224,225]. The threat of uncontrolled replication must be addressed. There are three main approaches: kill-switches and error detection and correction coding [226] and the implementation of a cancer analogue [227]. The self-replicating machine concept has enormous implications for interstellar exploration [228] and the search for extraterrestrial intelligence [229,230]. It suggests that extraterrestrial intelligence does not exist [231,232,233].

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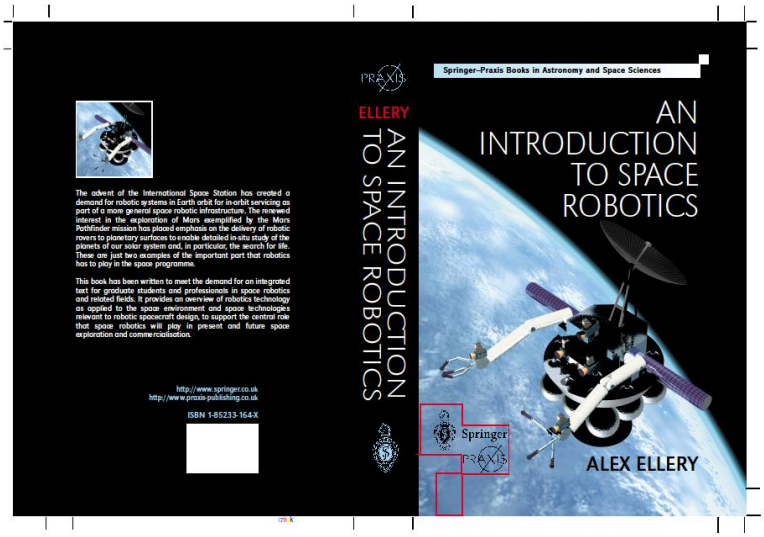

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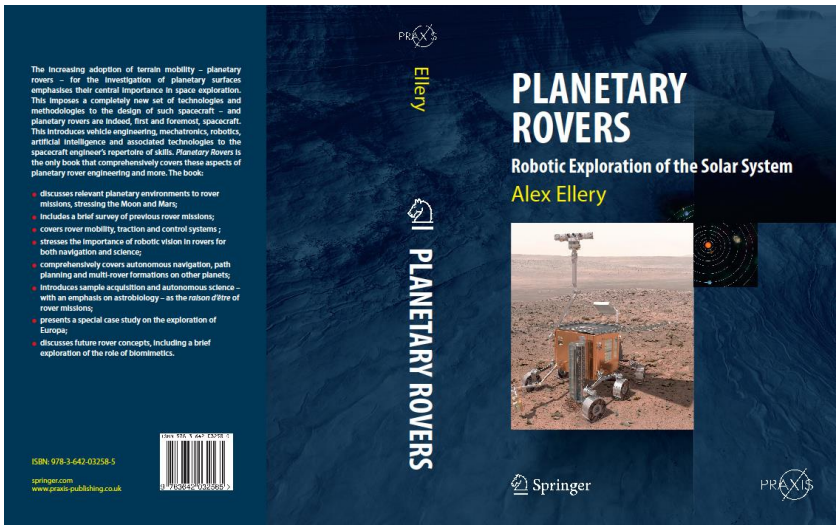

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2. Walls X, Ellery A, Thibodeau B (2023) "Aluminium metal extraction from lunar highland simulant using electrochemistry" accepted for *ASCE Earth & Space Conf*, paper 7061
3. Ellery A (2023) "Trials and tribulations of asteroid mining" accepted for *ASCE Earth & Space Conf*, paper 8087
4. Ellery A (2023) "Are 3D printers universal constructors?" accepted for *ASCE Earth & Space Conf*, paper 3666

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1. Driedger M, Harrison P, Berezin M, Ediger W, Ferguson P, Spray J, Gmerek A, Ellery A, Ma Y, Kennedy J (2023) "SpaceDust-laser/rf time of flight methods for space situational awareness" *Proc AMOS Tech Conf*, Maui, Hawaii
2. Ellery A, Schwarz M, Molina Cabrera P, Lynch B, Frazier C, Mack A (2023) "Rover operations for subsurface mining on the Moon" *Proc ASTRA Symp*, Leiden, Holland, paper 33
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29. Ellery A (2019) “Hybrid artificial intelligence as a defence against cyber-interference of military satellites” *Int Astronautics Congress*, Washington DC, IAC-19,D5.4.6.x49642
30. Ellery A, Elaskri A (2019) “Steps towards self-assembly of lunar structures from modules of 3D printed in-situ resources” *Int Astronautics Congress*, Washington DC, IAC-19,D4.1.4.x49787
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33. Ellery A (2019) “Self-Replicating the Hart-Tipler argument against the existence of extraterrestrial intelligence” *Int Astronautics Congress*, Washington DC, IAC-19,A.4.1.14.x49645
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36. Ogundipe C, Ellery A (2019) “Imaging terrestrial extrasolar planets using submicron interferometric platforms” *Int Astronautics Congress*, Washington DC, IAC-19,A7.3.4.x50556
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38. Ellery A (2018) “The ultimate physiomimetic machine – a leap towards a self-replicating machine for planetary colonisation” *Proc 3rd Biomimicry Summit (Biocene)*, Cleveland
39. Ellery A (2018) “Solar power satellites: reconsideration as renewable energy source based on novel approaches” *Proc 18th World Renewable Energy Congress*, Kingston-upon-Thames, UK
40. Ellery A (2018) “Lunar in-situ resource utilisation – the key to human salvation on Earth” in press with *ASCE Earth & Space Conf*, Cleveland, Ohio
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42. Ellery A, Howe S (2018) “Robust asteroid impact mitigation by viral infection-induced exocytosis” *Proc 16th Reinventing Space Conf*, London, UK
43. Ellery A (2018) “Sustainability through leveraging of extraterrestrial resources” *Proc IEEE Conf Technologies for Sustainabiility*, 8671386
44. Ellery A, Lowing P, Mellor I, Conti M, Wanjara P, Bernier F, Kirby M, Carpenter K, Dillon P, Dawes W, Sibille L, Mueller R (2018) “Towards in-situ manufacture of magnetic devices from rare earth materials mined from asteroids” *Proc Int Symp Artificial Intelligence Robotics & Automation in Space*, Madrid, Spain, paper no. 10c-1
45. Tettenborn A & Ellery A (2018) “Comparison of Gabor filters and wavelet transform methods for extraction of lithological features” *Proc Int Symp Artificial Intelligence Robotics & Automation in Space*, Madrid, Spain, paper no. P9
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47. Ellery A (2018) “The machine to end all machines – towards self-replicating machines on the Moon“ *Proc IEEE Aerospace Conf*, Big Sky, MT, paper no. 2032_2.0602
48. Ellery A (2017) “Bioinspiration lessons from a self-replicating machine concept in a constrained environment” *Proc IEEE Int Conf Robotics & Biomimetics*, Macau, 1874-1879
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56. Ellery A (2017) "Building physical self-replicating machines" *Proc European Cong Artificial Life*, Lyon, France
57. Ellery A (2017) "Self-replicating machines: from theory to practice" *Proc Planetary & Terrestrial Mining Science Symp/Space Resources Roundtable*, paper no 1661
58. Ellery A (2016) "Extraterrestrial 3D printing and in-situ resource utilisation to sidestep launch costs" *Proc 14th Reinventing Space Conf*, London, UK
59. Ellery A (2016) "Solar power satellites for clean energy enabled through disruptive technologies" *Proc 23rd World Energy Congress (Award Winning Papers)*, Istanbul, Turkey, 133-147[238]
60. Ellery A (2016) "John von Neumann's self-replicating machine – critical components required" *Proc IEEE Int Conf Systems Man & Cybernetics*, Budapest, Hungary, 314-319
61. Ellery A (2016) "Space exploration through self-replication technology compensates for discounting in NPV cost-benefit analysis – a business case?" *Proc Int Astronautics Congress* IAC-16-E6.1.4.x33457
62. Ellery A (2016) "How to build a self-replicating machine on the Moon" *Proc ASCE Earth & Space Conf*, Orlando, USA
63. Ellery A (2016) "Progress towards 3D printed mechatronic systems" *Proc IEEE Int Conf Industrial Technology with Symp on 3D Printing*, Tapei, Taiwan, pp. 1129-1133
64. Larson S & Ellery A (2015) "Trainable analogue neural network with application to lunar in-situ resource utilisation" *Proc Int Astronautics Federation Congress*, Jerusalem, IAC-15-D3.3.6
65. Ellery A (2015) "Are self-replicating machines possible?" *AIAA Space 2015 Conf & Exposition*, AIAA-2015-4653, Pasadena
66. Ellery A (2015) "Notes on extraterrestrial applications of 3D-printing with regard to self-replicating machines" *Proc IEEE Int Conf Automation Science & Engineering (CASE)*, Gothernburg, 930-935
67. Ellery A (2015) "Engineering artificial extraterrestrial life?" *Proc European Conf on Artificial Life (Late Breaking)*, 12-14
68. Ellery A (2015) "Ultimate smart system – steps towards a self-replicating machine" *Proc 5th Int Conf Smart Materials & Structures*, 225-234

[236] Best paper of session
[237] Best paper of session
[238] 5th Best Paper of World Energy Congress 2016 Award

69. Ellery A (2015) “Prospects for a self-replication infrastructure on the Moon using in-situ resources and 3D printung technology” *Proc Space Resources Roundtable XVI/Planetary & Terrestrial Mining Sciences Symp,* Montreal, paper 11
70. Frazier C, Baddour N, Ellery A (2014) “Assisted teleoperation and autonomous operation for planetary rovers using re-active vector equilibrium (RAVE) navigation” *Proc 65th Int Astronautics Congress*, IAC-14.A5.3-B3.6.6
71. Scott R & Ellery A (2014) “Approach to ground based space surveillance of geostationary on-orbit servicing operations” *Proc 65th Int Astronautics Congress*, IAC-A6.7.8
72. Ellery A (2014) “Steps towards 3D-printable spacecraft as a byproduct of self-replication technology” *Proc 65th Int Astronautics Congress*, IAC-14-D4.1.4[239]
73. Ellery A (2014) “Manna from heaven – preliminary efforts for a self-replicating 3D printer for lunar in-situ resource utilisation” *Proc 12th Int Symp Artificial Intelligence Robotics & Automation in Space,* paper 7a-3
74. Nicol C, Ellery A, Cloutis E (2014) “Online estimation of soil parameters using the Kapvik microrover” *Proc 12th Int Symp Artificial Intelligence Robotics & Automation in Space,* paper 8a-3
75. Cloutis E, Whyte L, Qadi A**,** Ellery A et al (2013) "How to search for methane on Mars: Results of rover field trials at Mars analogue sites" *Geological Association of Canada – Mineralogical Association of Canada Joint Annual Meeting;* May 2013; Winnipeg, MB, Canada; paper #SS17-01
76. Cloutis E, Qadi A, Ellery A et al (2013) “Mars methane analogue mission (M3): results of the 2012 field deployment” *Lunar & Planetary Science Conf 44*, abstract #1579
77. Nicol C, Ellery A, Cloutis E (2012) "Targeting Enceladus' plume – the viffing penetrator approach" *63rd International Astronautical Congress,* October 2012; Naples, Italy; paper 13061
78. Qadi, A, Nicol C, Mack A, Ellery A (2012) "Design and experiments for a Mars methane analogue mission rover operations" *63rd International Astronautical Congress,* October 2012; Naples, Italy; paper 15336
79. Hewitt R, Ellery A, de Ruiter A (2012) “Efficient navigation and mapping techniques for the Kapvik analogue micro-rover*” Proc Global Space Exploration Conf*, Washington DC, GLEX-2012.P.8.p1x12478
80. Hewitt R, Ellery A, de Ruiter A (2012) “FastSLAM on a planetary micro-rover prototype” *Proc 16th CASI Conf ASTRO*, Quebec
81. Kruzelecky R, Ellery A et al (2012) “LORE: lunar origins resource explorer science payload” *Proc GLEX Conf*, Washington DC, GLEX-2012.02.1.8x12372
82. Qadi A, Cross M, Ellery A, Nicol C (2012) “Smart reconfigurable all-terrain multi-mission planetary micro-rover, design and control” *Proc 16th CASI Conf ASTRO*, Quebec City, no 84
83. Cloutis E, Qadi A, Ellery A et al (2012) “Mars methane analogue mission (M3): results of the 2011 field deployment” Proc *43rd Lunar and Planetary Science Conf 43*, Woodlands, Texas, abstract #1569
84. Kruzelecky R, Qadi A, Ellery A et al (2012) "Mars Methane Mission: A field deployment in a Mars analogue environment" *16th Canadian Astronautics Conference (ASTRO 2012);* April 2012; Quebec City, QC, Canada
85. Qadi A, Ellery A et al (2012) “Mars methane analogue mission rover operations at Jeffery mine deployment” Proc *16th CASI Conf ASTRO*, Quebec City, no 189
86. Cloutis E, Qadi A, Ellery A et al (2012) “Mars methane analogue mission - results of first field deployment” *Proc 16th CASI Conf ASTRO*, Quebec City
87. Skulinova M, Zheng W, Ellery A, Hu Y-R, Soucy Y (2012) “Enceladus micro-penetrator mission concept” *Proc 16th CASI Conf ASTRO*, Quebec City

[239] Best paper of session

88. Scott R, Ellery A, Levesque M (2011) “Non-resolved detection of objects performing on-orbit servicing in geostationary orbit” *AMOS Technical Conf*, paper no BJW-RLS-CM
89. Sharif H, Samson C, Ellery A (2012) “Autonomous rock identification based on image processing techniques” *Proc CASI Conf ASTRO*, no 129
90. Sharif H, Ellery A, Samson C (2012) “Strategies for sampling of planetary materials based on images” *Proc Global Space Exploration Conf*, GLEX-2012.03.P .6x12403
91. Nicol C, Ellery A, Cloutis E (2012) “Sniffing as a strategy for detecting life on Mars” *Proc Global Space Exploration Conf*, GLEX-2012.08.1.8x12332
92. Cloutis E, Whyte L, Qadi A, Ellery A et al (2012) “Mars methane analogue mission (M3): results of the 2011 field deployment“ *Lunar & Planetary Sciences Conf (LPSC)*
93. Gallant M, Ellery A, Marshall J (2011) “Science-influenced mobile robot guidance using Bayesian networks“ *Proc 24th Canadian Conf on Electrical & Computer Engineering*, Canada
94. Kruzelecky R, Cloutis E, Hoa S, Therriault D, Ellery A, Xian Jiang X et al (2011) “Project MoonDust: characterisation and mitigation of lunar dust” *Proc 41st Int Conf Environmental Systems*, AIAA 2011-5184
95. Gallant M, Ellery A, Marshall J (2010) “Exploring salience as an approach to rover-based planetary exploration“ *Proc ASTRO Conf*, Toronto, Canada
96. Setterfield T, Ellery A (2010) “Potential chassis designs for Kapvik, a Canadian reconfigurable planetary microrover“ *Proc ASTRO Conf*, Toronto, paper 16
97. Mack A, Ellery A (2010) “The potential steering function and its application to planetary exploration rovers“ *Proc 15th CASI Conf ASTRO*, Toronto
98. Hewitt R, de Ruiter A, Ellery A (2010) “Hybridizing neural networks and Kalman filters for robotic exploration*” Proc 15th CASI Conf ASTRO*, Toronto
99. Kruzeklecky R, Wong B, Aissa B, Haddad E, Jamroz W, Cloutis E, Rosca I, Hoa S, Therriault D, Ellery A (2010) “MoonDust lunar dust simulation and mitigation” *AIAA-2010-764033*
100. Kruzelecky R, Wong B, Zou J, Haddad E, Jamroz W, Cloutis E, Strong K, Ellery A, Ghafoor N, Ravindran G (2010) “LORE: Lunar Origins & Resource Explorer” *AAS 10-467*
101. Mack A, Ellery A (2009) “A method of real-time obstacle detection and avoidance using cameras for autonomous planetary rovers“ *Towards Autonomous Robotic Systems (TAROS 09)*, Londonderry, 112-118
102. Grove D, Ellery A (2008) “Designing a modular penetrator to accommodate multiple mission scenarios” *International Astronautics Congress (IAC)*, Glasgow, UK
103. Ellery A (2008) “Optic flow-based navigation for the ExoMars rover” *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 110
104. Hopkins T, Ellery A (2008) “Drilling model and applications of space drilling” *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 79
105. Swartz M, Ellery A (2008) “Towards adaptive localisation for rover navigation using multilayer feedforward neural networks” *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 74
106. Lynch B, Ellery A (2008) “Kinematics and dynamics of spacecraft robotic manipulators” *Canadian Aeronautics & Space Institute (CASI) ASTRO2008*, Montreal, Canada, paper no. 89
107. Lynch B, Ellery A, Nitzsche F (2008) “Two-dimensional robotic vehicle path planning based on artificial potential fields” *CSME Forum (CCToMM)*, Ottawa University, Canada
108. McLean D, Ellery A (2008) “Survey of traction control systems for planetary rovers” *CSME Forum (CCToMM)*, Ottawa University, Canada
109. Hopkins T, Ellery A (2008) “Rotary and percussive drilling penetration rate prediction model verification” *CSME Forum (AM)*, Ottawa University, Canada
110. Paar G, Griffiths A, Barnes D, Coates A, Jaumann R, Oberst J, Gao Y, Ellery A, Li R (2006) “Panoramic 3D vision on the ExoMars rover” *European Planetary Science Congress*, Berlin, Germany, pp. 295

111. Gao Y, Ellery A (2006) "Autonomous navigation based on optic flow for the ExoMars rover" *Proc ESA Advanced Space Technologies for Robotics & Automation (ASTRA)*, ESA-ESTEC, Noordwijk, Holland
112. Michaud S, Richter L, Patel N, Thuer T, Huelsing T, Joudrier L, Seigwart S, Ellery A (2006) "RCET: Rover chassis evaluation tools" *Proc ASTRA*, ESA-ESTEC, Noordwijk, Holland
113. Baker A, Phipps A, Sweeting M, Ellery A, **Gao Y** (2006) "Challenges and options for an affordable small lunar sample return mission" *International Astronautics Congress*, Valencia, Spain, IAC-06-B1.2.06
114. Barnhart D, Vladimirova T, Ellery A, Lappas V, Sweeting M (2006) "Utilising the Eyasat concept in space systems engineering courses at the University of Surrey" *International Astronautics Congress*, Valencia, Spain, IAC-06-E1.4.04
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116. Richter L, Ellery A, Gao Y, Michaud S, Schultz N, Weiss S (2006) "A predictive wheel-soil interaction model for planetary rovers validated in testbed and against MER Mars rover performance data" *Proc 10th Int Society for Terrain-Vehicle Systems (ISTVS)*, Budapest, Hungary, 343
117. Gao Y, Ellery A, Jaddou M, Vincent J (2006) "Bio-inspired drill for planetary subsurface sampling: literature survey, conceptual design and feasibility study" *Proc Adaptation in Intelligent Systems & Biology (AISB) Conf* **2**, University of Bristol, 71-77
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119. Smith A, Gowen R, Coates A, Crawford I, Scott R, Church P, Ellery A, **Gao Y**, Pike T (2006) "Lunar exploration with penetrators" *Proc 8th ILEWG Conf*, Beijing
120. Gao Y, Ellery A, Jaddou M, Vincent J (2006) "Deployable wood wasp drill for planetary subsurface sampling" *IEEE Proc. Aerospace Conf*, Big Sky, MT, USA
121. Allouis E, Ellery A, Sweeting M (2005) "Planetary exploration: SPADES – a new integrated entry system design tool" *International Astronautics Congress*, Kukoaka, Japan, IAC-05-D1.3
122. Ellery A, Patel N, Richter L, Bertrand R, Dalcomo Y (2005) "ExoMars rover dynamics analysis and design" *Proc 8th Int Symposium Artificial Intelligence Robotics & Automation in Space (iSAIRAS)*, Munich, Germany
123. Scott G, Ellery A (2005) "Using Bekker theory as the primary performance metric for measuring the benefits of legged locomotion over traditional wheeled vehicles for planetary robotic explorers" *Proc Space 2005*, Long Beach, California, AIAA-2005-6736
124. Ellery A, Richter L, Bertrand R (2005) "Chassis design and performance analysis for the European ExoMars rover" *Proc CCToMM Symposium on Mechanisms Machines & Mechatronics*, Montreal, Canada
125. Gao Y, Ellery A, Vincent J, Eckersley S (2005) "Biologically-inspired penetration/drilling/sampling system for in-situ astrobiological studies" *Proc Towards Autonomous Robotics (TAROS)*, Imperial College London (ed. U Nehmzow, C Melhuish, M Witkowski), 51-56
126. Scott G, Ellery A (2005) "Design of a biomimetic walking Mars explorer for the ESA Bionics & Space Systems Design contract (AO/1-4469/03/NL/Sfe)" *Proc Towards Autonomous Robotics (TAROS)*, Imperial College London (ed. U Nehmzow, C Melhuish, M Witkowski), 213-219
127. Patel N, Ellery A, Sweeting M (2004) "Rover Mobility Performance Evaluation Tool (RMPET): a systematic tool for rover chassis evaluation via the application of Bekker theory" *Proc Advanced Space Technologies for Robotics & Automation*, European Space Agency, ESTEC, Noordwijk, Holland

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129. Patel N, Scott G, Ellery A (2004) “Application of Bekker theory for planetary exploration through wheeled, tracked and legged vehicle locomotion“ *Space 2004 Conf*, San Diego, California, USA, AIAA-2004-6091
130. Scott G, Ellery A, Husbands P, Vincent J, Eckersley S, Cockell C, Dembo P (2004) “Bionics & Space Systems Design Project Progress Report for ESA Advanced Concepts Team“ *Proc Advanced Space Technologies for Robotics & Automation*, ESTEC, Noordwijk, Holland
131. Patel N, Ellery A (2004) “Performance evaluation of autonomous Mars mini-rovers“ *Proc Towards Autonomous Robotic Systems (TAROS 04): 5th British Conference on (Mobile) Robotics*, Rep No CSM-415, University of Essex, Colchester, Paper no. 18
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133. Ellery A (2003) “Ground-robot interaction - the basis for mobility in planetary micro-rovers“ *Towards Intelligent Mobile Robots (TIMR 03) - 4th British Conference on Mobile Robotics*, University of West of England, Bristol, Paper no. 8
134. Ellery A (2003) “A critique of SETI science“ *Proc SETICon 03 (3rd SETI League Technical Symposium)*, New Jersey, USA, 62-68
135. Ellery A, Ball A, Coste P, Dickensheets D, Hu H, Lorenz R, Nehmzow U, McKee G, Richter L, Winfield A (2003) “A robotic triad for Mars surface and sub-surface exploration“ *Proc 7th Int Symp on Artificial Intelligence, Robotics and Automation in Space*, Nara, Japan, paper no. 2-1-3
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138. Parnell J, Cockell C, Edwards H, Ellery A (2003) “The range of life habitats in volcanic terrains on Mars“ *Proc 3rd European Workshop on Exo/Astro-Biology* (SP-545), Madrid, Spain, 81-84
139. Patel N, Ellery A, Welch C, Curley A, van Winnendael M (2003) “Elastic loop mobility system (ELMS): concept, innovation and performance evaluation for a robotic Mars rover“ *International Astronautics Congress*, Bremen, Germany, IAC-03-IAA.1.1.05
140. Allouis E, Ellery A, Welch C (2003) “Parachutes and inflatable structures: parametric comparison of EDL systems for the proposed Vanguard Mars mission“ *International Astronautics Congress*, Bremen, Germany, IAC-03-Q.3B.04
141. Leveque N, Welch C, Ellery A, Curley A (2003) “Trajectory simulations for thrust-vectored electric propulsion missions“ *International Electric Propulsion Conf*, IEPC-3-0050
142. Ellery A (2002) “Technology of robotic in-orbit servicing“ *Proc 1st Bilateral DLR-CSA Workshop on On-Orbit Servicing of Space Infrastructure Elements via Automation & Robotics Technologies* (OOS 2002), Waldrunnen, Cologne-Bonn, Germany, 1.11.30
143. Patel N, Ellery A, Welch C, Curley A, van Winnendael M (2002) “Elastic loop mobility system: an alternative for rover mobility on Mars“ *Proc 7th ESA Workshop on Advanced Space Technologies for Robotics & Automation (ASTRA)*, WPP 204, ESTEC, Noordwijk, Holland, 2.2.1
144. Ellery A, Ball A, Cockell C, Coste P, Dickensheets D, Edwards H, Hu H, Lammer H, Lorenz R, McKee G, Richter L, Welch C, Winfield A (2002) “Vanguard - a proposal for a

European post-Beagle 2 robotic Mars mission“ *Proc 7th ESA Workshop on Advanced Space Technologies for Robotics & Automation (ASTRA)*, WPP 204, Cologne, Germany, 2.1.2
145. Patel N, Ellery A, Welch C, Curley A (2002) “Preliminary analysis of mobility systems for a Mars micro-rover“ *World Space Congress*, Houston, Texas, IAC-02-U.2.08
146. Ellery A, Welch C, Leveque N (2002) “Advanced Telerobotic Actuation System (ATLAS) in-orbit servicer propulsion options“ *World Space Congress*, Houston, Texas, IAC-02-U.2.08
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149. Ellery A, Welch C (2002) “A proposed public-private partnership for the funding of robotic in-orbit servicers“ *Proc Space 2002 and Robotics 2002*, Alburquerque, New Mexico, 07291734ELLE
150. Kolb C, Lammer H, Abart R, Ellery A, Edwards H, Cockell C, Patel M (2002) “The Martian oxygen surface sink and its implications for the oxidant extinction depth“ *Proc 2nd European Workshop on Exo/Astro-Biology* (ESA SP-518), Graz, Austria, 181-184
151. Ellery A, Ball A, Cockell C, Coste P, Dickensheets D, Edwards H, Hu H, Kolb C, Lammer H, Lorenz R, McKee G, Richter L, Winfield A, Welch C (2002) “Robotic astrobiology - the need for sub-surface penetration of Mars“ *Proc 2nd European Workshop on Exo/Astro-Biology* (ESA SP-518), Graz, Austria, 313-317
152. Ellery A (1994) “Resolved motion control of space manipulators“ *Proc 45th International Astronautics Congress*, Tel Aviv, Israel, ST-94-W2-574

MAJOR TECHNICAL REPORTS DELIVERED

1. Ellery A (2018) “Autonomous mission planning – review of current and past AI techniques” DRDC Scientific Report 1, Ottawa Research Centre
2. Ellery A (2019) “Artificial intelligence techniques – hybrid symbolic neutral network systems” DRDC Scientific Report 2, Ottawa Research Centre
3. Ellery A (2019) “Deep learning systems” DRDC Scientific Report 3, Ottawa Research Centre
4. Ellery A (2019) “Mission simulation and analysis tools” DRDC Scientific Report 4, Ottawa Research Centre
5. Hipkin V, Haltigin T, Ellery A, Moores J, Samson C, Timusk M (2013) “Lunar Polar Volatiles/ISRU Mission” Canadian RESOLVE Science Definition Document
6. Ellery A, **Nicol C**, Cloutis E (2012) “Scent of Science: Model Creation for Odour Based Control of Robotic Vehicles” ESA Advanced Concepts Team Report 11-6301
7. Ellery A (2011) “Review and Feasibility of Micro-Penetrators for Planetary Exploration” CSA Technical Report MPC-CU1
8. Ellery A (2011) “Astrobiology by Micro-Penetrator: The Case for Enceladus” CSA Technical Report MPC-CU2
9. Ellery A & Marshall J (2008) “Traction design options for a lunar exploration manned utility rover” MDA Technical Report LEMUR-CU02
10. Marshall J & Ellery A (2008) “Scalable autonomy options for the lunar exploration manned utility rover” MDA Technical Report LEMUR-CU01
11. Ellery A (2007) “Optic-flow based autonomous navigation for the ExoMars rover” PPARC Final Report (CREST programme)
12. Ellery A et al (2004) “Bionics & Space Systems Design 1 – Overview of Biomimetics Technology” ESA-ESTEC Technical Note 1 (ESA Contract no 18203/04/NL/PA)
13. Ellery A et al (2005) “Bionics & Space Systems Design 3 – Application of Biomimetics to Space Technology” ESA-ESTEC Technical Note 3 (ESA Contract no 18203/04/NL/PA)[8]

14. Ellery A, **Scott G** et al (2005) "Bionics & Space Systems Design 4 – Case Study 1 Mars Walker" ESA-ESTEC Technical Note 4 (ESA Contract no 18203/04/NL/PA)
15. Ellery A, **Gao Y** et al (2005) "Bionics & Space Systems Design 4 – Case Study 2 Biomimetic Drill" ESA-ESTEC Technical Note 4 (ESA Contract no 18203/04/NL/PA)
16. Ellery A (2003) "Elastic loop mobility/traction system study for Mars micro-rovers" ESA-ESTEC Final Report (ESA Contract no 16221/02/NL/MV)

POPULAR ARTICLES

1. Ellery A (2021) The Conversation: https://theconversation.com/mining-the-moons-water-will-require-a-massive-infrastructure-investment-but-should-we-117883
2. Ellery A (2019) The Conversation: http://theconversation.com/canadas-approach-to-lunar-exploration-needs-to-be-strategic-or-well-be-left-behind-112823
3. Ellery A (2019) The Conversation: https://theconversation.com/we-need-new-treaties-to-address-the-growing-problem-of-space-debris-115757
4. Ellery A (2016) "Salvation through the begetting machine" *Space Talk: the Next Generation* (summer), 15-17
5. Space.com: https://www.space.com/37101-self-replicating-3d-printer-moon-bases.html
6. Robotics Tomorrow: http://www.roboticstomorrow.com/article/2015/11/3d-printing-of-motors-and-electronics/7218
7. A. Ellery (2001) "Space robotics: an enabling technology for the space frontier*" Ad Astra* (June), 36-40
8. A. Ellery (2001) "Living machines" *Astronomy Now* (Jun), 26-28
9. A. Ellery (2001) "Alien life: SETI searches for life" *BBC Science Online*

BOOK REVIEWS (for International Journal of Astrobiology)

1. "Impossible Extinction" by Cockell C (2003) *Int J Astrobiology* **2** (2)
2. "Alone – a Discovery Sourcebook for Astrobiology" (2003) *Int J Astrobiology* **2** (2)
3. "Life Everywhere – the Maverick Science of Astrobiology" (2003) *Int J Astrobiology* **2** (4)
4. "Life in the Universe" by Bennett J, Shostak S & Jakosky B (2003) *Int J Astrobiology* **2** (4)
5. "Children of the Stars: our Origin, Evolution and Destiny" by Altschuler D (2004) *Int J Astrobiology* **3** (1)
6. "Life & Death of Planet Earth: How the New Science of Astrobiology charts the Ultimate Fate of our World" by Ward P & Brownlee D (2004) *Int J Astrobiology* **3** (4)
7. "Life in the Solar System and Beyond" by Jones B (2004) *Int J Astrobiology* **3** (1)
8. "Rare Earth – Why Complex Life is Uncommon in the Universe" by Ward P & Brownlee D (2004) *Int J Astrobiology* **3** (1)
9. "Where is Everybody: Fifty Solutions to the Fermi Paradox and the Problem of Extraterrestrial Life" by Webb S (2004) *Int J Astrobiology* **3** (1)
10. "Between Necessity & Probability: Searching for the Definition and Origin of Life" by Popa R (2007) *Int J Astrobiology* **6** (2)
11. "Intelligent Life in the Universe: From Common Origins to the Future of Humanity" by Ulmschneider P (2007) *Int J Astrobiology* **6** (2)
12. "Life in the Universe: Expectations & Constraints" by Schultze-Makuch D & Irwin L (2007) *Int J Astrobiology* **6** (2)

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Instructor II, PH.D., P.Eng
Carleton University, Ottawa, Canada

Portfolio
Linkedin

Education

Postdoctoral Fellowship, Mechanical Engineering, Concordia University, Montreal, Canada **2017 — 2018**

Project: Stress and dynamic analyses and health monitoring of two articulated booms used for ship loading in Gaspésie

Ph.D. of Mechanical Engineering , Concordia University, Montreal, Canada **2012 — 2015**

Thesis: Vibration analysis of MR fluid sandwich plates and identification of optimal MR fluids treatments

Graduate Certificate in University Teaching , Concordia University, Montreal, Canada **2014 — 2015**

Master of Engineering, Mechanical , Iran University of Science and Technology (IUST), Tehran, Iran **2007 — 2010**

Thesis: Vibratory behavior of functionally graded (FG) annular plates coupled with piezoelectric actuators and sensors

Bachelor of Engineering, Mechanical , Shahid Chamran University (SCU), Ahvaz, Iran **2002 — 2007**

Thesis: Investigating the effect of economical parameters on the design of wind turbines

Professional Engineering Membership

Professional Engineering of Ontario (PEO)

Canadian Engineering Education Association (CEEA-ACEG)

Carleton Centre for Research in Engineering Education (CCREE)

Academic Employment

Instructor II, Carleton University, Ottawa, Canada **2021 — Present**

- Teaching undergraduate and graduate level courses in an Extended Term Appointment (ETA).

Lecturer in LTA Position, Concordia University, Montreal, Canada **2017 — 2021**

- Teaching undergraduate and graduate level courses in the Limited Term Appointment (LTA).
- Experiential learning, blended learning and technology-based learning have been employed in the courses.

Part-Time Faculty Member, Concordia University, Montreal, Canada **2014 — 2015**

- Lecturer of undergraduate level Mechanical Vibrations course, MECH 375

Lab Demonstrator , Mechanical Vibrations Lab, Concordia University, Montreal, Canada **2012 — 2015**

- Developed lab manual and instructed students to conduct the experiments

Administrative Appointments and Committees

Capstone Design Project Committee, Carleton University, Ottawa, Canada **2021 — Present**
Accreditation/Graduate Attributes Committee, Carleton University, Ottawa, Canada **2021 — Present**
Curriculum Committee (MECH, BIOM), Carleton University, Ottawa, Canada **2021 — Present**
Undergraduate Scholarships Committee, Carleton University, Ottawa, Canada **2021 — Present**
Department Tenure and Promotional Committee, Carleton University, Ottawa, Canada **2023 — Present**

Evidence of Professional Development

Optimization of Mechanical Systems (MAAE 4902). Designed the course for the fourth year undergraduate students at Carleton University.

Experimental Setups for Engineering Education. Developed hands-on experimental setups along with comprehensive instructional guides and manuals for visual demonstration in the lectures.

Continuing Professional Development Initiative (CPDI). Selected as a faculty member for the Carleton Engineering Continuing Professional Development Initiative in response to Professional Engineers Ontario's PEAK program requirements.

Awards and Honours

Favourite Faculty Member, Carleton University, Ottawa, Canada **2023 — 2024**
Support Package Award for Online Lecturing, Concordia University, Montreal, Canada **2020 — 2021**
Carolyn and Richard Renaud Teaching Assistantship, Concordia University, Montreal, Canada **2014 — 2015**
Accelerator Award, Concordia University, Montreal, Canada **2014 — 2015**
Full Tuition Remission Award, Concordia University, Montreal, Canada **2012 — 2013**
Merit Scholarship Award, Concordia University, Montreal, Canada **2012 — 2013**
Top Researcher Award, Iran University of Science and Technology (IUST), Tehran, Iran **2009 — 2010**

Taught Courses at Carleton University

2023 — 2024
- MAAE3300B, Fluid Mechanics II
- MAAE2300D, Fluid Mechanics I
- ECOR1047A, Visual Communication
- ECOR1048A, Dynamics
- MECH4604B, Finite Element Methods
- MAAE4907G, Capstone Project

2022 — 2023
- ECOR1047A, Visual Communication
- ECOR1047B, Visual Communication
- ECOR1047S, Visual Communication
- ECOR1048S, Dynamics
- MAAE2300A, Fluid Mechanics I
- MAAE2202D, Mechanics of Solids I
- MAAE2300D, Fluid Mechanics I
- MECH4604B, Finite Element Methods
- MAAE4907G, Capstone Project

2021 — 2022
- ECOR1047A, Visual Communication
- ECOR1047B, Visual Communication
- ECOR1048C, Dynamics
- ECOR1048D, Dynamics
- MAAE2300A, Fluid Mechanics I
- MECH4604A, Finite Element Methods
- MAAE4907G, Capstone Project

Taught Courses at Concordia University

- **Transform Calculus and PDE** (10 Sections)
- **Statics** (8 Sections)
- **Numerical Methods in Engineering** (2 Sections)
- **Dynamics** (2 Sections)
- **Mechanical Vibrations** (2 Section)
- **Stress and Failure Analysis of Machinery** (One Section)

Workshops and Certificates

The Institute for Engineering Teaching (IET), Candadian Engineering Education Association **2023 — 2024**
Experiential Learning Hub XR Drop-In, Carleton University, Carleton University, Ottawa, Canada **2023 — 2024**
Harness Generative AI for Enhanced Learning, Carleton University, Carleton University, Ottawa, Canada **2023 — 2024**
Designing Effective Discussion Forums, Carleton University, Ottawa, Canada **2022 — 2023**
Foundations of Multiple-Choice Testing, Carleton University, Ottawa, Canada **2022 — 2023**
Grading Rubrics, Carleton University, Ottawa, Canada **2022 — 2023**
Lesson Planning, Carleton University, Ottawa, Canada **2022 — 2023**
Designing Learning Experiences from Scratch, Carleton University, Ottawa, Canada **2022 — 2023**
Guideline for Writing Multiple Choice Items, Carleton University, Ottawa, Canada **2022 — 2023**
The Future of Teaching and Learning at Carleton, Carleton University, Ottawa, Canada **2022 — 2023**
Graduate Certificate in University Teaching, Concordia University, Montreal, Canada **2014 — 2015**

Record of Service to Society and Carleton University

Volunteer is National Shad Program. Conducted academic lectures and hands-on workshops on a broad range of topics in Mechanical Engineering, for well-rounded students finishing grades 10 and 11 to motivate and inspire them to tackle real world problems.

Chair of Defence Session. Served as a chair of defence sessions of two graduate students.

Research Experiences

Postdoctoral Fellow , Concordia University, Montreal, Canada **2017 — 2018**
- Conducting NSERC-Engage project on health monitoring of bearings.

Research Assistant , Concordia Centre for Advanced Vehicle Engineering (CONCAVE) **2011 — 2012**
- Conducted research under supervisions of Profs Rakheja and Sedaghati.

Researcher , Iran University of Science and Technology, Tehran, Iran **2007 — 2010**
- Investigated vibratory behavior of functionally graded (FG) annular plates coupled with piezoelectric actuators and sensors.

Researcher , Shahid Chamran University (SCU), Ahvaz, Iran **2006 — 2007**
- Evaluated the effect of economical parameters on the design of wind turbines .

Industrial Employment

NSERC-Engage Project, Strudes Inc, Montreal, Canada **2017 — 2018**
- Fatigue analysis and health monitoring of towers and articulated booms used for ship loading in Gaspésie.

Finite Element and Vibration Analyst, NOW! Energy Solutions Company, Montreal, Canada **2015 — 2017**
- Stress and vibration analyses of one of the largest cantilevered articulated booms in the world, used for ship loading in a cement plant in Gaspésie.

Researcher and Developer, National Iranian Gas Company (NIGC), Arak, Iran **2011 — 2012**
- Vibration analysis of gas pipelines in CGS and TBS gas stations, in Arak, Iran.

Selected Journal Publications

1. R. Aboutalebi, **M. Eshaghi** (2024) Flutter analysis of laminated fiber-reinforced magnetorheological elastomer sandwich plate resting on an elastic foundation using an improved first-order shear deformation theory. *Smart Materials and Structures*
2. **M. Eshaghi** (2023) Optimal core design of MR based smart panels subject of flutter instability. *Mechanics Based Design of Structures and Machines, An International Journal.*
3. R. Aboutalebi, **M. Eshaghi**, A. Taghvaeipour, F. Bakhtiari-Nejad (2022) Post-yield characteristics of electrorheological fluids in nonlinear vibration analysis of smart sandwich panels. *Mechanics Based Design of Structures and Machines*
4. **M. Eshaghi**, M. Ghasemi, K. Khorshidi (2021) Design, manufacturing and applications of small-scale magnetic soft robots, *Extreme Mechanics Letters*.
5. R. Aboutalebi, **M. Eshaghi**, M. Hemmatian, R, Sedaghati (2021) Post-yield characteristics of magnetorheological fluids; from modelling to large-amplitude vibration analysis of sandwich plates using nonlinear finite element method. *Aerospace Science and Technology*.
6. K. Khorshidi, M. Bahrami, **M. Eshaghi**, M. Ghasemi (2021) A comprehensive nonlocal surface-piezoelectricity model for thermal and vibration analyses of piezoelectric nanoplates. *Composite Structures*.
7. R. Nazemnezhad, M. Rabiei, P. Shafaat, **M. Eshaghi** (2021) Large amplitude free torsional vibration analysis of size-dependent circular nanobars using elliptic functions. *Structural Engineering and Mechanics, An International Journal.*
8. **M. Eshaghi** (2020) The effect of magnetorheological fluid and aerodynamic damping on the flutter boundaries of MR fluid sandwich plates in supersonic airflow, *European Journal of Mechanics*, 82: 103977.
9. R. Aboutalebi, **M. Eshaghi**, A. Taghvaeipour (2020) Nonlinear vibration analysis of circular/annular/sector sandwich panels incorporating magnetorheological fluid operating in the post-yield region. *Journal of Intelligent Material Systems and Structures*.
10. **M. Eshaghi** (2020) Supersonic flutter analysis of annular/circular sandwich panels containing magnetorheological fluid, *Journal of Sandwich Structures and Materials*, 0(0) 1–20.
11. **M. Eshaghi**, R. Sedaghati, S. Rakheja (2017) Vibration analysis and optimal design of multi-layer plates partially treated with the MR fluid. *Mechanical Systems and Signal Processing*, 82: 80-102.

12. **M. Eshaghi**, R. Sedaghati, S. Rakheja (2016) Analytical and experimental free vibration analysis of multi-layer MR-fluid circular plates under varying magnetic flux. *Composite Structures*, 157: 78-86.

13. **M. Eshaghi**, R. Sedaghati, S. Rakheja (2016) Dynamic characteristics and control of magnetorheological/electrorheological sandwich structures: A state-of-the-art review. *Journal of Intelligent Material Systems and Structures*, Review Article: 1-35.

14. **M. Eshaghi**, R. Sedaghati, S. Rakheja (2015) The effect of magneto-rheological fluid on vibration suppression capability of adaptive sandwich plates: Experimental and finite element analysis. *Journal of Intelligent Material Systems and Structures*, Special Issue Article: 1-16.

15. **M. Eshaghi**, R. Bhat (2015) Curve veering in torsional systems with stepped shafts. *World Journal of Mechanics* 5 (05), 86.

16. **M. Eshaghi**, S. Rakheja, R. Sedaghati, F. Yang (2014) Optimum design of a partially treated MR-fluid sandwich plate. *Vibroengineering PROCEDIA*, 5, 452-457.

17. **M. Eshaghi**, S. Rakheja, R. Sedaghati (2014) An accurate technique for pre-yield characterization of MR fluids. *Smart Materials and Structures*, 24: 1-22.

18. **M. Eshaghi** (2013) Accurate approach implementation in vibration analysis of thick sector plates. *International Journal of Mechanical Sciences*, 79: 1-14.

19. Sh. Hosseini-Hashemi, K. Khorshidi, **M. Eshaghi**, M. Fadaee, M. Karimi (2012) On the effects of coupling between in-plane and out-of-plane vibrating modes of smart functionally graded circular/annular plates. *Applied Mathematical Modelling*, 36(3): 1132-1147.

20. H. Bisadi, **M. Eshaghi**, H. Rokni, M. Ilkhani (2012) Benchmark solution for transverse vibration of annular Reddy plates. *International Journal of Mechanical Sciences,* 56(1): 35-49.

21. **M. Eshaghi**, Sh. Hosseini-Hashemi, M. Fadaie (2011) Vibration analysis of piezoelectric FGM sensors using an accurate method. *International Journal of Mechanical Sciences*, 53(8): 585-594.

22. Sh. Hosseini-Hashemi, **M. Eshaghi**, H. Rokni Damavandi Taher (2010) An exact analytical solution for freely vibrating piezoelectric coupled circular/annular thick plates using Reddy plate theory. *Composite Structures*, 92: 1333–1351.

Michael Feuerherm, MASc., P.Eng.

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Education

Carleton University | Ottawa, ON — August 2019
Master of Applied Science, Electrical and Computer Engineering

Carleton University | Ottawa, ON — August 2017
Bachelor of Engineering, Aerospace Electronics and Systems, Co-op Option

Relevant Qualifications

- Licensed Professional Engineer with Professional Engineers Ontario.
- Knowledgeable with implementing experiential learning approaches within design-based courses.
- Experienced in using hardware such as oscilloscopes, signal generators, and vector network analyzers.

Work Experience

Instructor (Full-time) — July 2019 – Present
Carleton University – Department of Electronics, Faculty of Engineering and Design | Ottawa, ON

- Co-supervised and mentored an MASc. student, providing guidance on proper research procedure, system implementation and testing, and funding applications.
- Participated as a member of the departmental curriculum committee, collected opinions from faculty members, and provided input for decisions regarding current and future departmental program curriculum.
- Supervised capstone project teams on topics such as the design of radio frequency integrated circuit transceiver components and utilizing microcomputers to create a safer experience for wheelchair users.
- Created and presented lectures for two courses:
  - Introduction to Mechatronics – designed the course material to provide students with several background topics for mechatronics applications, including various design approaches.
  - Introduction to Electronics – designed the course material in such a way that students would have the theoretical knowledge to build filters for implementation in professional settings.
- Built several laboratory experiments for two courses:
  - Introduction to Electronics – Created multiple laboratory experiments with a focus on practical knowledge, building towards the implementation and testing of several resistor, capacitor, and inductor-based filters, both in simulation and hardware.
  - Introduction to Mechatronics – drafted project-based laboratories that introduced students to physical computing with the use of a Raspberry Pi and several varied input/output devices. The laboratory experiments were designed to enable students to build and use of a facial tracking camera, which students could modify and improve upon.
- Coordinated departmental recruitment initiatives, providing prospective students with information regarding degree requirements and in-program experiences, and revitalized recruitment materials.
- Provided experiential learning opportunities for students through procuring and supervising the implementation of a printed circuit board creation device and training materials.
- Offered a 4th year course on RADAR and Navigation, providing an overview of RADAR and Navigation systems and circuits, their functionality, and their limitations, while also redesigning the course-pack and introducing new course content.
- Designed, implemented, and successfully tested a novel concept for self-interference cancellation in radio transceivers for use in telecommunications and RADAR applications.
- Consulted with the lab manager to select lab hardware, as well as design and implement workstations for students.

Head Teaching Assistant/Teaching Assistant September 2017 – April 2019
Carleton University, Faculty of Engineering | Ottawa, ON

- Presented multiple lectures covering course material, to cement student understanding and address any knowledge gaps that may exist.
- Directed and executed laboratory sessions for students, presenting an overall structure of the experiment as well as assisting with theoretical understanding and electrical debugging of circuits.
- Organized laboratory work for all students and teaching assistants, including scheduling and modification of lab description documents, ensuring the expectations and knowledge for the lab were presented to students in a proper, clear and concise manner.
- Reviewed and graded lab report submissions, assignments, and final exams, ensuring all necessary information was present and the required knowledge was understood.

Co-op Test/Systems Engineer – DND Maritime Helicopter Project May 2015 - August 2016
General Dynamics Mission Systems | Ottawa, ON

- Conducted design presentations both internally and with customers to discuss and present a new system design, including requirements, and give status reports of implementation of the design to all stakeholders.
- Planned, developed, and executed verification procedures including configuration descriptions and expected outcomes, ensuring alignment of the implemented system with design documents and requirements.
- Reported, investigated, and responded to verification and system design problem reports for multiple subsystems.

Relevant Coursework

Advanced Topics in VLSI September 2017 - December 2017

- Calculated component specifications such as gain, linearity, noise figure, and filter order for mixers, power amplifiers, and filters to meet required system performance.
- Programmed modules within MATLAB to simulate power amplifiers, and mixers considering noise figure, linearity, and gain implications.
- Integrated multiple modules to simulate a system level transceiver, ensuring that system requirements were met while also maintaining component specification feasibility.

Radio Frequency Circuit Design January 2018 - April 2018

- Characterized active components to measure their parameters such as transit frequency and maximum frequency of Oscillation, as well as create reference plots for bias current and small signal gain for varying bias voltages.
- Calculated initial component sizing based on the characterization performed, subsequently implemented the design into Cadence Virtuoso and adjusted the circuit for sources of error not originally accounted for in the design calculations.
- Simulated the final design over temperature corners using realistic models for all transistors, inductors, and capacitors within the circuit ensuring all design specifications were met across all areas of interest

Graduate Supervision

Master's Students

In Progress	Completed
0	1

- Connor Bezanson, MASc., "*A Novel Analog-Based Matched Filter Design*", January 2024

NSERC CRSNG

Canadian Common CV commun canadien

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This is a draft version only. Do not submit to any funding organization. Only the final version from the History page can be submitted.

Dr. Irina T. Garces

Correspondence language: English

Contact Information

The primary information is denoted by (*)

Address

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Ottawa Alberta K1S5W4
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NSERC CRSNG

Canadian Common CV commun canadien

Protected when completed

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Dr. Irina Garces

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes
Spanish; Castilian	Yes	Yes	Yes	Yes	Yes

Degrees

- 2022/11 — Post-doctorate, Mechanical Engineering and Civil Engineering, University of Alberta
- 2021/1 — Doctorate, Mechanical Engineering, University of Alberta
  Supervisors: Cagri Ayranci, 2014/9 - 2020/8
- 2014/6 — Bachelor's Honours, Mechanical Engineering, Universidad de las Fuerzas Armadas-ESPE
  Supervisors: Ernesto Echeverria, 2013/6 - 2014/6; Carlos Naranjo, 2013/6 - 2014/6

Recognitions

2022/7
Best Presentation Award at the Advanced Manufacturing Symposium
Canadian Society of Mechanical Engineers
Honor
Award at the 2022 CSME International Congress

2021/7 - 2022/7
MITACS ELEVATE - 120,000
University of Alberta
Prize / Award
Funding fellow for the duration of two years and a training program

User Profile

Research Specialization Keywords: nanocomposites, smart materials, polymers, composite materials, solid mechanics modelling, mechatronics, machine design, manufacturing

Employment

2023/1
Assistant Professor
Mechanical and Aerospace Engineering, Carleton University
Full-time, Assistant Professor
Tenure Status: Tenure Track

2015/1 — Independent Consultant- project-based work
Copperstone Technologies
Led the development and manufacturing of composite screw-drive wheels for amphibious robots. Involved in the design and fabrication of mechanical components for robotic payloads. Provided guidance on material selection for critical components subjected to high loads and harsh environmental conditions. Was part of the team in field deployments of an amphibious robot for bathymetry, sampling, and sensor placement for environmental monitoring of pit lakes in coal mines.

2021/2 - 2022/11 — Post Doctoral Fellow
Mechanical Engineering, University of Alberta
Full-time, Term
Tenure Status: Non Tenure Track
Research on Additive Manufacturing of Lyocell as part of a MITACS elevate. My work was divided between the partner organization (Innotech Alberta) and the university.

2021/9 - 2021/12 — Instructor MECE 569
Mechanical Engineering, University of Alberta
Part-time, Sessional, Lecturer
Tenure Status: Non Tenure Track
Instructor for the graduate course named Introduction to Composite Materials. The course consisted of 33 students.

2016/1 - 2020/8 — Teacher Assistant
Mechanical Engineering, University of Alberta
Part-time
Tenure Status: Non Tenure Track
During my PhD degree I held ~ 9 TA positions for Advanced strength of materials, mechanical and design of composite materials and engineering graphics and cad.

2019/9 - 2019/12 — Instructor MEC E 380
Mechanical Engineering, University of Alberta
Part-time, Sessional, Lecturer
Tenure Status: Non Tenure Track
Prepared and delivered the course for Advanced strength of Materials. The course consisted of 130 students.

2018/5 - 2018/8 — MEC E 260 (Spring-Summer 2018) - Mechanical Design (I)
Mechanical Engineering, University of Alberta
Part-time, Sessional, Lecturer
Tenure Status: Non Tenure Track
I was the instructor for ~ 40 students. Mechanical. In groups, students design and build a vehicle to compete against each other. Besides teaching the basics of design in the course, I was actively involved in updating the course material and designing the final competition, which involved the design of a Mars rover.

Research Funding History

Awarded [n=2]

2023/4 - 2028/3
Principal Investigator

“Designing and utilizing materials as machines: towards customizable, low-cost self-sensing actuating smart materials for adaptable systems and devices”, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 172,500

Portion of Funding Received - 44,500
Funding Competitive?: Yes

2021/1 - 2027/1
Principal Investigator

Start-up Funds for New Faculty, Grant

Funding Sources:
Carleton University
Total Funding - 100,000
Portion of Funding Received - 100,000
Funding Competitive?: No

Student/Postdoctoral Supervision

Master's Thesis [n=1]

2022/1 - 2024/1
Co-Supervisor

Marco Paez (In Progress) , University of Alberta
Student Degree Expected Date: 2022/1
Thesis/Project Title: Large scale self-sensing additive manufactured parts
Present Position: Student

Event Administration

2021/2 - 2022/8

Host and Administrator, Monthly Rainforest Connectors, Seminar, 2021/2 - 2022/8

Knowledge and Technology Translation

2021/6 - 2022/11

Co-Founder, Involvement in/Creation of Start-up
Group/Organization/Business Serviced: Octo-M Technologies
Target Stakeholder: Industry/Business-Small (<100 employees)
Outcome / Deliverable: Company focuses on the development of a sensor to detect quantify and characterize microplastics in water bodies.
Activity Description: I am currently the director of the company but I am not an employee, or hold any renumeration. This company started as an independent research project. The research involved in this project is completely separate from the present proposal and my research program.

2015/9 - 2021/12

Consultant, Involvement in/Creation of Start-up
Group/Organization/Business Serviced: Copperstone Technologies
Target Stakeholder: Industry/Business-Small (<100 employees)
Outcome / Deliverable: Involved as an Independent consultant. Please check previous section for details.

Other Memberships

2022/10

Board Member, Canadian Association for Composite Structures and Materials
Board Member

2021/5

Member, The Association of Professional Engineers and Geoscientists
Engineer in Trainning

Presentations

1. (2023). "Designing for 4D printing". SDPS Workshop - Design & 4D Printing panel session, Concordia University, Montreal, Canada
   Main Audience: Researcher
   Invited?: Yes, Keynote?: No
2. Garces Irina, Tri-Dung Ngo, Yaman Boluk, Cagri Ayranci. (2022). Rheology and extrusion of Lyocell towards additive manufacturing of regenerated cellulose. 2022 CSME International Congress, Edmonton, Canada
   Invited?: No, Keynote?: No

Publications

Journal Articles

1. Garces I.T., Tang T., Ayranci C. (2023). Review on Modelling Thermoresponsive Shape Memory Polymers and their Composites. Smart Structures.
   Submitted
   Refereed?: Yes, Open Access?: No
2. Garces I.T., Ngo T.D., Ayranci C., Boluk Y. (2023). Rheology, extrusion characterization and 3D printing of sustainable regenerated cellulose. ACS applied materials & interfaces.
   Submitted
   Refereed?: Yes, Open Access?: No
3. I.T.Garces, T.Tang, C.Ayranci. (2023). A Viscoelastic Model for Shape Memory Polymers Under Bending. Smart Structures.
   Submitted
   Refereed?: No, Open Access?: No
4. Demir E. C., Garces I.T., McDermott M.T., Kim C. I., Ayranci C. (2023). Towards Filamentless Extrusion-Based Additive Manufacturing of Nanocomposites: Cellulose Nanocrystals Reinforced Polyamide 12 (Part A). Composite Part A.
   Submitted
   Refereed?: Yes, Open Access?: No
5. Garces, Irina Tatiana and Ayranci, Cagri. (2021). Advances in additive manufacturing of shape memory polymer composites. Rapid Prototyping Journal.
   Published
   Refereed?: Yes, Open Access?: No
6. Chen, Yu and Garces, Irina Tatiana and Tang, Tian and Ayranci, Cagri. (2020). Cellulose nanocrystals reinforced shape memory polymer cardiovascular stent. Rapid Prototyping Journal.
   Published
   Refereed?: Yes, Open Access?: No
7. Garces, IT and Ayranci, C. (2020). Active control of 4D prints: Towards 4D printed reliable actuators and sensors. Sensors and Actuators A: Physical. 301: 111717.
   Published
   Refereed?: Yes, Open Access?: No
8. Garces, Irina T and Aslanzadeh, Samira and Boluk, Yaman and Ayranci, Cagri. (2020). Cellulose nanocrystals (CNC) reinforced shape memory polyurethane ribbons for future biomedical applications and design. Journal of Thermoplastic Composite Materials. 33(3): 377--392.
   Published
   Refereed?: Yes, Open Access?: No

9. Garces, Irina T and Aslanzadeh, Samira and Boluk, Yaman and Ayranci, Cagri. (2019). Effect of moisture on shape memory polyurethane polymers for extrusion-based additive manufacturing. Materials. 12(2): 244.
   Published
   Refereed?: Yes, Open Access?: Yes
10. Garces, IT and Ayranci, C. (2018). A view into additive manufactured electro-active reinforced smart composite structures. Manufacturing letters. 16: 1--5.
    Published
    Refereed?: Yes, Open Access?: No

Reports

1. Representative: Cagri Ayranci. Authors: Irina Garces, Abdelhaq Benkadoor, Jiawei Chen, Mark McDermott, Tian Tang, Cagri Ayranci. (2021). Towards Large-Scale Unconventional Micro-meter Diameter. 5. Alberta Innovates.
2. Y.Chen, I. T. Garces, T. Tang, C.Ayranci. (2019). EBAM-Extrusion Based Additive Manufacturing of SMP-Shape Memory Polymers. 15. Innotech Alberta.
3. Garces, I.T, and Ayranci,C. (2017). Realizing the potential benefits of CNC for the rapidly developing additive manufacturing market. 30. Innotech Alberta.

Conference Publications

1. I.T. Garces, J. Goncalves, T.D. Ngo, Y. Boluk, C. Ayranci1. (2023). Additive Manufacturing of Lyocell. ICCM23. International Conference on Composite Materials (ICCM), Belfast, Ireland
   Conference Date: 2023/7
   Paper
   Accepted
   Refereed?: Yes, Invited?: No
2. Garces I.T. ,Tang, T. , Ayranci, C. (2023). A Simple Predictive Model for Bending of Shape Memory Polymers. International Conference on Composite Materials (ICCM), Belfast, Ireland
   Conference Date: 2023/7
   Paper
   Accepted
   Refereed?: Yes, Invited?: No
3. Garces,I.T. and Ayranci C. (2019). Additive Manufactured Electroactive Shape Memory Polymer Composites. 22th International Conference of Composite Materials, Melbourne, Australia
   Paper
   Published
   Refereed?: Yes, Invited?: No
4. Garces, I.T., Aznarte, E., Ngo, T-D, Melenka, G.W., and Ayranci, C. (2018). Additive Manufacturing Bio-based Filaments Reinforced with Cellulose Nanocrystals. 12th Joint Japan-Canada joint conference., Takayama, Japan
   Paper
   Published
   Refereed?: Yes, Invited?: No
5. Schiavone, A., Garces, I.T. , Melenka, G.W. , and Ayranci, C. (2018). Achieving Structural Health Monitoring Using Additive Manufacturing. 12-Joint Japan-Canada joint Conference, Edmonton, Canada
   Paper
   Published
   Refereed?: Yes, Invited?: No

6. Garces, I. T., Aslanzadeh, S., Boluk, Y., Ayranci, C. (2017). Tailoring Properties of Shape MemoryPolymers Using Celulose Nanocrystals. 10th Canadian International Conference CANCOM, Ottawa, Canada
   Paper
   Published
   Refereed?: Yes, Invited?: No

7. Milne L., Romamiak D., Villacres J., Ivey M., Garces I. T., and C. Ayranci. (2017). Pilot Study: Evaluation of Shape Memory Polymer use in Orthodontic Arch wires. IADR/AADR/CADR, San Fancisco, United States of America
   Poster
   Published
   Refereed?: Yes, Invited?: No

Rose (Shaghayegh) Gomar

rosegomar@cunet.carleton.ca
(519) 991 1904
www.linkedin.com/in/RoseGomar

EDUCATION

Ph.D. Degree in Electrical and Computer Engineering May 2015-Mar 2019
University of Windsor, Windsor, ON, Canada
Dissertation: Digital Hardware Implementation of Spiking Neural Network

M.Sc. Degree in Electrical Engineering Sep 2011-Sep 2013
Razi University, Kermanshah, Iran
Thesis: Digital Multiplier-less Implementation of Adaptive Exponential Neuron Model

B.Sc. Degree in Electrical Engineering Sep 2007-Sep 2011
Razi University, Kermanshah, Iran

TEACHING EXPERIENCE

Instructor II Aug 2022-Present
Carleton University, Ottawa, ON Canada

- **Systems on Chip (SYSC 3320):** This is a 3rd year undergraduate course. Topics include computer architecture, ARM processor and its instructions, VHDL programming and hybrid digital system design approach. I taught this course two times.
- **Digital Systems Design (SYSC 2310):** taught the basics of digital circuit design. Topics included number systems, Boolean algebra, combinational and sequential circuits designs and analysis, and finite state machines. I taught this course three times.
- **Computer Systems Architecture (SYSC 4310):** This is a 4th year undergraduate course. I taught advanced computer systems architecture including supercomputers, vectors, and multi-threaded processors. I taught this course two times.

Lecturer Sep 2020-Aug 2022
Concordia University, Montreal, QC, Canada

- **Microprocessor-based Systems (COEN 317):** developed and taught the course for three semesters. Topics included microprocessor architecture, instruction sets, interfacing and I/O organization.
- **Computer Organizations and Software (COEN 311):** developed and taught the course for three semesters. Topics included microprocessor architecture, addressing modes, instructions, subroutine and interrupts, and assembly programming.
- **Digital System Design I (COEN 212):** taught the basics of digital circuit design for three semesters. Topics included number systems, Boolean algebra, combinational and sequential circuits designs, and finite state machines.
- **Microprocessors and their Applications (COEN 6711):** developed and taught advanced topics related to microprocessors based on ARM processor. This was a graduate course.
- **Programming Methodology I (COEN 243):** taught the course for two semesters. Topics included the basics of programming in C++ and an introduction on object-oriented programming.

Lab-Coordinator Aug 2019-Dec 2019
University of Windsor, Windsor, ON, Canada

- **Mentorship**
  - Instructed students on how to use CAD tools and embedded boards
  - Evaluated students' digital circuit and embedded systems course projects
  - Guided students through their courses and research projects

Instructor Sep 2017-Aug 2019
St. Clair College, Windsor, ON, Canada

- **LabView (BME501)**: developed and taught the concepts of digital signal processing and data acquisition by LabVIEW.
- **Microcomputer (EET315):** taught microcomputer architecture and assembly programming

(lecture and lab).

- **Introductory programming (ERT207)**: re-developed the course and taught the basic constructs of C# programming (lecture and lab).
- **DC Fundamentals (ELT103):** taught the basics of electrical components including resistors, capacitors, and inductors. Described the basic circuit analysis laws such as KCL and KVL.
- **Microcontroller programming for electrical engineering applications (EET237):** re-developed and taught the fundamentals of microcontroller programming.

Graduate Assistant (GA) Sep 2016-Apr 2019

University of Windsor, Windsor, ON, Canada

- Electronic II lab (ELEC-3160)
- Digital Logic Design lab for two semesters (ELEC-2170)
- Circuit Analysis (ELEC-2140)
- Digital Signal Processing (ELEC-4570)

TEACHING AWARDS AND GRANTS

Future Learning Innovation Fellowship ($10,000) Dec 2023-Apr 2025

- A competitive fund to implement innovated teaching methodologies using learning analytics.

Experiential Learning Fund ($2,500)

- Was granted this fund to develop new experiential learning activities for the system on chip course Feb 2024 – Aug 2024

UNDERGRADUATE SUPERVISION

4th Year Project Supervision Sep 2022-Present

- Co-supervised four 4th year undergraduate projects
- Second-reader for seven undergraduate 4th year projects

PROFESSIONAL SERVICES

Member of Faculty Committee on Admission and Studies (CAS) May 2023-Present

Carleton University, Ottawa, ON

- Participated in monthly meetings
- Investigated the students requests for backdated withdraw, 4th attempt courses, re-admission to programs

CUASA Representative May 2023-Present

Carleton University, Ottawa, ON

- Participated in monthly meetings
- Served as the connection between the department and the Union
- Arranged meetings for CUASA departmental visits
- Conveyed information between the union and the department

Member of Carleton Centre for Research in Engineering Education (CCREE) Feb 2023- Present

Carleton University, Ottawa, ON

- A faculty-level group dedicated to conduct research in engineering teaching.
- Participated in meetings and discussed ideas, projects and goals to improve teaching in engineering.

Curriculum Development Activities Jan 2023- April 2023

Carleton University, Ottawa, ON

- Reviewed the curriculum content of three courses within the computer systems track: Compute Organizations (SYSC 2320), Systems on Chip (SYSC 3320), and Computer Systems Architecture (SYSC 4310).
- Identified areas of overlap between the courses and noted insufficient coverage of certain topics.
- Participated in collaborative meetings with another faculty member to discuss potential revisions to

the course content.
- Presented proposals to the Department Academic Planning Committee aimed at reducing curriculum redundancies, incorporating additional topics, and enhancing overall course content. These proposals, were discussed with the department chair and documented for presentation at the department academic planning meeting, were subsequently approved by the committee. The approved changes will be implemented starting in the Fall semester of 2025.

Teaching Demonstration Sep 2023
Carleton University, Ottawa, ON
- Conducted a demonstration showcasing a handwriting tablet designed to enhance the teaching methodologies employed in problem-solving courses.

Member of Hiring Committee Feb 2023-Present
Carleton University, Ottawa, ON
- Engaged in equity, diversity, and inclusivity (EDI) training sessions designed for members of hiring committees.
- Participated in the shortlisting process for candidates applying for an Instructor position specializing in embedded systems

Member of Hiring Committee Dec 2021-July 2022
Concordia University, Montreal, QC
- Participated in equity, diversity, and inclusivity (EDI) training session for hiring committee members
- Participated in the interview sessions

Undergraduate Services Sep 2020-Present
Concordia University, Montreal, QC
- Member of undergraduate committee
- Member of graduate attribute evaluation committee
- Developed undergraduate curriculum
- Co-supervised capstone projects

Graduate Services Sep 2021-Present
Concordia University, Montreal, QC
- Member of graduate committee
- Evaluated graduate awards applications
- Developed graduate curriculum

Academic Examiner of Undergraduate Work-Term Projects Dec 2021-Present
Concordia University, Montreal, QC
- Evaluated undergraduate students' work-term reports

Organizer of GirlSET Bootcamp Program July 2021 and 2022
Concordia University, Montreal, QC
- Organized a two-week bootcamp program to promote engineering fields among female high-school students
- Conducted workshops for high-school students

IEEE Windsor Section Services Sep 2016-Aug 2018
University of Windsor, Windsor, ON, Canada
- Chair of IEEE Women in Engineering (WIE), University of Windsor (Sep 2017-Aug 2018)
- Vice-Chair of IEEE Women in Engineering (WIE), University of Windsor (Sep 2016-Sep 2017)

Organizer of Conferences Aug 2017 and Aug 2018
University of Windsor, Windsor, ON, Canada
- Organized electrical and computer engineering conferences held in Windsor, ON (CCECE 2017 and Midwest 2018)

WORKSHOPS AND CERTIFICATES

- Successfully completed "Course Design Fundamentals (CDF) program" (Jun 2023-Sep 2023)
  - A collection of 5 workshops and 15 hours completion
- "University Teaching Certificate", Carleton University (Jan 2023- April 2023)
  - An 11-week course with 6-7 hours of commitment per week
- "Teaching Effectiveness" meeting, Carleton University (April 2023)
- "No More Brains on Sticks: A Case for Embodied Learning", presented by Susan Hrach, Fulbright Canada Distinguished Chair in the Scholarship of Teaching and Learning (SoTL), Carlton University (March 2023)
- "AI and Education in Systems and Computer Engineering", Carleton University (March 2023)
- "New Faculty Orientation", Carleton University (Sep 2022)
- Training modules on "Brightspace" learning management system, Carleton University (Aug 2022)
- "Getting started with Moodle", Concordia University (Oct 2020)
- "Universal Design for Learning and Inclusive Teaching", Concordia University (Sep 2020)
- "Moodle quiz", Concordia University (Sep 2020)
- "Crucial conversation on teaching and learning", University of Windsor (May 2019)
- "Teaching for Critical Thinking and Transfer by Integrating Metacognition Instruction" Workshop, University of Windsor (May 2019)
- "IBM Artificial Intelligence workshop", University of Windsor (Sep 2018)
- "Certified National Instrument (NI) LabView Associate Developer (CLAD)", University of Windsor, (Dec 2017)
- "Workshop for part-time instructors", St. Clair College (Sep 2017)
- "Mitacs presentation skills I workshop", University of Windsor (Sep 2017)
- "GATAcademy teaching skills workshop", University of Windsor (Sep 2015)

INDUSTRIAL EXPERIENCE

Digital Design Engineer Dec 2019-Aug 2020

Huawei Ottawa Research and Development Center, Ottawa, ON, Canada

- Digital design (front-end):
  - Designed and simulated asynchronous multiple clock digital circuits and systems
  - Designed first in-first out (FIFO) memory block and gearbox (data-bus width converter)
  - Designed finite state machine (FSM) to control signals power up and down sequence
  - Automated RTL code generation using Python script
  - Worked with Cadence and Synopsys design tools
  - Designed high-speed low-power circuits
  - Handled cross domain clock (CDC) signals
  - Performed pre-layout, post-layout, gate-level, and RTL simulations
  - Performed digital circuit power estimation (using PrimeTime)
- Verification
  - Supported the verification team to write test cases for verifying the functionality of designed digital building blocks.

HONORS AND AWARDS

- The recipient of Ontario Trillium Scholarship (OTS) at the University of Windsor (total of $160,000), Windsor, ON, Canada (May 2015)
- Ranked 3rd best student (among 40 M.Sc. Electrical Engineering students), Razi University, Kermanshah, Iran (July 2013)
- Ranked 6th best student (among 75 B.Sc. Electrical Engineering students), Razi University, Kermanshah, Iran (July 2011)
- One of the top 0.8% of students in Nationwide Entrance Exam for entering University (B.Sc. degree) among about 500,000 participants (Sep 2007)

PUBLICATIONS

Journal papers:

Sh. Gomar, and M. Ahmadi, "Digital hardware implementation of gaussian Wilson–Cowan neocortex model," *IEEE Transactions on Emerging Topics in Computational Intelligence*, Vol. 3, no.1, pp. 24-35, 2019.

E. Eskandari, A. Ahmadi, and **Sh. Gomar**, "Effect of spike-timing-dependent plasticity on neural assembly computing." *Neurocomputing*, vol. 191, pp. 107-116, 2016.

Sh. Gomar, and A. Ahmadi, "Digital multiplierless implementation of biological adaptive-exponential neuron model," *IEEE Transactions on Circuits and Systems I*, Regular Papers vol. 61, no. 4, pp. 1206-1219, 2014.

Conference presentations:

Sh. Gomar, and M.Ahmadi. "A Digital Pseudo Random Number Generator Based on a Chaotic Dynamic System," *26th IEEE International Conference on Electronics, Circuits and Systems (ICECS),* 2019.

Sh. Gomar, and M. Ahmadi, Digital Realization of PSTDP and TSTDP Learning," *International Joint Conference on Proceeding, Neural Networks (IJCNN),* 2018.

Sh. **Gomar**, M. Mirhassani, and M. Ahmadi, "Precise digital implementations of hyperbolic tan and sigmoid function," *50th IEEE Asilomar Conference on Signals, Systems and Computers*, 2016.

Sh. Gomar, et al, "A digital neuromorphic circuit for neural-glial interaction," *IEEE International Joint Conference on Neural Networks* (IJCNN), 2016.

Sh. Gomar, A. Ahmadi, Sh. Alirezaee, M. Ahmadi, M. Mirhassani, "Neuromorphic CPG Based on Adaptive Exponential Neuron Model, *ICECS*, 2014.

A. Kazemi, A. Ahmadi, **Sh. Gomar**, "A Digital Synthesis of Hindmarsh-Rose Neuron: A Thalamic Neuron Model of the Brain*", 22nd IEEE Iranian Conference on Electrical Engineering (ICEE),* 2014.

Sh. Gomar, A. Ahmadi, and E. Eskandari, "A modified adaptive exponential integrate and fire neu- ron model for circuit implementation of spiking neural networks." *21st IEEE Iranian Conference on Electrical Engineering (ICEE),* 2013.

M. Eslamdoost, A. Ahmadi, M. Ahmadi, **Sh. Gomar**, "Fast multi-match packet classification using index bits", *3th IEEE International Conference on Computer and Knowledge Engineering*, 2013.

Sh. Gomar, S. V. Makki, Sh. Alirezaei, "Optimum Dimension of Crossed Field Antenna (CFA)Using The Quasi Scheme", *4th International Conference on Computational Intelligence and Commu- nication Networks*, 2012.

COMPUTER AND TECHNICAL SKILLS

- Programming Languages: C, C++, C#, MATLAB, Python, Verilog, VHDL, LabVIEW
- Software: Microsoft Visual Studio, Eclipse, ModelSim, FPGA Compilers (Xilinx ISE, Altera Quartus II), Multisim, PSpice, Cadence, Synopsys, PrimeTime
- Hardware/ Microcontrollers/ Microprocessors: Embedded systems, Xilinx and Altera FPGAs, Arduino, STMicroelectronics devices, PIC, ARM, AVR, Z80, 8085, 8086, RISC-V

REFRENCES

Prof. Majid Ahmadi, University of Windsor, ON, Canada
ahmadi@uwindsor.ca

Dr. Arash Ahmadi, Carleton University, ON, Canada
ArashAhmadi3@cunet.carleton.ca

Dr. Rashid Rashidzadeh, University of Windsor, ON, Canada
rashidza@uwindsor.ca

Derek I. Gransden, Ph. D.

CONTACT *Phone*: (613) 818 6459 *Email*: digransden@gmail.com or derek.gransden@carleton.ca
Citizenship: Canadian

EDUCATION

Doctor of Philosophy in Aerospace Engineering *2005 – 2011*
Carleton University

- Thesis Title: *Aeroservoelasticity of Rotorcraft Hubs*
  - Modelled constrained parallel-chain rigid kinematics with nonlinear elastodynamics for vibration transmissibility attenuation using state-switching control.

Bachelor Degree of Aerospace Engineering *1999 – 2003*
Carleton University

- Awarded Distinction in aerospace structures stream.

PEDOGOGICAL EXPERTISE

Master Lecturer/Assistant Professor

Carleton University (Carleton) *2022 – Present*

- Developing aeronautical laboratory experiments for 4th year students.
- Using blended learning to deliver on- and offline content for students across all years of undergraduate studies.
- Assisting Msc students with nonlinear contact dynamics simulations using FEM.

Laurentian University (LU) *2018 – 2022*

- Experienced with blended learning, gamification, and other pedagogical techniques.
- Developed synchronous and asynchronous delivery including videos and online demonstrations.
- Created and taught courses to Chinese students from Jiangxi University of Science and Tech (JXUST) as part of a student-sharing program between the two universities.

Delft University of Technology (TUD) *2011 – 2017*

- Obtained University Teaching Qualification (UTQ) in 2017.
- Nominated Teacher-of-the-Year in 2017 by students.

Courses Delivered

- **Design teaching stream** *2011 – Present*
  - *Graphics and Design (1st year, LU/JXUST, Carleton)*
    - Taught in person at Laurentian and Carleton and online for Jiangxi University of Science and Tech (JXUST).
    - Systems-centric design content with a focus on drafting standards and procedures.
    - Introduced project skills, interpersonal development, decision making charts, bill of materials, work breakdown structures, and work flow diagrams.
  - *Experimental Research and Data Analysis (2nd year, TUD)*
    - Project exercise designed to extract information from large data sets and create useful (analytical) products.
    - No formal lecturing, but meetings with students during the semester twice per week for updates and guidance.

- *Design Synthesis Exercise (3rd (final) year, TUD)*
  - Systems-centric design content, based on tutor objective.
  - Teams of 10 students, working full time for 10-weeks (4000 person-hours) on a project, formal lectures (MBTI personality and interpersonal skills and some project management techniques) only in first week of work.
  - Acted as coach for 5 years on aerospace design teams, co-lead team to win European Space Agency award in 2017 for Saturn Ring Observer (SAURON).
- *Aerospace Engineering Design (4th year, LU)*
  - Created a systems-centric design course based on aircraft conceptual design philosophy.
  - Introduced flight theory, basic definitions and standards for aircraft, examples of aircraft systems that were developed in the project.
  - Emphasis on communication, written and oral – students develop logbooks as recommended in engineering to keep daily records of work – set deliverables: reporting and video presentation.
- *Aerospace Vehicle Performance (4th year, Carleton)*
  - Taught principles of vehicle kinetics and developed equations useful for the analysis of aircraft.
  - Elaborated on performance characteristics and parameters useful for comparing different aircraft and their abilities.
- *CAD/CAM (4th year, Carleton)*
  - Instructed students on the basics of computer aided engineering and manufacturing.
  - Created design projects that require students to show their understanding of manufacturing, design, and analytical skills in a competition-like format.
- *Capstone Project (4th year, Carleton)*
  - Assisted students with the structural design of a bio-inspired environmentally-friendly battery-powered autonomous aircraft.
  - Chaired weekly update meetings with the full group of students and with the structures team separately.
  - Evaluated design work on structural aspects of a new aircraft design.
  - Supported students' bio-inspiration to add to the design of an aircraft.
- *Forensic Engineering (MSc, TUD)*
  - Co-ordinated exercises to support stages of forensic discovery as part of aircraft accident investigation.
  - Field exams conducted and supervised (with actual wreckage) to re-create aircraft accidents, including data recovery, deduction of events, analysis, and communication.

- **Mechanics teaching stream** *2011 – Present*
  - *Applied Mechanics I/Statics (1st year, LU/TUD)*
    - Developed gamified learning techniques for students in difficult 1st year course.
    - Lectured vector math and Newton's Laws for external and internal forces.
  - *Applied Mechanics II/Dynamics (1st year, LU/TUD/Carleton)*
    - Developed gamified and blended learning classroom with asynchronous content.
    - Substantially improved the pass-rate in very high attrition-rate courses.
    - Used demonstrations for Newton's 2nd Law and energy/momentum concepts of particles and rigid bodies.

- *Mechanics and Strengths of Materials I (2nd year, LU/ 1st year, TUD)*
  - Developed demonstrations for traditional classroom environment.
  - Taught Mohr's circle, stress and strain, beam bending, torsion, shear/shear flow theory.
- *Mechanics and Strengths of Materials II (3rd year, Carleton)*
  - Supervised lab demonstrations for student teams.
  - Taught unsymmetric beam bending analysis, energy methods, prelude to finite element analysis, and twisting of non-circular shafts.
- *Aerospace Lightweight Structures (3rd year, Carleton)*
  - Presented concepts relating to lightweight structural design.
  - Course material includes energy methods, Castigliano's and Rayleigh-Ritz methods, open- and closed-beam system analysis.
- *System Modelling and Simulation (3rd year, LU)*
  - Continuation of Dynamics, online only due to COVID, presented MATLAB skills, and lectured on linearised single and multi-degree of freedom ordinary differential equations: development and solution.
- *Vibrations of Dynamic Systems (3rd year, LU)*
  - Continuation of System Modelling and Simulation, taught practical application of vibration theory, especially design of vibration isolators and absorbers.
- *Advanced Solid Mechanics (MSc, LU)*
  - Flipped classroom for mechanical and mining graduate students, continuing on Mechanics and Strengths of Materials II courses.
  - Project and communication-based learning development, with traditional synchronous lecture material.
- *Finite Element Methods (4th year, Carleton)*
  - Developed direct methods so students can apply finite element formulations immediately to mechanics problems.
  - Discussed static structural problems, but also the applicability to other engineering problems, such as thermal or multi-physics analysis.
  - Taught 'best practices' for developing finite elements and using commercial software to solve problems.
- *Linear and Nonlinear Finite Element Analysis (MSc, TUD/Carleton)*
  - Assisted students in practical sessions learning Abaqus (in both courses) and elucidated 3D continua theory during traditional lectures.

- **Materials teaching stream** *2018 – 2023*
  - *Material Science for Engineers (2nd year, JXUST)*
    - Developed videos and lectured students on basics of the chemistry of materials (metallic and ceramic), including mechanics properties, failure analysis, phase diagrams and fabrication.
  - *Materials and Manufacturing (3rd year, LU)*
    - Produced videos and theory lecture content, including machinery, manufacturing tips for designing producing parts and systems.
    - Project and design competition at end of course, focus was on design of parts and justification/decision-making of final processing.

- **Professional Practice Courses** *2021 - 2022*
  - *Engineering Seminar (4th year, LU)*
    - Flipped the classroom to give students practical experience in presentation communication, technical writing, and record keeping.
    - Topics covered included: technical communication, engineering practice and ethics, and engineering law.
  - *Research Methods (MSc, LU)*
    - Hybrid classroom: lectured in classroom with online (Zoom) connections.
    - Required course for MSc students, topics cover many aspects of long-term project management, especially relative to graduate studies.
    - Lectured mathematical analytical techniques, research and writing practices, presentation skills, and how to prepare a project proposal.

Guest Lecturer and Teaching Assistant *2004 – 2011*

Carleton University

- In addition to the courses above, I have guest lectured aeroelasticity (4th year) and finite element mechanics. I had practical experience supervising students in a laboratory/practicum in the following courses: Mechanics of Solids II, Aerospace Design, Mechanical Design, and Professional Practice (Ethics and Law).

Listing of Teaching and Masterclass Courses Taken

Carleton University *2022- Present*

- Ungrading
- Assign2 for grading

Laurentian University *2018 – 2022*

- Teaching with technology
- Teaching mental awareness for students coming from secondary school
- Blended learning
- (Creating) Rubrics
- Teaching remotely and using alternative assessment
- Teaching to students with different abilities coming from secondary school
- Introduction to student response systems
- (Gamification and) Flipping classroom teaching styles

Delft University of Technology *2015 – 2017*

- University Teaching Qualification
  - Constructive Alignment
  - Aligning your Delivery
  - Assessment for Learning Objectives
  - Conflict Resolution
  - Supervising International Students
- Gamification Masterclass

Independent *2021*

- Diversity, Inclusion and Belonging

SUPERVISION EXPERIENCE

Doctoral Theses *2014 – 2022*

- **Borrdephong Rattanagraikanakorn,** *Risk Assessment and Impact Hazard Consequence for Remotely Piloted Aerial Systems (RPASs)*
- **Shi Chunsen,** *Hypervelocity Impact and its Influence on Fibre Metal Laminates (FMLs) for Improved Micro-Meteroid and Orbital Debris Shielding*

Master's Theses *2012 – 2019*

- **Sunayna Hima,** *Flexible Appendages and Satellite Control under Orbital Manoeuvres*
- **Bob Verheijen,** *Feasibility of DSM® Dyneema for Spacecraft Radiation and Micro-Meteroid Impact Shielding*
- **Michel Wolken,** *Energy dissipation response of a rectangular metal tube on axial impact*
- **Kevin Simiou,** *Development of a low-cost Fiber Metal Laminate with a focus on low-velocity impacts*
- **Philippe Willems,** *Design and analysis of a composite side impact structure for application in the automotive industry*
- **Siebe Spronk,** *Thermo-mechanical properties of A350-like composite materials for fire strength estimation*
- **Vishal Sridhar,** *Combined Numerical & Experimental Methodology for the Detection of Structural Non-Linearity in Composite Wind Turbine Blades*

RESEARCH PROJECTS

Master Lecturer *2018 – 2022*

Laurentian University

- Continuing with RPAS (below) impact causing human injury or fatality with PhD Student at TU Delft
- Flexible spacecraft body control during manoeuvres and after high-momentum impact
- Dynamic control of launch vehicles with tank sloshing

Assistant Professor *2014 – 2017*

Delft University of Technology

- DSM DYNEEMA® – Hypervelocity and radiation damage of UHMWPE for spacecraft shielding
- IRON (Horizon2020 Project) – Estimating the damage tolerance of a future composite fuselage aircraft to impact from open-rotor turboprop blades
- XFRIS (Aerospace Faculty Multidisciplinary Project) – Investigating the civil risk and potential impact damage of remotely piloted aircraft systems (RPASs)

Post-doctorate Researcher *2011 – 2014*

Delft University of Technology

- AircraftFire (Seventh Framework Programme) – European Union consortium project to determine the post-crash survivability of passengers involved in a composite-bodied aircraft

Graduate Researcher *2003 – 2005*

Carleton University

- Smart Hybrid Active Rotor Control System (SHARCS)
- Analysed transonic flutter for fixed-wing aircraft with vibration attenuation control

PUBLICATIONS

Refereed Journals

Rattanagraikanakorn, B., Blom, H. A., **Gransden, D. I.**, et al. *Variation in Human Injury and Fatality from Impacts by Different UAS Types*. Journal of Accident Analysis and Prevention. Submitted Feb. 2021.

Rattanagraikanakorn, B., Schuurman, M., **Gransden, D. I.,** et al. *Modelling Head Injury due to Unmanned Aircraft Systems Collision: Crash Dummy vs Human Body*. International Journal of Crashworthiness. 2020. pp. 1–14. DOI: 10.1080/13588265.2020.1807687.

Rattanagraikanakorn, B., **Gransden, D. I.,** et al. "Multibody system modelling of unmanned aircraft system collisions with the human head". International Journal of Crashworthiness. Jul. 2019. DOI: 10.1080/13588265.2019.1633818.

Gransden, D. I. and Alderliesten, R. "Development of a Finite Element Model for Comparing Metal and Composite Fuselage Section Drop Testing". International Journal of Crashworthiness. Jan. 2017.

Gransden, D. I., Bornemann, P. B., Rose, M., and Nitzsche, F. "Constrained Generalised-alpha Method for Coupling Rigid Parallel Chain Kinematics and Elastic Bodies". Computational Mechanics. Jan. 2015.

Conference Papers

Rattanagraikanakorn, B., et al. *Modeling and Simulating Human Fatality due to Quadrotor UAS Impact*, AIAA AVIATION 2020 FORUM, 2020. DOI: 10.2514/6.2020-2902.

Rattanagraikanakorn, B., et al. *Modelling Head Injury due to Unmanned Aircraft Systems Collision: Crash Dummy vs Human Body.* AIAA Aviation Forum. June 2019. DOI: 10.2514/6.2019-2835.

Mooij, E., and **Gransden, D. I.** *The Effect of Sloshing on the Controllability of a Conventional Aeroelastic Launch Vehicle* AIAA Scitech 2019 Forum. Jan. 2019. DOI: 10.2514/6.2019-0116.

Singh, S., Mooij, E., and **Gransden, D. I.** *Multibody Approach to the Controlled Removal of Large Space Debris with Flexible Appendages*, AIAA Scitech 2019 Forum. Jan. 2019. DOI: 10.2514/6.2019-1916.

Rattanagraikanakorn, B., et al, *Characterizing UAS Collision Consequences in Future UTM*. 2018 Aviation Technology, Integration, and Operations Conference. June 2018. DOI: 10.2514/6.2018-3031.

Gransden, D. I. and Mooij, E. *Control Recovery of a Satellite with Large Flexible Appendages after Impact with Space Debris*. Science and Technology Forum Exposition. Jan. 2018.

Mooij, E. and **Gransden, D. I.** *Model Verification of a Satellite with Large Flexible Appendages for Control System Design*. AIAA Space Flight Mechanics Conference. Jan. 2018.

Verheijen, B., **Gransden, D. I.**, Bergsma, O. K., Riedel, W., Lässig, T., Long, N., van der Werff, H., Heisserer, U. *Feasibility study on Dyneema®-based spacecraft impact shielding*. 9th International Association for the Advancement of Space Safety Conference. Oct. 2017.

Gransden, D. I. and Mooij, E. *Quasi-Static Flight Performance of a Conventional Aeroelastic Launch Vehicle*. 68th International Astronautical Congress. Sep. 2017.

Schuurman, M., and **Gransden, D. I.** *Sky Lantern Safety Flight Profile for Risk Assessment*. AIAA Balloon Systems Conference. June 2017.

Gransden, D. I. and Mooij, E. *Simple Adaptive Control of a Satellite with Large Flexible Appendages*. 67th International Astronautical Congress. Sep. 2016.

Mooij, E. and **Gransden, D. I.** *The Impact of Aeroelastic Effects on the Controllability of Conventional Launch Vehicles*. 67th International Astronautical Congress. Sep. 2016.

Gransden, D. I. *Design of a lightweight open-rotor impact shield*. International Aerospace Engineering Conference. Aug. 2015.

Gransden, D. I. and Alderliesten, R. *Development of an FEM Model for Comparing Metal and Composite Fuselage Section Drop Testing*. International Crashworthiness Conference. Sep. 2014.

Gransden, D. I. *Aircraft Fires and Passenger Safety*. Leonardo Times. Mar. 2012.

Lynch, B., et al. *Development of a Smart Rotorcraft Blade for noise and vibration attenuation*. Canadian Aeronautics and Space Institute (CASI) AERO 2007 Conference. Apr. 2007.

Gransden, D., Ghorashi, M., Langlois, R., Nitzsche, F. *Development of nonlinear elastic bending and torsion of articulated rotor blades with an impedance control device replacing the common pitch link*. 31st European Rotorcraft Forum. 2005.

Editorial Work

Mooij, E., *Re-entry Systems*. 2024.
Chambers, P. *Introduction to Engineering*. Oxford University Press. 2021.
Hibbeler, R. C. *Learning Catalytics*. Pearson Publishing. 2016.
Hibbeler, R. C. *Engineering Mechanics: Dynamics, 14th SI ed*. Pearson Publishing. 2016.

ELIGIBILITY FOR P.ENG

- Registered as an engineer-in-training with APEGS.

Protected when completed

Date Submitted: 2024-02-15 10:34:54
Confirmation Number: 1742348
Template: NSERC_Researcher

Dr. James Robert Green

Correspondence language: English

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NSERC CRSNG

Canadian Common CV commun canadien

Protected when completed

Dr. James Green

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes

Degrees

- 2005/8 — Doctorate, Electrical and Computer Engineering, Queen's University at Kingston
  Supervisors: Michael J Korenberg, 2001/4 - 2005/8
- 2000/9 — Master's Thesis, Electrical and Computer Engineering, Queen's University at Kingston
  Supervisors: Michael J Korenberg, 1998/9 - 2000/9
- 1998/5 — Bachelor's, Systems Design Engineering, University of Waterloo

Recognitions

2020/10 — IEEE Ottawa Section Outstanding Educator Award
IEEE Ottawa Section
Prize / Award
Awarded in recognition of developing and offering machine learning courses at both the undergraduate and graduate levels for many years.

2020/6 — 2020 IEEE MeMeA Best Student Paper Award
IEEE
Prize / Award
Graduate student and co-author Ms. Samreen Aziz received this award at MeMeA2020 in Bari, Italy.

2018/6 — 2018 IEEE MeMeA "Best Women in Engineering Paper Award"
IEEE
Prize / Award
Graduate student and co-author Ms. Yasmina Souley Dosso received this award at MeMeA2018 in Rome.

2018/5 — Carleton University Teaching Achievement Award - 15,000
Carleton University
Prize / Award
Engineers in the Hospital – Experiential Learning in Capstone Projects

2018/5 — Carleton University Research Achievement Award - 15,000
Carleton University
Prize / Award
Real-time Monitoring of Vibrations and Noise During Neonatal Patient Transport

2018/3
Carleton University Faculty Mentoring Award
Carleton University
Prize / Award
Student-nominated university-wide award in recognition of excellence in graduate supervision and mentoring.

2017/11
CASCON 2017 Best Poster Award
IBM
Prize / Award
Tied for best poster among 75 exhibits

2017/5
2017 IEEE MeMeA "Best Women in Engineering Paper Award"
IEEE
Prize / Award
Won by PDF S. Nizami for our paper entitled "Comparing time and frequency domain estimation of neonatal respiratory rate using pressure-sensitive mats"

User Profile

Research Specialization Keywords: Biomedical Informatics, Machine Learning, Patient Monitoring, Bioinformatics, Development of novel assistive tech. & devices, High performance computing, microRNA prediction, Prediction of protein-protein interactions, Prediction of protein structure, Proteomics, Species-specific bioinformatic systems

Employment

2019/7
Full Professor (cross-appointment)
Department of Health Sciences, Faculty of Science, Carleton University
Full-time, Professor
Tenure Status: Tenure

2019/7
Full Professor
Department of Systems and Computer Engineering, Faculty of Engineering and Design, Carleton University
Full-time, Professor
Tenure Status: Tenure

2015/2 - 2019/6
Associate Professor (cross-appointment)
Department of Health Sciences, Faculty of Science, Carleton University
Full-time, Associate Professor
Tenure Status: Tenure

2010/7 - 2019/6
Associate Professor
Department of Systems and Computer Engineering, Faculty of Engineering and Design, Carleton University
Full-time, Associate Professor
Tenure Status: Tenure

2016/1 - 2016/6
Interim Director
Institute for Data Science, Faculty of Engineering and Design, Carleton University
Full-time
Tenure Status: Tenure

2014/7 - 2016/6
Program Director, Collaborative Program in Bioinformatics
Systems and Computer Engineering, Faculty of Engineering and Design, Carleton University
Full-time, Associate Professor
Tenure Status: Tenure
Coordinate a 'Specialization in Bioinformatics' open to graduate students at Carleton University and the University of Ottawa.

2012/7 - 2014/6
Associate Program Director of the Collaborative Program in Bioinformatics
Systems and Computer Engineering, Faculty of Engineering and Design, Carleton University
Full-time, Associate Professor
Tenure Status: Tenure
Associate Director of the Collaborative Program in Bioinformatics. This program permits graduate students in multiple participating units to add the "Specialization in Bioinformatics" to their degree.

2005/9 - 2010/6
Assistant Professor
Department of Systems and Computer Engineering, Faculty of Engineering and Design, Carleton University
Full-time, Assistant Professor
Tenure Status: Tenure Track

2003/9 - 2005/4
Teaching Fellow
Electrical and Computer Engineering, Faculty of Engineering, Queen's University at Kingston
Part-time, Sessional, Lecturer
Tenure Status: Non Tenure Track

2000/9 - 2001/4
Computational Scientist
Molecular Mining Corporation
Conducted research for clients in the area of gene expression analysis. Developed novel algorithms for analyzing and visualizing gene expression data.

1997/5 - 1997/8
Software developer (co-op)
SHL Vision Solutions
Developed software for porting aspects of geographical information systems to CORBA.

1996/9 - 1996/12
Human Factors Research Assistant
Road Safety Division, Transport Canada
Collaborated with members of the Canadian and American Transportation Safety Boards to research human factors issues relevant to motor vehicle collision investigations. Authored and presented a paper based on this research, which was later published in the CMRSC-X Conference Proceedings. Conducted a pilot study involving 34 participants and extensive field work.

Research Funding History

Awarded [n=10]

2022/4 - 2026/3
Collaborator

Artificial Intelligence for the Prevention of Unplanned Dialysis, Grant

Funding Sources:
Canadian Institutes of Health Research (CIHR)
Project Grant
Total Funding - 195,000
Portion of Funding Received - 50,000
Funding Competitive?: Yes

Co-applicant : Ayub Akbari; Christopher McCudden; Kednapa Thavorn; Ran Klein;

Principal Investigator : Gregory Hundemer

2021/4 - 2026/3
Principal Applicant

"Reciprocal Perspective Machine Learning to Identify Relationships in Sparse Biological Networks", Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 175,000
Portion of Funding Received - 175,000
Funding Competitive?: Yes

2022/5 - 2023/3
Co-investigator

Multi-sensor Applications to Address Critical Electricity Infrastructure Vulnerabilities, Contract

Funding Sources:
Natural Resources Canada
Total Funding - 225,000
Portion of Funding Received - 56,250
Funding Competitive?: No

Co-investigator : Marzieh Amini; Sreeraman Rajan;

Principal Applicant : Rafik Goubran

2016/4 - 2023/3
Co-applicant

Biomedical Engineering Smartphone Training (BEST) Program, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
CREATE - Collaborative Research and Training Experience Program
Total Funding - 1,650,000
Portion of Funding Received - 176,000
Funding Competitive?: Yes

Co-applicant : Abdulmotaleb El Saddik; Adrian D.C. Chan; David Buckeridge; Edward Lemaire; Liam Peyton; Robyn Tamblyn; Voicu Groza;

Principal Applicant : Natalie Baddour

2020/4 - 2023/3
Co-investigator

Reducing Vibrations to Improve Infant Patient Safety During Transportation, Grant

Funding Sources:
Canadian Institutes of Health Research (CIHR)
Collaborative Health Research Projects
Total Funding - 261,433
Portion of Funding Received - 65,358
Funding Competitive?: Yes
Natural Sciences and Engineering Research Council of Canada (NSERC)
Collaborative Health Research Projects
Total Funding - 261,433
Portion of Funding Received - 65,358
Funding Competitive?: Yes

2020/1 - 2022/12
Principal Applicant

Machine learning and computer vision for contactless patient monitoring in the NICU, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Collaborative Research and Development (CRD) Grant
Total Funding - 102,000
Portion of Funding Received - 102,000

Funding Competitive?: Yes
IBM Centre for Advanced Studies
CAS Fellowship
Total Funding - 51,000
Portion of Funding Received - 51,000
Funding Competitive?: Yes

2020/4 - 2022/3
Co-investigator

AI for simulation of biological systems - Probabilistic modeling of exosome metabolism and automatic quantification of metabolic activity from NMR data, Grant

Funding Sources:
National Research Council Canada (NRC) (Ottawa, ON)
AI4Design
Total Funding - 158,400
Portion of Funding Received - 79,200
Funding Competitive?: Yes

Principal Investigator : David Campbell

2020/8 - 2021/7
Co-applicant

COVID-19: Annotating and controlling the inter-species protein interactome through the development of peptide inhibitors for SARS-CoV-2 and human protein interactions, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Alliance-COVID19
Total Funding - 50,000
Portion of Funding Received - 25,000
Funding Competitive?: Yes

Principal Applicant : Kyle Biggar

2020/5 - 2021/4
Co-applicant

Development of peptide inhibitors of SARS-CoV-2: human protein interaction, Grant

Funding Sources:
Carleton University
CU COVID-19 Rapid Response Research Grant
Total Funding - 14,000
Portion of Funding Received - 7,000
Funding Competitive?: Yes

Principal Applicant : Kyle Biggar

2016/4 - 2021/3
Principal Applicant

Effective prediction of microRNAs in the face of class imbalance, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant (Individual)
Total Funding - 110,000
Portion of Funding Received - 110,000
Funding Competitive?: Yes

Completed [n=9]

2020/5 - 2021/1
Principal Applicant

Machine Learning for Automating Adjudication Claims of Noise-Induced Hearing Loss, Contract

Funding Sources:
Workplace Safety and Insurance Board (WSIB)
Strategic Procurement
Total Funding - 40,000
Portion of Funding Received - 40,000

Funding Competitive?: No

2019/7 - 2020/6
Principal Applicant

Assessing and Improving the Safety of Neonatal Patient Transport, Grant

Funding Sources:
Carleton University
Development Grant
Total Funding - 10,000
Portion of Funding Received - 10,000
Funding Competitive?: Yes

2018/6 - 2020/5
Principal Applicant

Using machine learning to investigate sympathetic activation of the autonomic nervous system during the treatment of mild traumatic brain injury, chronic pain, and post-traumatic stress disorder, Grant

Funding Sources:
CIMVHR / MITACS / IBM
Canadian Institute for Military and Veteran Health Research - Advanced Analytics Initiative
Total Funding - 230,000
Portion of Funding Received - 115,000
Funding Competitive?: Yes

Co-applicant : Adrian DC Chan

2019/4 - 2020/3
Co-investigator

Prediction & Detection of Anomalous Events, Grant

Funding Sources:
Fields Institute for Research in Mathematical Sciences (The)
Centre for Quantitative Analysis and Modelling
Total Funding - 60,000
Portion of Funding Received - 50
Funding Competitive?: Yes

Co-investigator : Sreeraman Rajan

2016/4 - 2019/3
Principal Applicant

Pressure sensitive mats for patient monitoring in the NICU, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Collaborative Research and Development
Total Funding - 204,000
Portion of Funding Received - 204,000
Funding Competitive?: Yes
IBM (CAS) Centre for Advances Studies
CAS Research Fellowship
Total Funding - 102,000
Portion of Funding Received - 102,000
Funding Competitive?: Yes

2017/8 - 2018/12
Principal Applicant

Automating classification of ShoeBOX audiograms, Grant

Funding Sources:
Ontario Center of Excellence (OCE)
VIP-I
Total Funding - 25,000
Portion of Funding Received - 25,000
Funding Competitive?: Yes
Natural Sciences and Engineering Research Council of Canada (NSERC)
Engage
Total Funding - 25,000
Portion of Funding Received - 25,000

Funding Competitive?: Yes

2018/1 - 2018/3
Principal Investigator

Towards Energy Infrastructure Image Segmentation using Deep Learning, Contract

Funding Sources:
Natural Resources Canada
Critical Infrastructure Protection Program
Total Funding - 23,000
Portion of Funding Received - 23,000
Funding Competitive?: Yes

2017/3 - 2017/11
Principal Applicant

Facilitating document collaboration and processing for review committees, Grant

Funding Sources:
Natural Sciences and Engineering Research Council of Canada (NSERC)
Engage
Total Funding - 25,000
Portion of Funding Received - 25,000
Funding Competitive?: Yes

Co-investigator : Andy Adler

2017/2 - 2017/3
Principal Applicant

Deep Learning for Identifying Threats to Critical Infrastructure, Contract

Funding Sources:
Natural Resources Canada
Critical Infrastructure Protection Program
Total Funding - 22,500
Portion of Funding Received - 22,500
Funding Competitive?: No

Student/Postdoctoral Supervision

Bachelor's Honours [n=4]

2020/5 - 2020/8
Principal Supervisor

Daniel Kyrollos (Completed) , Carleton University
Thesis/Project Title: (NSERC USRA) Propagation of Uncertainty in Pressure-SensitiveMat Physiologic Parameter Estimation
Present Position: Candidate for MASc-BIOM

2018/5 - 2018/8
Principal Supervisor

William Ma (Completed) , Carleton University
Thesis/Project Title: (NSERC USRA) Neonatal Patient Vibration During Emergency Transport
Present Position: Graduate studies at McGill

2018/5 - 2018/8
Principal Supervisor

Stephan Murga (Completed) , Carleton University
Thesis/Project Title: (NSERC USRA) Deep Learning for Patient Monitoring
Present Position: Software Development Engineer at Amazon

2017/1 - 2018/3
Principal Supervisor

Mohamed Hozayen (Completed) , Carleton University
Thesis/Project Title: (NSERC USRA) Neonatal Patient Monitor Data Export and Parsing
Present Position: Candidate for PhD, Carleton University

Master's non-Thesis [n=1]

2020/5 - 2021/4 Principal Supervisor	Joshua Tanner (Completed) , Carleton University Thesis/Project Title: Computer vision for environmental assessment from autonomous vehicle sensor data Present Position: Software engineer in industry

Master's Thesis [n=22]

2023/9 - 2025/8 Principal Supervisor	Sean Kirkby (In Progress) , Carleton University Thesis/Project Title: Multi-view and multi-modal monitoring of activities of daily living Present Position: Candidate for MASc
2023/5 - 2025/4 Co-Supervisor	Olivier Papillon (In Progress) , Carleton University Thesis/Project Title: Pressure sensitive mats for sleep studies Present Position: Candidate for MASc
2023/1 - 2024/8 Principal Supervisor	Jonathan Dupuis (In Progress) , Carleton University Thesis/Project Title: Robust image acquisition for critical infrastructure monitoring Present Position: Candidate for MASc
2022/9 - 2023/8 Co-Supervisor	Anthony Fuller (Completed) , Carleton University Thesis/Project Title: Vision Transformers for Remote Sensing Present Position: Candidate for PhD-ECE
2022/5 - 2024/4 Co-Supervisor	Michael Avarello (In Progress) , Carleton University Thesis/Project Title: Characterizing Noise Experienced by Neonatal Patients During Ground Transport Present Position: Candidate for MASc
2021/9 - 2023/5 Principal Supervisor	Victoria Ajila (Completed) , Carleton University Thesis/Project Title: Adapting Genome-wide microRNA Discovery and Target Prediction to Specific Species *(nominated for Senate Medal)* Present Position: Data Scientist at Health Canada
2021/9 - 2023/9 Co-Supervisor	Saif Huq (Completed) , Carleton University Thesis/Project Title: Deep Learning for Cough Sound Analysis in the Presence of Noise and Reverberations Present Position: Engineer in industry
2021/9 - 2023/9 Co-Supervisor	Martin Klamrowski (Completed) , Carleton University Thesis/Project Title: Prediction of unplanned kidney dialysis using machine learning Present Position: Candidate for PhD-ECE (University of Ottawa)
2021/1 - 2023/1 Principal Supervisor	Jaser El-Habrouk (Completed) , Carleton University Thesis/Project Title: The use of EEG and VR in Mental State Recognition Present Position: BIosignals data scientist in industry
2020/9 - 2023/1 Principal Supervisor	Zein Hajj-Ali (Completed) , Carleton University Thesis/Project Title: Depth-based Patient Monitoring in the NICU with Non-Ideal Camera Placement Present Position: AI Engineer at a startup
2020/9 - 2022/8 Principal Supervisor	Daniel Kyrollos (Completed) , Carleton University Thesis/Project Title: Region-of-Interest Detection for the Neonatal Intensive Care Unit *(nominated for Senate Medal)* Present Position: Data scientist at NRC
2020/1 - 2022/5 Principal Supervisor	Eric Arezza (Completed) , Carleton University Thesis/Project Title: Predicting Bacterial Protein-protein Interaction Interactions Present Position: Bioinformatics research associate, Ottawa Hospital Research Institute

2018/9 - 2020/12 Principal Supervisor	Fadwa Darwaish (Completed) , Carleton University Thesis/Project Title: Quantifying the patient experience during neonatal emergency transport to the NICU Present Position: PhD at University of Ottawa
2018/9 - 2021/12 Principal Supervisor	Samreen Aziz (Completed) , Carleton University Thesis/Project Title: Neonatal patient movement detection from time-varying pressure-sensitive mat data Present Position: Software/ML engineer in industry
2018/5 - 2021/5 Principal Supervisor	Aishwarya Purohit (Completed) , Carleton University Thesis/Project Title: Sequence-based Protein Interaction Site Prediction using Computer Vision and Deep Learning Present Position: Software engineer in industry
2017/9 - 2020/1 Principal Supervisor	Calvin Jary (Completed) , Carleton University Thesis/Project Title: Augmenting protein-protein interaction prediction using physico-chemical properties Present Position: Candidate for PhD, Carleton University
2017/5 - 2018/8 Principal Supervisor	Francois Charih (Completed) , Carleton University Thesis/Project Title: Intelligent Classification of Audiograms Present Position: Candidate for PhD, Carleton University
2016/9 - 2018/9 Principal Supervisor	Amente Bekele (Completed) , Carleton University Thesis/Project Title: Patient monitoring in the NICU via pressure-sensitive mats Present Position: Software engineer at IBM
2016/9 - 2018/9 Principal Supervisor	Mohsen Sheikh-Hassani (Completed) , Carleton University Thesis/Project Title: Active and Multi-View Machine Learning for microRNA Prediction Present Position: Senior Artificial Intelligence (AI) Policy Analyst, Royal College of Physicians and Surgeons of Canada
2016/5 - 2018/12 Principal Supervisor	Roger Selzler (Completed) , Carleton University Thesis/Project Title: Development of a novel flexible pressure-sensitive mat Present Position: Candidate for PhD, Carleton University
2015/9 - 2017/8 Principal Supervisor	Bradley Barnes (Completed) , Carleton University Thesis/Project Title: Computational prediction of information-rich descriptors of genomic sequences. Present Position: Data Scientist in industry (Clearwater Clinical)
2015/5 - 2017/7 Principal Supervisor	Madison Cohen-McFarlane (Completed) , Carleton University Thesis/Project Title: Detection of central sleep apnea using microphone arrays, beamforming, and pressure-sensitive mats Present Position: Candidate for PhD (Biomedical Engineering)

Doctorate [n=14]

2024/1 - 2028/1 Co-Supervisor	Aziz Al-Najjar (In Progress) , Carleton University Thesis/Project Title: Computer vision for critical infrastructure resilience Present Position: Candidate for PhD-DSAAI
2023/9 - 2027/8 Co-Supervisor	Mohsen Sheikh Hassani (In Progress) , Carleton University Thesis/Project Title: Neuroplasticity Related to Binaural Audio Processing Following Brain Injury Present Position: Candidate for PhD-DSAAI

2023/9 - 2027/8 Principal Supervisor	Anthony Fuller (In Progress) , Carleton University Thesis/Project Title: Multi-modal self-supervised deep learning using directed attention Present Position: Candidate for PhD-ECE
2023/9 - 2027/8 Co-Supervisor	Martin Klamrowski (In Progress) , University of Ottawa Thesis/Project Title: Predicting Unplanned Kidney Dialysis Present Position: Candidate for PhD-ECE
2023/7 - 2027/6 Co-Supervisor	Elmira Amooei (In Progress) , Carleton University Thesis/Project Title: Reinforcement learning for prescribing tacrolimus following kidney transplant Present Position: Candidate for PhD-DSAAI
2023/5 - 2027/4 Co-Supervisor	Hamid Reza Aghamiri (In Progress) , Carleton University Thesis/Project Title: Moment-preserving signal estimation Present Position: Candidate for PhD-ECE
2022/9 - 2024/8 Co-Supervisor	Keely Gibb (In Progress) , Carleton University Thesis/Project Title: Dynamic Modeling of a Neonatal Patient Transport System to Assess Patient Vibrations Present Position: Candidate for PhD-MECH
2021/9 - 2025/8 Co-Supervisor	Matthew Stewart (In Progress) , Carleton University Thesis/Project Title: Novel Sensors for Polysomnography Present Position: Candidate for PhD-BIOM
2020/9 - 2025/12 Principal Supervisor	Mohsen Mozafari (In Progress) , Carleton University Student Degree Expected Date: 2025/12 Thesis/Project Title: Non-contact continuous patient monitoring in continuing care facilities Present Position: Candidate for PhD, Carleton University
2019/1 - 2023/12 Co-Supervisor	Francois Charih (In Progress) , Carleton University Thesis/Project Title: Synthetic biology for studying protein methylation Present Position: Candidate for PhD
2019/1 - 2024/1 Co-Supervisor	Roger Selzler (In Progress) , Carleton University Thesis/Project Title: Using deep learning to estimate patient stress from heart rate variability and gait Present Position: Candidate for PhD
2016/9 - 2022/5 Principal Supervisor	Yasmina Souley Dosso (Completed) , Carleton University Thesis/Project Title: Machine Vision for Patient Monitoring in the Neonatal Intensive Care unit Present Position: Pursuing computer vision career in industry
2015/9 - 2022/5 Principal Supervisor	Kevin Dick (Completed) , Carleton University Thesis/Project Title: Reciprocal Perspective: A Cascaded Semi-Supervised Machine Learning Framework to Improve Pairwise Classification & Regression ***(Awarded Governor General Gold Medal)*** Present Position: Postdoc, CHEO Research Institute
2015/9 - 2017/8 Co-Supervisor	Maryam L Shahreza (Completed) , Isfahan University of Technology, Iran Thesis/Project Title: Drug Repositioning Based on Complex Networks Present Position: Assistant Professor, University of Shahreza

Post-doctorate [n=4]

2019/4 - 2022/3 Co-Supervisor	Roy Wang (Completed) , Carleton University Thesis/Project Title: 2019-20: Fields Institute/CQAM PDF - Investigating machine learning methods for predicting rare events 2020-22: National Research Council - AIfor simulation of biological systems - Probabilistic modeling of exosomemetabolism and automatic quantification of metabolic activity from NMR data Present Position: Postdoctoral Fellow
2018/8 - 2019/7 Principal Supervisor	Alistair Boyle (Completed) , Carleton University Thesis/Project Title: Estimating Sympathetic Activation of the Auntonomic Nervous System Using Machine Learning Present Position: Chief Technical Officer, Kite Medical
2018/6 - 2020/5 Principal Supervisor	Andrew Smith (Completed) , Carleton University Thesis/Project Title: Estimating Sympathetic Activation of the Auntonomic Nervous System Using Machine Learning Present Position: Analyst/Researcher, Health Canada
2016/8 - 2020/5 Principal Supervisor	Shermeen Nizami (Completed) , Carleton University Thesis/Project Title: Patient Monitoring in the NICU via Pressure-sensitive Mats Present Position: Training Support Coordinator, The Centre for Addiction and Mental Health (CAMH)

Event Administration

2019/8 - 2020/7	Theme Co-Chair, IEEE Engineering in Medicine and Biology Conference (EMBC2020), “Theme 4. Computational systems & synthetic Biology; Multiscale modelling”, Conference, 2020/7 - 2020/7
2019/1 - 2019/11	General Co-Chair, IEEE GlobalSip Symposium on Machine Learning for Rare Event Detection in Healthcare, Conference, 2019/11 - 2019/11
2019/1 - 2019/6	General Co-Chair, 2019 Fields Conference on Machine Learning in the Presence of Class Imbalance, Conference, 2019/6 - 2019/6

Editorial Activities

2019/7 - 2024/6	Associate Editor, (Nature) Scientific Reports, Journal
2015/1 - 2023/12	Member of the International Editorial Board, (Springer) Journal of Medical and Biological Engineering, Journal

Organizational Review Activities

2019/7 - 2024/6	Scientific Advisory Board member, SOSCIP Consortium Assess collaborative research proposals for scientific merit. Determine and approve the allocation of SOSCIP high-performance computing resources. Monitor progress of ongoing SOSCIP research projects.

Knowledge and Technology Translation

2016/5 - 2022/4

Principal Investigator and Inventor, R&D Collaboration with Industry
Group/Organization/Business Serviced: IBM Centre for Advanced Studies
Target Stakeholder: Industry/Business (>500 employees)
Outcome / Deliverable: This collaboration has resulted in one poster, several industry-facing posters, academic conference papers, and articles in research journals.
Evidence of Uptake/Impact: IBM invested in patenting ideas arising from our research collaboration.
Activity Description: Collaborating with IBM CAS to investigate novel non-contact patient monitoring technologies for the neonatal intensive care unit.

2020/5 - 2021/1

Principal Investigator, Technology, Product, Process, Service Improvement/Development
Group/Organization/Business Serviced: Workplace Safety and Insurance Board (Ontario)
Target Stakeholder: Government Personnel
Outcome / Deliverable: Collaborated with Ontario's WSIB to automate the adjudication of incoming claims of noise induced hearing loss. Developed machine vision approaches for automating the digitization of audiology reports received by fax and implemented machine learning systems to make a determination regarding hearing loss.
Activity Description: Used machine learning and computer vision to automatically digitize/ interpret audiology reports and determine if the patient suffered from noise-induced hearing loss. Worked with the Workplace Insurance and Safety Board of Ontario

2018/5 - 2020/6

Principal Investigator, R&D Collaboration with Industry
Group/Organization/Business Serviced: Canadian Institute for Military and Veteran Health Research/IBM
Target Stakeholder: Private Not-for-Profit Organization
Outcome / Deliverable: We have created a mobile app for clinicians to record and quantify signs & symptoms of stress during rehabilitation sessions. We have also prototyped a number of machine learning and DSP approaches to estimating patient stress, based on the gold-standard data collected during our study. The research has led to academic conference publications, and presentations and posters at CIMVHR events attended by veterans, active military personnel, and military leadership.
Evidence of Uptake/Impact: Our study represents one of the first investigations of how machine learning can augment treatment of military service members and veterans.
Activity Description: We are collaborating with the Canadian Institute for Military and Veteran Health Research (CIMVHR), IBM, and the Ottawa Hospital Rehab Centre, to develop non-contact estimators of patient stress whilst undergoing VR-therapy for PTSD, mild traumatic brain injury, and complex pain. We are using a combination of machine learning and advanced digital signal processing for both physiologic and gait data.

2018/5 - 2019/4

Principal Investigator, R&D Collaboration with Industry
Group/Organization/Business Serviced: Shoebox.md
Target Stakeholder: Industry/Business-Medium (100 to 500 employees)
Outcome / Deliverable: Our research resulted in conference and journal publications, as well as a software environment for the analysis and annotation of audiograms now used by the company. We also ran a focus group with expert audiologists to assemble a fully annotated dataset of audiograms.
Evidence of Uptake/Impact: The company adopted our software (developed by MASc student Francois Charih) for the analysis and annotation of audiograms.
Activity Description: We collaborated with Shoebox.md (originally "Clearwater Clinical Corp") to develop both supervised and unsupervised machine learning techniques for the interpretation of audiograms.

2017/1 - 2018/3

Principal Investigator, Technology, Product, Process, Service Improvement/Development
Group/Organization/Business Serviced: Natural Resources Canada
Target Stakeholder: Government Personnel
Outcome / Deliverable: Worked with Natural Resources Canada toinvestigate the potential use of autonomous vehicle imagery for surveying criticalinfrastructure in the environment, such as vegetation approaching power linesor poles with significant lean.
Evidence of Uptake/Impact: Spoke to industry leaders at the 2017 annual Meeting of the Energy and Utilities Sector Network (EUSN), Ottawa, Canada, 60 minutes, 15 Nov 2017.
References / Citations / Web Sites: Produced a technical report and co-authored a journal paper with government collaborator ([J32])
Activity Description: Explored the potential for using deep learning to analyze imagery collected from autonomous vehicles as they circulate through urban and rural environments. Developed a proof-of-concept demonstration using Google StreetView images and discussed the wider potential secondary use of autonomous vehicle sensor data.

Committee Memberships

2018/7

Committee Member, Data Science and Analytics Steering Committee, Carleton University
I represent the Department of Systems and Computer Engineering on the university-level committee tasked with developing masters and PhD programs in "Data Science and Analytics".

2007/2

Committee Member, Fully Certified Member of Carleton University Joint Health and Safety Committee, Carleton University

2020/7 - 2020/8

Committee Member, Peer review committee for the CIHR Project Grant: Spring 2020 competition, Canadian Institutes of Health Research
Peer reviewer on the Clinical Investigation - A: Reproduction, Maternal, Child and Youth Health (CIA) committee for the CIHR Project Grant: Spring 2020 competition

2019/1 - 2019/5

Committee Member, Fields-CQAM Interdisciplinary Thematic Program, Fields Inst. for Res. in Mathematical Sc.
Along with 7 co-applicants, secured $350,000 in funding for a thematic program relating to the Fields Centre for Quantitative Analytics and Modelling. Participated in the organizing committee for several events within the thematic program.

2018/10 - 2019/3

Committee Member, Technical Program Committee - IEEE Medical Measurements and Applications (MeMeA 2019), IEEE

Other Memberships

2007/9

Various (Chapter Vice-Chair, Secretary), IEEE EMBS Ottawa
I have served in various roles (currently Chapter Vice-Chair, previously Chapter Secretary) in the IEEE EMBS Ottawa Chapter since 2007. In 2011, our chapter received the IEEE Engineering in Medicine and Biology Society Best Chapter Award (international award). In recognition of the number of events we organized last year, we received the "Best Chapter" award among all of the Ottawa Section.

2006/7

Faculty Liaison for Undergraduate Biomedical Engineering Society, Carleton University
Founder and faculty liason for undergraduate Carleton University Biomedical Engineering Club (CUBE)

2006/7

Professional Engineer (Ontario), Professional Engineers of Ontario

Presentations

1. (2023). Deep Learning for Multimodal Monitoring in the Neonatal Intensive Care Unit. Clinical Decision Support Systems Colloquium, Acfas congress, Montreal, Canada
   Main Audience: Researcher
   Invited?: Yes, Keynote?: No
2. (2023). Biomedical Informatics in Carleton's cuBIC and Associated Labs – Greater Impact through Collaboration. Ottawa Hospital Health and Data Science Journal Club, Ottawa, Canada
   Main Audience: Researcher
   Invited?: Yes, Keynote?: No
3. (2023). Computer Vision for Noncontact Patient Monitoring in the NICU. Research Canada Parliamentary Health Research Caucus Reception on Artificial Intelligence and Machine Learning, Ottawa, Canada
   Main Audience: Decision Maker
   Invited?: Yes, Keynote?: No
4. (2022). Machine Learning (ML) Applications in Critical Infrastructure Monitoring. Centre for Energy Advancement through Technological Innovation (CEATI) Virtual Black Sky Hazards Workshop, Ottawa, Canada
   Main Audience: Knowledge User
   Invited?: Yes, Keynote?: No
5. (2020). Non-Contact Neonatal Patient Care. InGenius Talks, Canada
   Main Audience: General Public
   Invited?: Yes, Keynote?: Yes
6. (2019). Machine Learning for Biomedical Informatics. Students in Engineering and Technology (SET) Conference, Canada
   Main Audience: Knowledge User
   Invited?: Yes, Keynote?: No
7. (2018). Reciprocal Perspective:Leveraging Context in Complete Prediction Graphs. Ottawa AI Alliance Workshop, Ottawa, Canada
   Main Audience: Knowledge User
   Invited?: Yes, Keynote?: No

Broadcast Interviews

2020/06/15 - 2020/06/15	Machine learning for creating novel peptides to combat COVID-19, All in a Day, CBC Radio One (Ottawa/Kingston)

Text Interviews

2019/09/01	Our collaboration with clinicians from the Canadian Forces and the Ottawa Hospital Rehabilitation Centre, where we are developing novel methods for estimating patients' stress levels (sympathetic activation of the autonomic nervous system) using ML., Canadian Military Family Magazine

Publications

Journal Articles

1. [J60] Kyrollos D*, Fuller A*, Greenwood K, Harrold J, Green JR. (2023). Under the Cover Infant Pose Estimation using Multimodal Data. IEEE Transactions on Instrumentation and Measurement. 72: 22686076.
Published
Refereed?: Yes, Open Access?: No

2. [J61] Nissan N*, Hooker JC*, Arezza E*, Dick K*, Golshani A, Mimee B, Cober ER, Green JR, Samanfar B. (2023). Large-Scale Data Mining Pipeline for Identifying Novel Soybean Genes Involved in Resistance Against Soybean Cyst Nematode. Frontiers in Bioinformatics. 3: 10.3389/fbinf.2023.1.
Published
Refereed?: Yes, Open Access?: Yes

3. [J64] Kehoe P*, Gibb K*, Hurley J*, Langlois RG, Green JR, Chan ADC, Toma E, Aubertin C, Greenwood K, Ibey A, Redpath S. (2023). Simulating whole-body vibration for neonatal patients on a tire-coupled road simulator. Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine.
In Press
Refereed?: Yes, Open Access?: No

4. [J65] Al-Najjar A, Amini M, Rajan S, Green JR. (2023). Identifying Areas of High-risk Vegetation Encroachment on Electrical Powerlines using Mobile and Airborne Laser Scanned Point Clouds. IEEE Sensors Journal.
In Press
Refereed?: Yes, Open Access?: Yes

5. [J63] Souley Dosso Y*, Greenwood K, Harrold J, Green JR. (2023). Uncertainty Measurements in Non-Contact Neonatal Heart Rate Monitoring. IEEE Access. 11: 144168-144179.
Published
Refereed?: Yes, Open Access?: Yes

6. [J59] Ajila V*, Colley L*, Ste-Croix DT*, Nissan N*, Golshani A, Cober ER, Mimee B, Samanfar B, Green JR. (2023). P-TarPmiR accurately predicts plant-specific miRNA targets. Scientific Reports. 13(332)
Published
Refereed?: Yes, Open Access?: Yes

7. [C62] Klamrowski MM*, Klein R, McCudden C, Green JR, Ramsay T, Rashidi B, White CA, Oliver MJ, Akbari A, Hundemer GL. (2023). Short Timeframe Prediction of Kidney Failure among Patients with Advanced Chronic Kidney. Clinical Chemistry. 69(10): 1163–1173.
Published
Refereed?: Yes, Open Access?: No

8. [J58] Sharifisoraki Z*, Dey A*, Selzler R*, Amini M, Green JR, Rajan S, Kwamena FA. (2022). Monitoring Critical Infrastructure Using 3D LiDAR Point Clouds. IEEE Access. 11: 314-336.
Published
Refereed?: Yes, Open Access?: Yes

9. [J53] Charih F*, Biggar KK, Green JR. (2022). Assessing sequence-based protein-protein interaction predictors for use in therapeutic peptide engineering. Scientific Reports. 12: 9610.
Published
Refereed?: Yes, Open Access?: Yes

10. [J52] Dick K*, Tanner JB*, Charih F*, Green JR. (2022). GasBotty: Multi-Metric Extraction in the Wild. IEEE Access. 10: 28487-28498.
Published
Refereed?: Yes, Open Access?: Yes

11. [J51] Rurak GM*, Simard S*, Freitas-Andrade M*, Lacoste B*, Charih F*, Van Geel A, Stead J, Woodside B, Green JR, Coppola G, Salmaso N. (2022). Sex differences in developmental patterns of neocortical astroglia: A mouse translatome database. Cell Reports. 38(5): 110310.
Published
Refereed?: Yes, Open Access?: Yes

12. [J56] Fuller A*, Millard K, Green JR. (2022). SatViT: Pretraining Transformers for Earth Observation. IEEE Geoscience and Remote Sensing Letters. 19: 3513205.
Published
Refereed?: Yes, Open Access?: No

13. [J55] Dick K*, Kyrollos DG*, Cosoreanu ED*, Dooley J*, Fryer JS*, Gordon SM*, Kharbanda N*, Klamrowski M*, LaCasse PNL*, Leung TF*, Nasir MA*, Qiu C*, Robinson AS*, Shao D*, Siromahov BR*, Starlight E*, Tran C*, Wang C*, Yang Y-K*, Green JR. (2022). Reciprocal perspective as a super learner improves drug-target interaction prediction (MUSDTI). Scientific Reports. 12: 13237.
Published
Refereed?: Yes, Open Access?: Yes

14. [J57] Charih C*, Green JR. (2022). Audiogram Digitization Tool for Audiological Reports. IEEE Access. 10: 110761-110769.
Published
Refereed?: Yes, Open Access?: Yes

15. [J54] Souley Dosso Y*, Kyrollos D*, Greenwood K, Harrold J, Green JR. (2022). NICUface: Robust Neonatal Face Detection in Complex NICU Scenes. IEEE Access. 10: 62893-62909.
Published
Refereed?: Yes, Open Access?: Yes

16. [J48] Nizami S*, McGregor AM C, Green JR. (2021). Integrating Physiological Data Artifacts Detection With Clinical Decision Support Systems: Observational Study. JMIR Biomed En. 6(2): e23495.
Published
Refereed?: Yes, Open Access?: Yes

17. [J47] Dick K*, Chopra A*, Biggar K, Green JR. (2021). Multi-Schema Computational Prediction of the Comprehensive SARS-CoV-2 vs. Human Interactome. PeerJ. TBD: TBD.
In Press
Refereed?: Yes, Open Access?: Yes

18. [J46] Wang RCC*, Campbell D, Green JR, Čuperlović-Culf M. (2021). 1D 1H NMR metabolite quantification for bioreactor monitoring. Metabolomics. TBD: TBD.
In Press
Refereed?: Yes, Open Access?: Yes

19. [J50] Souley Dosso Y*, Greenwood K, Harrold J, Green JR. (2021). RGB-D Scene Analysis in the NICU. Elsevier Computers in Biology and Medicine. 138: 104873.
Published
Refereed?: Yes, Open Access?: Yes

20. [J49] Dick K*, Hooker J*, Nissan N*, Pattang A*, Sadowski M*, Barnes B*, Tan LH, Burnside D*, Phanse S, Aoki H, Babu M, Dehne F, Golshani A, Cober ER, Green JR, Samanfar B. (2021). Human-Soybean Allergies: Elucidation of the Seed Proteome & Comprehensive Protein-Protein Interaction Prediction. Journal of Proteome Research. 20(11): 4925–4947.
Published
Refereed?: Yes, Open Access?: No

21. [J40] Charih F*, Steeves A*, Bromwich M, Mark AE, Lefrancois R, Green JR. (2020). Data-Driven Audiogram Classification for Mobile Audiometry. Scientific Reports. 10: 3962.
Published
Refereed?: Yes, Open Access?: Yes

22. [J42] Shahreza ML*, Ghadiri N, Green JR. (2020). A computational drug repositioning method applied to rare diseases: Adrenocortical carcinoma. Scientific Reports. 10: 8846.
Published
Refereed?: Yes, Open Access?: Yes

23. [J39] Dick K*, Samanfar B, Barnes B*, Cober ER, Mimee B, Tan LH, Molnar SJ, Biggar KK, Golshani A, Dehne F, Green JR. (2020). PIPE4: Fast PPI Predictor for Comprehensive Inter- and Cross-Species Interactomes. Scientific Reports. 10: 1390.
Published
Refereed?: Yes, Open Access?: Yes

24. [J45] Charih F*, Green JR, Biggar KK. (2020). Machine Learning-Driven Identification of Novel Lysine Methylation Sites with MethySight. STAR Protocols. TBD: TBD.
Accepted
Refereed?: Yes, Open Access?: Yes

25. [J44] Kyrollos D*, Reid B*, Dick K*, Green JR. (2020). RPmirDIP: Reciprocal Perspective Improves miRNA Targeting Prediction. Scientific Reports. 10: 11770.
Published
Refereed?: Yes, Open Access?: Yes

26. [J43] Biggar KK, Charih F*, Liu H, Ruiz-Blanco YB, Stalker L, Chopra A, Connolly J, Adhikary H, Frensemier K, Hoekstra H, Galka M, Fang Q, Wynder C, Standford WL, Green JR, Li SS-C. (2020). Proteome-wide Prediction of Lysine Methylation Leads to Identification of H2KB43 Methylation and Outlines the Potential of the Methyllysine Proteome. Cell Reports. 32(2): 107896.
Published
Refereed?: Yes, Open Access?: Yes

27. [J41] Goswami I, Redpath S, Langlois RG, Green JR, Lee KS, Whyte HEA. (2020). Whole-body vibration in neonatal transport: a review of current knowledge and future research challenges. Early Human Development. 146: 105051.
Published
Refereed?: Yes

28. [J38] Sheikh Hassani M*, Green JR. (2019). A Semi-Supervised Machine Learning Framework for MicroRNA Classification. BMC Human Genomics. 13: 43.
Published
Refereed?: Yes, Open Access?: Yes

29. [J33] Grigg N*, Schoenrock A*, Dick K*, Green JR, Golshani A, Wong A, Dehne F, Tsai EC, Biggar KK. (2019). Insights into the suitability of utilizing brown rats (Rattus norvegicus) as a model for healing spinal cord injury with epidermal growth factor and fibroblast growth factor-II by predicting protein-protein interactions. Computers in Biology and Medicine. 104: 220-226.
Published
Refereed?: Yes

30. [J32] Dick K*, Russell L*, Souley Dosso Y*, Kwamena F, Green JR. (2019). Deep learning for critical infrastructure resilience. Journal of Infrastructure Systems. 25(2): 11.
Published
Refereed?: Yes

31. [J35] Peace R*, Sheikh Hassani M*, Green JR. (2019). miPIE: NGS-based Prediction of miRNA Using Integrated Evidence. Scientific Reports. 9: 1548.
Published
Refereed?: Yes

32. [J36] Romero-Molina S*, Ruiz-Blanco YB, Green JR, Sanchez-Garcia E. (2019). ProtDCal-Suite: A web server for the numerical codification and functional analysis of proteins. Protein Science. 28(9): 1734-1743.
Published
Refereed?: Yes, Open Access?: Yes

33. [J34] Burnside D*, Schoenrock A*, Moteshareie H*, Hooshyar M*, Basra P*, Hajikarimloo M*, Dick K*, Barnes B*, Kazmirchuk T*, Jessulat M*, Pitre S, Samanfar B, Babu M, Green JR, Wong A, Dehne F, Biggar KK, Golshani A. (2019). A robust computational tool for engineering synthetic binding proteins from random amino acid sequences. ISCIENCE. 11: 375-387.
Published
Refereed?: Yes

34. [J37] Sheikh Hassani M*, Green JR. (2019). Multi-view Co-training for microRNA Prediction. Scientific Reports. 9: 10931.
Published
Refereed?: Yes, Open Access?: Yes

35. [J30] Nizami S*, Bekele A*, Hozayen M*, Greenwood K, Harrold J, Green JR. (2018). Measuring uncertainty during respiratory rate estimation using pressure-sensitive mats. IEEE Transactions on Instrumentation and Measurement. 67(7): 1535-1542.
Published
Refereed?: Yes

36. [J31] Dick K*, Green JR. (2018). Reciprocal Perspective for Improved Protein-Protein Interaction Prediction. Scientific Reports. 8(1): 11694.
Published
Refereed?: Yes, Open Access?: Yes

37. [J24] Shahreza ML*, Ghadiri N, Mossavi SR, Varshosaz J, Green JR. (2018). A review of network-based approaches to drug repositioning. Briefings in Bioinformatics. 19(5): 878–892.
Published
Refereed?: Yes, Open Access?: Yes

Book Chapters

1. [B2] Shahreza ML, Ghadiri N, Green JR. (2019). Heter-LP: A heterogeneous label propagation method for drug repositioning. Vanhaelen Q. Computational Methods for Drug Repurposing. (1903): 291-316.
Published, Humana Press - Springer Protocols
Refereed?: Yes

2. [B1] Peace RJ*, Green JR. (2018). Computational sequence- and NGS-based microRNA prediction. Sejdic E, Falk TH. Biomedical Signal Processing in Big Data. : 30.
Published, CRC Press
Refereed?: Yes

Reports

1. [T5] Dick K*, Charih F*, Russell L*, Souley Dosso Y*, Green JR. (2018). Towards Energy Infrastructure Image Segmentation Using Deep Learning. 88. Natural Resources Canada.

Conference Publications

1. [C103] Fuller A*, Millard K, Green JR. (2023). CROMA: Remote Sensing Representations with Contrastive Radar-Optical Masked Autoencoders. NeurIPS, New Orleans, United States of America
   Conference Date: 2023/12
   Paper
   Published
   Refereed?: Yes, Invited?: No
2. [C102] Ajila V*, Green JR. (2023). Domain Adaptation applied to microRNA Target Prediction. IEEE International Conference on BioInformatics and BioEngineering (BIBE), Virtual, Canada
   Conference Date: 2023/12
   Paper
   Published
   Refereed?: Yes, Invited?: No
3. [C79] Souley Dosso Y*, Greenwood K, Harrold J, Green JR. (2021). Bottle-Feeding Intervention Detection in the NICU. IEEE Engineering in Medicine and Biology Conference - EMBC 2021, Guadalajara (virtual), Mexico
   Conference Date: 2021/11
   Paper
   Published
   Refereed?: Yes, Invited?: No
4. [C69] Kyrollos D*, Tanner JB, Greenwood K, Harrold J, Green JR. (2021). Noncontact Neonatal Respiration Rate Estimation Using Machine Vision. Sensors Applications Symposium (SAS), Sundsvall, Sweden
   Conference Date: 2021/8
   Paper
   Published
   Refereed?: Yes, Invited?: No
5. [C71] Mozafari M*, Goubran RA, Green JR. (2021). A Fusion Model for Cross-Subject Stress Level Detection Based on Transfer Learning. Sensors Applications Symposium (SAS), Sundsvall, Sweden
   Conference Date: 2021/8
   Paper
   Published
   Refereed?: Yes, Invited?: No
6. [C68] Souley Dosso Y*, Selzler R*, Greenwood K, Harrold J, Green JR. (2021). RGB-D Sensor Application for Non-Contact Neonatal Monitoring. Sensors Applications Symposium (SAS), Sundsvall, Sweden
   Conference Date: 2021/8
   Paper
   Published
   Refereed?: Yes, Invited?: No
7. [C70] Kyrollos D*, Greenwood K, Harrold J, Green JR. (2021). Detection of False Alarms in the NICU Using Pressure Sensitive Mat. Sensors Applications Symposium (SAS), Sundsvall, Sweden
   Conference Date: 2021/8
   Paper
   Published
   Refereed?: Yes, Invited?: No

8. [C66] Cohen-McFarlane M*, Dick K*, Green JR, Goubran RA. (2021). Chaos Game Representation of Audio Signals. IEEE International Instrumentation and Measurement Technology Conference, Glascow (virtual), United Kingdom
Conference Date: 2021/5
Paper
Published
Refereed?: Yes, Invited?: No

9. [C67] Kyrollos D*, Hassan R*, Souley Dosso Y*, Green JR. (2021). Fusing Pressure-Sensitive Mat Data with Video through Multi-Modal Registration. IEEE International Instrumentation and Measurement Technology Conference, Glascow (virtual), United Kingdom
Conference Date: 2021/5
Paper
Published
Refereed?: Yes, Invited?: No

10. [C65] Kyrollos D*, Stachiw T*, Green JR, Langlois RG. (2020). Injury Risk and Comfort Assessment Applied to Ambulance Transportation. 7th International Conference of Control Systems, and Robotics (CDSR'20), Niagara Falls, Canada
Conference Date: 2020/11
Paper
Published
Refereed?: Yes, Invited?: No

11. [C63] Darwaish F*, Selzler R*, Law A, Chen E, Ibey A, Aubertin C, Greenwood K, Redpath S, Chan ADC, Green JR, Langlois RG. (2020). Preliminary Laboratory Vibration Testing of a Complete Neonatal Patient Transport System. IEEE Engineering in Medicine and Biology Conference - EMBC 2020, Montreal, Canada
Conference Date: 2020/7
Paper
Published
Refereed?: Yes, Invited?: No

12. [C64] Souley Dosso Y*, Aziz S*, Nizami S*, Aubertin C, Greenwood K, Harrold J, Green JR. (2020). Video-based Neonatal Motion Detection. IEEE Engineering in Medicine and Biology Conference - EMBC 2020, Montreal, Canada
Conference Date: 2020/7
Paper
Published
Refereed?: Yes, Invited?: No

13. [C61] Aziz S*, Souley Dosso Y*, Nizami S*, Greenwood K, Harrold J, Green JR. (2020). Detection of Neonatal Patient Motion Using a Pressure-Sensitive Mat. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Bari, Italy
Conference Date: 2020/6
Paper
Published
Refereed?: Yes, Invited?: No

14. [C60] Souley Dosso Y*, Aziz S*, Nizami S*, Greenwood K, Harrold J, Green JR. (2020). Neonatal Face Tracking for Non-Contact Continuous Patient Monitoring. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Bari, Italy
Conference Date: 2020/6
Paper
Published
Refereed?: Yes, Invited?: No

15. [C62] Selzler R*, Smith A*, Charih F*, Boyle A*, Holly J, Bridgewater C, Besemann M, Curan D, Chan ADC, Green JR. (2020). Exploratory Analysis of Ultra-Short-Term Heart Rate Variability Features in Virtual Rehabilitation Sessions. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Bari, Italy
Conference Date: 2020/6
Paper
Published
Refereed?: Yes, Invited?: No

16. [C59] Dick K*, Charih F*, Woo J*, Green JR. (2020). Gas Prices of America: The Machine-Augmented Crowd-Sourcing Era. CRV 2020 Computer and Robot Vision, Ottawa, Canada
Conference Date: 2020/5
Paper
Published
Refereed?: Yes, Invited?: No

17. [C58] Green JR, Langlois R, Chan A, Selzler R*, Darwaish F*, Ibey A, Aubertin C, Greenwood K, Redpath S. (2019). Investigating vibration levels in a neonatal transport system. Can Med Biol Eng Conf (CMBEC42), Ottawa, Canada
Conference Date: 2019/5
Paper
Published
Refereed?: Yes, Invited?: No

18. [C56] Sheikh Hassani M*, Green JR. (2018). Active Learning for MicroRNA Prediction. IEEE International Conference on Bioinformatics and Biomedicine - BIBM2018, Madrid, Spain
Conference Date: 2018/12
Paper
Published
Refereed?: Yes, Invited?: No

19. [C50] Oommenn J*, Bews D*, Sheikh Hassani M*, Ono Y, Green JR. (2018). A Wearable Electronic Swim Coach for Blind Athletes. IEEE Life Sciences Conference 2018, Montreal, Canada
Conference Date: 2018/10
Paper
Published
Refereed?: Yes, Invited?: No

20. [C55] Bekele A*, Samuel J*, Nizami S*, Basharat A, Giffen PR, Green JR. (2018). Ontology Driven Temporal Event Annotator mHealth Application Framework. CASCON 2018, Markham, Canada
Conference Date: 2018/10
Paper
Published
Refereed?: Yes, Invited?: No

21. [C51] Selzler R*, Green JR, Goubran RA. (2018). Neurodegenerative Disease Prediction Based on Gait Analysis Signals Acquired with Force-Sensitive Resistors. IEEE Life Sciences Conference 2018, Montreal, Canada
Conference Date: 2018/10
Paper
Published
Refereed?: Yes, Invited?: No

22. [C52] Charih F*, Steeves A*, Bromwich M, Mark AE, Lefrançois R, Green JR. (2018). Applications of Machine Learning Methods in Retrospective Studies on Hearing. IEEE Life Sciences Conference 2018, Montreal, Canada
Conference Date: 2018/10
Paper
Published
Refereed?: Yes, Invited?: No

23. [C54] Dick K*, Green JR. (2018). Fitting Rank Order Data in the Age of Context. IEEE Life Sciences Conference 2018, Montreal, Canada
Conference Date: 2018/10
Paper
Published
Refereed?: Yes, Invited?: No

24. [C53] Souley Dosso Y*, Bekele A*, Nizami S*, Aubertin C, Greenwood K, Harrold J, Green JR. (2018). Segmentation of Patient Images in the Neonatal Intensive Care Unit. IEEE Life Sciences Conference 2018, Montreal, Canada
Conference Date: 2018/10
Paper
Published
Refereed?: Yes, Invited?: No

25. [C45] Nizami S*, Basharat A, Shaukat A*, Hameed U*, Raza SA*, Bekele A*, Giffen PR, Green JR. (2018). CEA: Clinical Event Annotator mHealth Application for Real-time Patient Monitoring. IEEE 40th International Engineering in Medicine and Biology Conference (EMBC2018),
Conference Date: 2018/7
Paper
Published
Refereed?: Yes, Invited?: No

26. [C44] Dick K*, Charih F*, Souley Dosso Y*, Russell L*, Green JR. (2018). Systematic Street View Sampling: High Quality Annotation of Power Infrastructure in Rural Ontario. CRV 2018 Computer and Robot Vision, Toronto, Canada
Conference Date: 2018/5
Paper
Published
Refereed?: Yes, Invited?: No

27. [C46] Bekele A*, Nizami S*, Souley Dosso Y*, Aubertin C, Greenwood K, Harrold J, Green JR. (2018). Real-time Neonatal Respiratory Rate Estimation using a Pressure-Sensitive Mat. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Rome, Italy
Conference Date: 2018/5
Paper
Accepted
Refereed?: Yes, Invited?: No

28. [C48] Selzler R*, Aubertin C, Greenwood K, MacLean G, Redpath S, Green JR. (2018). Measurement of Vibration Levels on Neonatal Transport Systems Using a Custom Data Logger. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Rome, Italy
Conference Date: 2018/5
Paper
Accepted
Refereed?: Yes, Invited?: No

29. [C49] Souley Dosso Y*, Bekele A*, Green JR. (2018). Eulerian Magnification of Multi-Modal RGB-D Video for Heart Rate Estimation. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Rome, Italy
Conference Date: 2018/5
Paper
Accepted
Refereed?: Yes, Invited?: No

30. [C47] Charih F*, Bromwich M, Lefrancois R, Mark A, Green JR. (2018). Mining Audiograms to Improve the Interpretability of Automated Audiometry Measurements. IEEE International Symposium on Medical Measurements and Applications (MeMeA), Rome, Italy
Conference Date: 2018/5
Paper
Accepted
Refereed?: Yes, Invited?: No

31. [C43] Selzler R*, Green JR, Goubran RA, Knoefel F. (2018). Pressure sensitive mat using proximity sensors for vital sign monitoring. IEEE International Instrumentation and Measurement Technology Conference, Houston, United States of America
Conference Date: 2018/5
Paper
Accepted
Refereed?: Yes, Invited?: No

32. [C57] Hozayen H*, Nizami S*, Bekele A*, Dick K*, Green JR. (2018). Developing a Real-Time Patient Monitor Data Import System. National Conference on Undergraduate Research (NCUR2018), Edmund, United States of America
Conference Date: 2018/4
Paper
In Press
Refereed?: Yes, Invited?: No

Intellectual Property

Patents

1. Detecting Quality of Physiologic Data Using Contact Pressure Data for Alarm Generation. United States of America. 10,297,143. 2018/03/19.
Patent Status: Granted/Issued
Year Issued: 2019
Inventors: Nizami S, Green JR, Giffen PR

Pakeeza Hafeez

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287 Stoneway Dr,
K2G 6E5, Nepean, ON
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Tel: +1 (519) 608-8319
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Education

University of Toronto, Toronto, Canada
Ph.D., Mechanical Engineering 2010 - 2016
Dissertation: Heat Transfer through Thermally Sprayed Metal Foam-Heat Exchangers at High Temperature
Supervisor: Dr. Sanjeev Chandra, Co-supervisor: Dr. Javad Mostaghimi

Western University, London, Canada
M.E.Sc., Mechanical Engineering 2006 - 2009
Dissertation: Modal Characterization of Micron Scale Structure Elements
Supervisor: Dr. Samuel Asokanthan

NED University of Engineering and Technology, Karachi, Pakistan
BE in Mechanical Engineering 2000 - 2004
Concentration: Heating Ventilation and Air-conditioning System
Project: Design a Cost-effective Energy-efficient HVAC System for McDonald's in Karachi, Pakistan
Supervisor: Dr. Muzaffar Mehmood

Industry Experience

Mechanical Engineer, Master Motor Inc., Pakistan 2004-2006
Mechanical Design Engineer, Petrocam Engineering, Pakistan 2003-2004

Teaching Experience

Carleton University
Instructor II 2022-present

MAAE 2700 (0.5)	fall
Capstone 490D	fall
MAAE3004C (0.5)	winter
MAAE 2400 (0.5)	winter
MAAE 2001(0.5)	winter
Capstone490D	winter
ECOR1047 (0.25)	summer
ECOR1048 (0.25)	summer

Conestoga College
Course Instructor

Applied Science (Thermodynamics)	2019-22
Chemistry and Thermodynamic	2020-22

Curriculum Development

Applied Science (Thermodynamics)	2021
Chemistry and Thermodynamic	2022

University of Toronto, Department of Mechanical and Industrial Engineering
Teaching Assistant

Kinematics and Dynamics of Machinery	Head TA	2014
Mechanics of Solids I	Lab TA	2012
Dynamics	Tutorial TA	2012

Western University, Department of Mechanical and Material Engineering
Teaching Assistant

HVAC I	Tutorial TA	2009
Mechanics of Material	Lab TA	2008
Project Management for Engineers	Tutorial TA	2008
Advanced Vibration Analysis	Tutorial TA	2007
Kinematics and Dynamics	Project TA	2007

Private Tutoring

Calculus I, II	University of Toronto, Ryerson University	2015
Machine Design I & II	Ryerson University	2014
Strength of Material	University of Toronto	2013
Thermodynamics	University of Toronto	2012
Fluid Mechanics I & II	University of Toronto, Ryerson University	2012
Heat and Mass Transfer	University of Toronto, Ryerson University	2011
Heat and Mass Transfer	University of Toronto	2010

Teaching Workshops (selected)

"Teaching in Higher Education", from the University of Toronto	2015
"Assessment to promote consistent, fair and timely evaluation" from Conestoga College	2019
"Creating a Positive Learning Environment" from Conestoga College	2019
"Providing Online Materials to Students" from Conestoga College	2019
"Creating Lesson Plans" from Conestoga College	2020
"Technology Orientation for faculty" from Conestoga College	2021
Workshop on "Risky things to say in class" from Conestoga College	2021
Workshop on "Managing your marking" from Conestoga College	2022
Workshop on "Tuning into Accents: Improving Your Listening for a Global World" from Conestoga College	2022

Membership

Engineer in Training (EIT), PEO Professional Practice Exam passed

Publications

Journal

Hafeez, P., Yugeswaran., S., Chandra, S., and Mostaghimi, J., and Coyle, T.," Fabrication of High-Temperature Heat Exchangers by Plasma Spraying Exterior Skins on Nickel Foams". Journal of Thermal Spray Technology, 25(5): p. 1056-1067, 2016.

Hafeez, P., Chandra, S., and Mostaghimi, J.,"Heat Transfer During High Temperature Gas Flow Through Metal Foam Heat Exchangers". ASME Journal of Heat Transfer, 139(12):121801-121801-11, 2017.

Conferences

Hafeez, P., and Chandra, S.,"High Temperature Metal Foam Heat Exchangers". Proceedings of 23rd National Heat and Mass Transfer Conference and 1st International ISHMT-ASTFE Heat and Mass Transfer Conference IHMTC 2015, Kerala, India, 2015.

Hafeez, P., Salavati, S., Esmaeelpanah, J., Chandra, S., and Mostaghimi, J., and Coyle, T., "High Temperature Metal Foam Heat Exchanger". Proceeding of 15th International Heat Transfer Conference IHTC 2014, Kyoto, Japan. 2014.

Hafeez, P., Chandra, S., and Mostaghimi, J., "Surface Temperature Distribution of Metal Foam Heat Exchanger". Canadian Society for Mechanical Engineering International Congress 2014. Toronto, Canada, 2014.

Hafeez, P., Esmaeelpanah, J., Chandra, S., and Mostaghimi, J.,"Heat Transfer Through Metal-Foam Heat Exchanger at Higher Temperature." ASME 2013 Heat Transfer Summer Conference collocated with the ASME 2013 7th International Conference on Energy Sustainability and the ASME 2013 11th International Conference on Fuel Cell Science, Engineering and Technology. American Society of Mechanical Engineers, 2013.

Hafeez, P., Book. J., and Asokanthan, S.,"Ssi-based modal characterization of micron-scale structures." Proceedings of the 22nd Canadian Congress of Applied Mechanics. 2009.

Presentation

Hafeez, P., and Chandra, S. "High Temperature Metal Foam Heat Exchangers." 4th MIE Symposium, Toronto, Canada, June 2013.

Community Involvement

Volunteer Tutor	Pathways to Education	2011 – 2012
Industry liaison	Sustainable Engineers Association	2013 – 2014
Secretary	Graduate Students' Association, University of Toronto	2010 – 2014

ACADEMIC AND PROFESSIONAL CREDENTIALS

EDUCATION

PostDoc **Rolls-Royce Canada Limited**, Dartmouth Engineering, 2012-2014
The Development of Maritime Motion Compensation Systems

PhD **Dalhousie University**, Mechanical Engineering, 2011
Dynamic Terramechanic Model for Lightweight Wheeled Mobile Robots

MASc **Dalhousie University**, Mechanical Engineering, 2006
Dual Cutting Fluid Application in the Grinding Process

BASc **University of Windsor**, Mechanical Engineering with Materials Option, 2003
Senior Project: SAE Mini Baja & Castings

ACADEMIC APPOINTMENTS AND POSITIONS

Associate Professor 2021 – Present
Carleton University, Ottawa, ON
Department of Mechanical and Aerospace Engineering

Assistant Professor 2016 – 2021
Carleton University, Ottawa, ON
Department of Mechanical and Aerospace Engineering

Adjunct Assistant Professor 2013 – 2020
Dalhousie University, Halifax NS
Department of Mechanical Engineering

Lecturer 2009 – 2011
Dalhousie University, Halifax NS
Department of Mechanical Engineering

Lecturer 2012
St. Mary's University, Halifax, NS
Division of Engineering

Engineering Research Associate 2005 – 2007
Dalhousie University, Halifax, NS
Department of Oceanography

Teaching Assistant 2004 – 2011
Dalhousie University, Halifax, NS
Department of Mechanical Engineering

Engineering Research Associate 2002
Dalhousie University, Halifax, NS
Department of Physics and Atmospheric Science

Industrial Work Experience

Senior Mechanical Engineer & Researcher 2012 – 2016
Rolls-Royce Canada Limited, Naval Marine, Dartmouth, NS

Contract Researcher (NRC–IRAP) 2011
A.C. Dispensing Equipment Inc. Halifax, NS

Contract Researcher 2006 – 2008
MDA - Space Missions, Brampton, ON and Halifax, NS

Professional Affiliations

Engineers Nova Scotia (Professional Engineer, PEng, Member number: 10115)
Professional Engineers of Ontario (Professional Engineer, PEng, Member number: 10023050)
Institute of Electrical and Electronics Engineers, IEEE (Member number: 92321815)

TEACHING

A) TEACHING AND TRAINING:

CARLETON TEACHING EXPERIENCE

Course Instructor (15), Directed Studies (6)

Course Reviews: Mean Aggregate Score [Median of Aggregate Score]

	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	Average
MECH 5302 *Instrumentation Techniques*	NR						Sabbatical		--
AERO4540 *Spacecraft Dynamics and Control*	4.85[1] [5]								**4.85**
MAAE 3500*/4500* *Feedback Control Systems*	4.38 [5]	4.31 [5]	4.33 [5]						**4.34**
MAAE 3004 *Dynamics of Machines*		4.53[1] [5]		4.27 [4]				4.09 [4]	**4.30**
MECH 5508 *Modelling, Dynamics & Identification*		4.94[1] [5]	4.52[1] [5]	NR		4.64 [5]		*TBD*	**4.70**
MAAE 2101* *Engineering Dynamics*			4.78[1] [5]	NR		3.75 [4]			**4.27**
ECOR 1048* *Dynamics*					NR				
Average	4.62	4.59	4.54	4.27		4.20	--	*TBD*	**4.45**
Faculty Average	4.27	4.30	4.26	COVID	COVID	COVID	--	*TBD*	**4.28**

NOTE: NR – No Response provided or officially recorded; TBD – upcoming/current courses
Class Size reflects average size; Complete reviews are available upon request
** Indicates course coordinator*
[1] Teaching Evaluation Scores for Career Decisions

B) SUPERVISION OF SENIOR UNDERGRADUATE STUDENTS

Upon joining Carleton University in Winter 2016 I became an academic advisor and a Lead Engineer for the Carleton University Simulator Project (CUSP). Starting in September of 2020 I became the Project Manager. Additionally, I completed several personalized directed studies.

Capstone Design Project

Carleton University Simulator Project (Project Manager)	2020 – Present
Carleton University Simulator Project (Lead Engineer)	2016 – 2020
Carleton University Simulator Project (Advisor)	2016 (Winter)

Directed Studies

Corneilius Liburd (MAAE 4917)	2021 (Winter)
Chris Weller (MAAE 4917)	2018 (Fall)
Justin Kernot (MECH 5906)	2017 (Summer)
Shadi Abujob (MAAE 4917)	2017 (Winter)
Woles Wahidi (MAAE 4917)	2017 (Fall)
Esteban Andrade (MAAE 4917)	2016 (Winter)

C) Supervision of Highly Qualified Personnel (HQP)

Graduated/Completed HQP at Carleton University:

Name	Degree	Years	Thesis or Project Title
Cassidy Westin[O]	PhD	2018 – 2024	Development of a Real-Time Physics-Based Digital Twin of a Marine Towed Cable-Body System
Steffan Lloyd[1,N,F,O]	PhD	2018 – 2023	Precision Robotic Machining: Modelling and Control Innovations for Improved Performance **[Awarded: Senate Medal for Outstanding Graduate Work – Doctorial]**
Wade MacMillan[1]	MASc	2020 – 2022	Contour Following and Trajectory Planning for Robotic Deburring **[Nominated: Senate Medal for Outstanding Graduate Work – Master's]**
Iain Martin[N,F]	PhD	2018 – 2022	Real-Time Operator-in-the-Loop Anti-Sway Control for Shipboard Cranes
Stephanie Lowell[M]	MASc	2018 – 2021	Sensitivity analysis and experimental validation of plunger-type wavemakers modelled with a steady flow **[Nominated: Senate Medal for Outstanding Graduate Work – Master's]**
Grael Miller	MASc	2019 – 2021	Pilot Study for Cutting Force Model of Robotic Deburring
Ryan McKenzie[N,O]	MASc	2017 – 2020	Motion Compensation and Robotic Control of Maritime Cranes
Mikayla Micomonaco[2]	MASc	2017 – 2019	Large Angle Washout Algorithms for Flight Simulators
Johanna McPhee[N,O]	MASc	2016 – 2019	Control, Simulation, and Testbed Development for Improving Maritime Launch and Recovery Operations **[Awarded: Senate Medal for Outstanding Graduate Work – Master's]**
Shadi Abujoub	MASc	2017 – 2019	Development of a Landing Period Indicator and the use of Signal Prediction to Improve Landing Methodologies of Autonomous Unmanned Aerial Vehicles on Maritime Vessels
Camilla Jastrzebski[U]	BASc (Intern)	2019	Hardware Development of an Unmanned Aerial Vehicle
Devin Wang[2]	BASc (Intern)	2019	Design and construction of a Robotic Work Cell
Cassidy Westin	MASc	2016 – 2018	Modelling and Simulation of Marine Cables with a Dynamic Winch and Sheave Contact

Shadi Abujoub	BASc (Intern)	2016 – 2017	System Modelling of an Unmanned Aerial Vehicle
Woles Wahidi	BASc (Intern)	2016 – 2017	System Modelling of a Marine and High Inertia Systems
Nathan Schut[1,*]	MASc	2016 – 2019	Sensor Fusion-based Control of a Spherical Motion Platform (Incomplete)

[1] Co-supervised with Dr. Mojtaba Ahmadi
[2] Co-supervised with Drs. Robert Langlois and M. John D. Hayes
[N] Recipient of a NSERC award
[O] Recipient of an Ontario Graduate Scholarship award
[M] Recipient of a MITAS Research Training Award
[U] Recipient of NSERC USRA award
[*] Withdrawn due to personal circumstances

CURRENT HQP AT CARLETON UNIVERSITY:

Name	Degree	Years	Thesis or Project Title
Kameron Palmer	MASc	2019 –	Neural Net Landing Methodologies of Autonomous Uncrewed Aerial Vehicles on Maritime Vessels
Reza Dehghani Tafti[1]	PostDoc	2019 –	Control and Online Monitoring for Robotic Deburring
Stephanie Lowell	PhD	2021 –	Topology of the Ocean Surface and Relation to Maritime Launch and Recovery
Eric Giroux[O]	MASc	2022 –	Autonomous Mapping and Landing Location Determination for Uncrewed Aerial Vehicles on Maritime Vessels
Cornelius Liburd	MASc	2022 –	Drone Design for Autonomous Whale Blow Capture
Clair Vandesande	MASc	2023 –	Examination of Ship Motion Induced by Crane Motions
Utkarsh Sheel Anand	BASc	2022 –	Development of Whale Achoo: a whale blow simulator
Zaid Al-Lahham	BASc	2022 –	Development of Whale Achoo: a whale blow simulator
Ahmad El-Ferri	BASc	2022 –	Development of Whale Achoo: a whale blow simulator

Daan Singh	BASc	2022 –	Development of Whale Achoo: a whale blow simulator
Kashish Ralli	BASc	2022 –	Development of Whale Achoo: a whale blow simulator
Christine Oweis	BASc	2022 –	Development of Whale Achoo: a whale blow simulator
Carlos Prata Ramos	BASc	2023 –	Development of a New Autonomous Drone Simulator for Maritime Applications
Benjamin Zuniga - Rodriguez	BASc	2023 –	Development of a New Autonomous Drone Simulator for Maritime Applications
Brianna Hines	BASc	2023 –	Development of a New Autonomous Drone Simulator for Maritime Applications

[1] Co-supervised with Dr. Mojtaba Ahmadi
[O] Recipient of an Ontario Graduate Scholarship award

GRADUATED/COMPLETED HQP AT DALHOUSIE UNIVERSITY:

Name	Degree	Years	Thesis or Project Title
Clark Calnan[3]	MASc	2015 – 2017	Active Heave Compensation with Tow Angle Compensation for Unmanned Systems
Jeffrey Woodacre[3]	MASc	2013 – 2015	Model-Predictive Control of a Hydraulic Active Heave Compensation System with Heave Prediction
Dustin Johnson[4]	MASc	2013	Withdrew from program after 2 months to become a Program Officer with The Roméo Dallaire Child Soldiers Initiative
Lydia North[5,U]	BASc	2010 – 2011	Preliminary Investigation of Joint Failures for a Robotic Snake
Michael Nicholson[5]	BASc	2010 – 2011	Controller Design and Implementation for a Robotic Snake
David Nolan[5]	BASc	2010 – 2011	Design, Construction and Fabrication a Robotic Snake
Brennan West[5]	BASc	2010 – 2011	Dynamic Modelling of Robotic Snake

[3] Co-supervised with Dr. Robert Bauer at Dalhousie University
[4] Co-supervised with Dr. Yajun Pan at Dalhousie University

[5] Supervised while a Lecturer at Dalhousie and co-authored a collaborative paper
[U] Recipient of a NSERC USRA award

PAST RESEARCH ASSOCIATES:

Name	Location	Years	Thesis or Project Title
Jeffrey Woodacre	Dalhousie/ Carleton	2016 - 2019	Implementation of a Model Predictive Controller and Signal Prediction Algorithm for Real-Time Motion Compensation
Taufiqur Rahman[6]	Memorial University/ Rolls-Royce	2014-2015	Real-time object and pose recognition of a sparse 3D point cloud for the marine environment
John Kerr	Rolls-Royce	2014	Control System Support of Launch and Recovery Systems
Paul Bezanson	Rolls-Royce	2013-2015	Hydraulic System Design for a Novel Motion Compensation System
James Mallett	Rolls-Royce	2013-2015	Electrical and Software Design of a Novel Motion Compensation System
Daniel MacPhee	Rolls-Royce	2013-2015	Technical Design of a Novel Motion Compensation System
Julia Outerbridge	Rolls-Royce	2013	Modelling of Ship Motion in Regular and Irregular Seaways
Brian MacDonald	Rolls-Royce	2013	Proof-of-Concept Equipment Selection for an Electric Active Heave Compensation System for Unmanned Surface Vessels
Daniel Kehoe	Rolls-Royce	2012-2015	Preliminary Proof-of-Concept Design and Testing for the Launch and Recovery or Unmanned Surface and Sub-Surface Vessels

[6] Co-supervised with Nicholas Krouglicof at Memorial University

D) Other Evidence Of Teaching Effectiveness

In the first 8 months at Carleton University, I led a successful academic grant, valued at $50,000, from National Instruments. Carleton Simulator Project (CUSP) used the award to upgrade various aspects of the command and control systems. The new hardware & software allows undergraduate students to transition the previously developed small-scale control systems to the full-scale simulator. The added hardware has accelerated the operational progress of CUSP.

In 2023 I received funding from the Kennth M. Molson foundation to support a new capstone design project that will aim to develop technologies to autonomous collect whale blow samples. The students will advance their knowledge of drone flights in piloted and autonomous modes of operation. The team will also improve the capabilities of our laboratory whale blow apparatus 'Whale Achoo' so that it can be used with existing drone systems. The students will manually fly a commercial off-the-shelf drone to acquire test and measurement data from their advanced Whale Achoo. They will then use the data from their drone flights to improve the fully autonomous Gesundheit drone.

Teaching Awards:

Name	Year	Description
New Faculty Excellence in Teaching Award	2019	Award recognizes new faculty members who underscore Carleton's commitment to teaching excellence and innovation (Submission available upon request)
Teaching Achievement Award	2020	Award recognizes and enhances excellence in teaching while supporting the development of innovative teaching projects at Carleton University (Submission available upon request)

RESEARCH & SCHOLARLY WORK

MARINE SYSTEMS: PRIMARY RESEARCH PROGRAM

The mission of my research program is to increase safety on maritime vessels by advancing deck-machinery and robotics. To increase operational availability and welfare during maritime load transfers, the research program focuses on enabling technologies that can be used to compensate for the relative motion on all axes. Specific issues, due to the relative motion between the bodies, arise during cargo transfer between two floating platforms and during launch and recovery operations. The end goal of the program is to reliably launch, recover or transfer any load or object from the sea surface or another vessel to the host ship irrespective of weather conditions or relative motions. The program takes a systems level approach to the problem to make advances in: control algorithms, system modelling, machine vision, robotic actuation, and mechanical design of marine deck machinery and robotics.

To remove the motion of a ship relative to the fixed earth frame, heave compensation systems are employed in maritime operations. During ship-to-shore cargo transfers these systems allow the cargo to remain at a constant height above the dock regardless of the host ship's motion. However, traditional heave compensation systems are not adequate for load transfer between two bodies in motion such as a supply vessel and a floating oil platform. Traditional maritime cranes of an oil platform are unable to automatically compensate for the motion of the supply vessel. The rigging crews of the vessel must rely on the skills of the crane operator to account for the ship motion to prevent the hook from colliding with the deck or other equipment. Moreover, the ship's availability is severely limited by the sea conditions, as cargo transfer is extremely dangerous during inclement weather. The use of advanced simulations, robotics and motion compensation systems have been identified as growing areas of interest in a 2016 keynote address by Rear Admiral Michael Haycock, Chief Engineer of the Coast Guard to the research and industrial community.

The resulting technology of my research program would enable the marine industry to increase their operational safety as the relative motion between a crane's hook and the deck of the vessel could be drastically reduced without relying on operator experience. Moreover, the resulting systems would reduce dangerous slack cable on the deck of the support vessel while adding an automated level of safety for the ship's rigging crew. Crews would no longer need to worry about the hook or cable impacting them, the deck or being entangled in the slack cable. In the end, the program aims to reliably launch, recover or transfer any load or object from the sea surface or another vessel to the host ship irrespective of the daughter vessel, crane configuration, weather conditions or the relative motions.

ADDITIONAL RESEARCH INTERESTS/ACTIVITIES:

Uninhabited Aerial Vehicles (UAVs)

For any rotary aerial vehicle, ship-deck landings pose some of the most challenging flight dynamics in an ever-changing environment. Determining the safest time to land on a ship typically relies on the skill of the pilot to account and predict changes in the ship's motion. On an autonomous vehicle determining a 'quiescent period', where the ship's roll and pitch angles are below a critical threshold, is a significant problem. We are examining the landing challenges by developing new and novel algorithms to estimate quiescent periods enabling UAVs to land safely. This work is an extension and application of the primary research program.

Carleton University Simulator Project (CUSP)

As part of the undergraduate graduation requirements, all engineering students must take part in a year-long design project during their fourth year; one of these is the Carleton University Simulator Project (CUSP). CUSP began in 2002 with the goal of developing a novel simulator platform, free from the physical restrictions of traditional designs. The current design, the Atlas motion platform, is unique in that it may rotate freely in any direction. Working with Professors Hayes and Langlois, we are currently constructing the unique full-scale flight simulator which is capable of full inverted flight and unlimited rotation on all axes. The system is transitioning from an undergraduate teaching and learning tool to a high-fidelity instrument for graduate research at the masters and doctorial levels. The ultimate outcome of the research is a unique kinematic architecture and a new paradigm for motion simulators. This long-term outcome will provide incremental advancements and studies in sensor fusion, digital filtering, spherical mapping, mechanism design and human factors.

Robotic Manufacturing

Aerospace manufacturing involves large and complex parts with high variability and stringent precision and reliability constraints. Automated manufacturing can improve quality and efficiency while reducing the risk to humans. Deburring is a very complex, time-consuming, and expensive process that is currently done manually in this sector. Hand deburring is highly reliant on human skills and is prone to errors and low consistency with potentially harmful dust. Robotic deburring in sheet metal working is in high demand, but very complex to implement due to the intricate planning, tight tolerances, and variable loading involved. The work aims to develop a Sensor-based Precision Robotic Deburring (SPRD) technology for thin sheet metal parts.

To achieve the required machining stability and precision, novel multi-layer sensor-based controllers are being developed and investigated. Working with Professor Ahmadi, a robotic open-architecture experimental platform has been designed and integrated as the proof-of-concept for the SPRD technology at Carleton University. The platform facilitates the research on advanced sensing, control, and data processing methods, and enables studies to gain a better understanding of the material removal process and inter-relation of the process parameters.

A) PUBLICATIONS

Publication Summary

Peer-Reviewed Journal Articles	29	
Conference Proceedings	22	
Patent Application	1	
NATO report	3	
Theses and Technical Reports	11	
Career citations:	1040	(Google Scholar)
H-Index:	14	(Google Scholar)

In the listings below, HQP are denoted in bold face.

JOURNAL ARTICLES (29)

J29: **Martin I. A.**, Irani R. A. (2024) *Examination of Operator Performance with Shipboard Anti-Sway Crane in Virtual-Reality*. Ocean Engineering, Special Edition "Advances in Maritime Human Factors". Volume 298, 15 April 2024, 117164.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Assisted with experiments and testing. Reviewed all work and provided detailed feedback on the paper.

J28: **Lloyd S.**, Irani R. A., Ahmadi M., (2024) *Precision robotic deburring with Simultaneous Registration and Machining for improved accuracy, quality, and efficiency*. Robotics and Computer-Integrated Manufacturing, 88, 102733.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J27: **Lloyd S.**, Irani R. A., Ahmadi M., (2024) *Improved Accuracy and Contact Stability in Robotic Contouring With Simultaneous Registration and Machining*. IEEE Transactions on Control Systems Technology.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J26: **Lowell S.**, Irani R. A. (2023) *Experimental validation of the plunger-type flow model for irregular waves*. Ocean Engineering. Volume 279, 114463.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J25: **MacMillan W.**, Irani R. A., Ahmadi M., (2023) *Planar image-space trajectory planning algorithm for contour following in robotic machining*. CIRP Journal of Manufacturing Science and Technology, Volume 42, June 2023, Pages 1-11.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J24: **Westin C.**, Irani R. A. (2023) *Efficient semi-implicit numerical integration of ANCF and ALE-ANCF cable models with holonomic constraints*. Computational Mechanics.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J23: **Dehghani M.**, **McKenzie R. A.**, Irani R. A., Ahmadi M., (2023) *Robot-Mounted Sensing and Local Calibration for High-Accuracy Manufacturing*. Robotics and Computer-Integrated Manufacturing, Volume 79, 2023, 102429.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J22: **Lloyd S.**, Irani R. A., Ahmadi M., (2022) *Fast and Robust Inverse Kinematics of Serial Robots using Halley's Method*. IEEE Transactions on Robotics (T-RO) 3162954.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J21: **Martin I. A.**, Irani R. A. (2022) *Self-Tuning Anti-Sway Control For Shipboard Cranes Providing Combined World and Deck-Frame Compensation*. Ocean Engineering. v. 251, 110957.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J20: **Lowell S.**, **McPhee J.**, Irani R. A. (2022) *Plunger-type wavemakers with flow: sensitivity analysis and experimental validation*. Applied Ocean Research. Volume 121, 103065.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Assisted with experiments. Reviewed all work and provided detailed feedback on the paper.

J19: **McKenzie R. A.**, Irani R. A. (2022). *Motion Compensation for Maritime Cranes During Time-Varying Operations at the Pendulum's Natural Frequency*. Mechanism and Machine Theory. Volume 168, 104573.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and wrote a majority of the paper.

J18: **Miller G.**, Irani R. A., Ahmadi M. (2021) *Application of Mechanistic Force Models to Features of Arbitrary Geometry at Low Material Removal Rate*. The International Journal of Advanced Manufacturing Technology.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J17: **Miller G.**, Irani R. A., Ahmadi M. (2021) *The Application of Mechanistic Cutting Force Models for Robotic Deburring*. The International Journal of Advanced Manufacturing Technology v. 115, pg.199–212.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J16: **Westin C.**, Irani R. A. (2021) *Modelling Dynamic Cable-Sheave Contact and Detachment During Towing Operations*. Marine Structures, v. 77, 102960.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J15: **Martin I. A.**, Irani R. A. (2021) *Dynamic Modeling and Self-Tuning Anti-Sway Control of a Seven Degree of Freedom Shipboard Knuckle Boom Crane*. Mechanical Systems and Signal Processing, v. 153, 107441.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J14: **Lloyd S.**, Irani R. A., Ahmadi M., (2021) *A numeric Derivation for Fast Regressive Modeling of Manipulator Dynamics*. Mechanism and Machine Theory, Volume 156, 104149.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J13: **Abujoub S.**, **McPhee J.**, Irani R. A. (2020) *Methodologies for Landing Autonomous Aerial Vehicles on Maritime Vessels*. Aerospace Science and Technology, v. 106, pp. 106169.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J12: **Martin I.,** Irani R. A. (2020), *A Generalized Approach to Anti-Sway Control for Shipboard Cranes*. Mechanical Systems and Signal Processing, v. 148, pp. 107168.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J11: **Lloyd S.**, Irani R. A. and Ahmadi M. (2020), *Neural Network Quadrature for Fast Numerical Integration and Optimization*. IEEE Access, v. 8, pp. 84519-84531.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed all work and provided detailed feedback on the paper.

J10: **Calnan C**., Bauer R. J., Irani R. A. (2018), *Reference-Point Algorithms for Active Motion Compensation of Towed Bodies*. IEEE Journal of Oceanic Engineering, v. 44, n. 4, pp. 1024-1040.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Assisted with experiments. Reviewed all work and provided detailed feedback on the paper.

J9: **Woodacre J**., Bauer R. J., Irani R. A. (2018), *Hydraulic Valve-Based Active-Heave Compensation using a Model-Predictive Controller and Dead-band Correction*. Ocean Engineering, v. 152C, pp. 47-56.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Assisted with experiments. Reviewed all work and provided detailed feedback on the paper.

Above Line with Carleton Affiliation

J8: **Woodacre J.**, Bauer R. J., Irani R. A. (2015) *A Review of Vertical Motion Heave Compensation Systems*. Ocean Engineering, v. 104, pp. 140-154.
Role: PI of the research. Provided significant input to the review. Provided student with conceptual framework, purpose, and scope for article. Reviewed and provided detailed feedback on the paper.

J7: Irani R. A., Bauer R. J., **North L.**, **Nicholson M.**, **Nolan D.**, **West B.** (2014) *Analysis of Joint Failures on the Lateral Undulation Gait of a Robotic Snake*. Transactions of the Canadian Society for Mechanical Engineering, v. 39, n. 2, pp. 253-268.
Role: PI of the research. Provided significant input to the writing of the article, technical content, development and performed experiments. Reviewed and provided detailed feedback on the paper.

J6: Irani R. A., Bauer R. J., Warkentin A. (2014) *Application of a Dynamic Pressure-Sinkage Relationship for Lightweight Mobile Robots*. International Journal of Vehicle Autonomous Systems, v. 12, n. 1, pp. 1-23.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor and his colleague.

J5: Irani R. A., Bauer R. J., Warkentin A. (2013) *Dynamic Wheel-Soil Model for Lightweight Mobile Robots*. Journal of Intelligent and Robotic Systems, v. 71, n. 2, pp. 179-193.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor and his colleague.

J4: Irani R. A., Bauer R. J., Warkentin A. (2011) *A Dynamic Terramechanic Model for Small Lightweight Vehicles with Rigid Wheels and Grousers Operating in Sandy Soil*. Journal of Terramechanics, v. 48, n. 4, pp. 307-318.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor and his colleague.

J3: Irani R. A., Bauer R. J., Warkentin A. (2007). *Development of a New Cutting Fluid Delivery System for Creepfeed Grinding*. International Journal of Manufacturing Technology and Management, v. 12, n. 1/2/3, pp. 108-126.
Role: Conducted during my MAsc therefore this paper is co-authored with my graduate supervisor and his colleague.

J2: Salam A., Lohmann U., Crenna B., Lesins G., Klages P., Rogers D., Irani R. A., MacGillivray A., Coffin M. (2006). *Deposition Ice Nucleation Studies of Mineral Dust Particles with a New Continuous Flow Diffusion Chamber*. Aerosol Science and Technology, v. 40, n. 3, pp. 134-143.
Role: Developed the novel design and construction of the test chamber and experimental setup. Reviewed and provided detailed feedback on the paper.

J1: Irani R. A., Bauer R.J., Warkentin A. (2005) *A Review of Cutting Fluid Application in the Grinding Process*. International Journal of Machine Tools and Manufacture, v. 45, n. 15, pp. 1696-1705.
Role: Conducted during my MASc therefore this paper is co-authored with my graduate supervisor and his colleague.

Refereed Conference Proceedings (18)

C22: **Lloyd S**., Irani R. A., Ahmadi M., (2023) *A Framework for Simultaneous Workpiece Registration in Robotic Machining Applications*, the 2023 IEEE International Conference on Robotics and Automation (ICRA 2023), May 29 – June 2, 2023. London, UK.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C21: **Lloyd S.**, Irani R. A., Ahmadi M., (2023) *Fast and Robust Inverse Kinematics of Serial Robots Using Halley's Method*, IEEE Transactions on Robotics (T-RO) paper, presented at ICRA 2023, London, UK.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C20: **Lloyd S.**, Irani R. A., Ahmadi M., (2022) *Application of Pseudo-Symbolic Dynamic Modeling (PSDM) in the Modeling & Calibration of a 6-DOF Articulated Robot*, the American Automatic Control Council (AACC) and International Federation of Automatic Control (IFAC) conference on Modeling, Estimation and Control Conference (MECC 2022), October 2-5, 2022, Jersey City, USA. BEST STUDENT PAPER AWARD.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C19: **Lloyd S.**, Irani R. A., Ahmadi M., (2022) Fast and Robust Inverse Kinematics of Serial Robots using Halley's Method, the American Automatic Control Council (AACC) and International Federation of Automatic Control (IFAC) conference on Modeling, Estimation and Control Conference (MECC 2022), October 2-5, 2022, Jersey City, USA. RISING STAR SPECIAL SESSION.

Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C18: **Lowell S.,** Irani R. A. (2020) *Sensitivity analysis of plunger-type wavemakers with water current*, IEEE Global OCEANS 2020: Singapore - U.S. Gulf Coast, Virtual, October 5-20th. (Accepted)
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C17: **M. Micomonaco**, M.J.D. Hayes, R. Irani, R.G. Langlois, (2020) *Performance of Recent Large-Angle Extensions to Classical Simulator Washout Algorithms*, Proceedings of the Vertical Flight Society Forum 76 (VFS 76), Virtual, October 5-8th. (Accepted)
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C16: **Westin C.,** Irani R. A. (2020) *Continuously Differentiable Stick-Slip Friction Model with Applications to Nonlinear Systems*, 4th IEEE Conference on Control Technology and Applications (CCTA 2020), Virtual, August 24-26th.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C15: **Martin I. A.**, Irani R. A. (2019) *Evaluation of Both Linear and Non-Linear Control Strategies for a Shipboard Marine Gantry Crane*, MTS IEEE OCEANS 2019 Seattle WA, October 27-31st, 2019.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C14: **M. Micomonaco**, M.J.D. Hayes, R. Irani, R.G. Langlois, (2019) *Classical Washout Using Quaternions*, Proceedings of the 10th CCToMM Symposium on Mechanisms, Machines, and Mechatronics, École de technologie supérieure, Montréal QC, May 16-17th, 2019.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C13: **Abujoub S., McPhee J., Westin C.**, Irani R. A. (2018) *Unmanned Aerial Vehicle Landing on Maritime Vessels using Signal Prediction of the Ship Motion*, In the Proceedings of Oceans18 MTS IEEE, Charleston NC, October 22-25th, 2018.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C12: **Westin C.**, Irani R. A. (2018) *Vortex-Induced Vibrations of a Low-tension Cable-Sheave System Modeled using Nonlinear Finite Elements*, In the Proceedings of The Canadian Society for Mechanical Engineering International Congress 2018 (CSME 2018), Toronto ON, May 27-30th, 2018.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Reviewed and provided detailed feedback on the paper.

C11: **McPhee J.**, Irani R.A. (2018) *On-line Determination of a Go-NoGo State Using a Continous Estimation of the System Response*, In the Proceedings of The Canadian Society for Mechanical Engineering International Congress 2018 (CSME 2018), Toronto ON, May 27-30th, 2018.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Performed and reviewed simulations. Reviewed and provided detailed feedback on the paper.

C10: **Westin C.**, Irani R. A. (2017) *Cable-Pulley Interaction with Dynamic Wrap Angle Using the Absolute Nodal Coordinate Formulation*. In the proceedings of the 4th International Conference of Control, Dynamic Systems, And Robotics (CDSR'17), Toronto ON, August 21-23rd, 2017. **[BEST PAPER AWARD]**
Role: PI of the research. Provided significant input to the technical content and direction of the work. Performed and reviewed simulations. Reviewed and provided detailed feedback on the paper.

C9: Irani R. A., **Schut N.**, Hayes M.J., and Langlois R., (2017) *A Novel Flight Simulator Capable of Unbounded Rotation*. In the proceedings of 2017 IEEE International Symposium on Systems Engineering, Vienna, Austria, October 11-13th, 2017.
Role: co-PI of the research. Provided significant input to the technical content and direction of the work. Wrote the paper and performed much of the analysis/discussion.

C8: **Woodacre J.**, **Woles W.**, Bauer R. J., Irani R. A. (2016) *Coupling a Standard Hydraulic Valve and Advanced Control to Achieve a Motion Compensation System*. In the proceedings of American Society of Naval Engineers: Launch & Recovery Symposium, Linthicum MD, November 16-17th, 2016.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Performed and reviewed simulations. Reviewed and provided detailed feedback on the paper.

C7: **Calnan C.**, Bauer R., Irani R. A., (2016) *Controller Design and Generalized Motion Compensation for Marine Towed Bodies*. Oceans16 MTS IEEE Monterey CA, September 19-23rd 2016.
Role: PI of the research. Provided significant input to the technical content and direction of the work. Performed and reviewed simulations. Reviewed and provided detailed feedback on the paper.

Above Line with Carleton Affiliation

C6: Irani R. A., Spencer W. W. (2014) *Future Launch and Recovery System.* In the proceedings of American Society of Naval Engineers: Launch & Recovery of Manned and Unmanned Vehicles from Surface Platforms, Linthicum MD, November 19-20th, 2014.
Role: PI of the research. Authored the paper, summarized findings, and had significant input to the technical content.

C5: Irani R. A., **Kehoe D.**, Spencer W. W., Watt G., Gillis C., Carretero J. A., Dubay R. (2014) *Towards a UUV Launch and Recovery System on a Slowly Moving Submarine*. In the proceedings of The Royal Institution of Naval Architects: Warship 2014, Naval Submarines & UUV's, Bath UK, June 18-19th 2014.
Role: PI of the research. Authored the paper, summarized findings, and had significant input to the technical content.

C4: Irani R. A., Bauer R. J., Warkentin A. (2011). *Dynamic Terramechanic Model for Grouser Wheels on a Planetary Rover in Sandy Soil*. In the proceedings of Canadian Congress of Applied Mechanics, CANCAM 2011, Vancouver BC, June 5-9th 2011.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor and his colleague.

C3: Irani R. A., Bauer R. J., Warkentin A. (2010). *Modelling a Single-wheel Testbed for Planetary Rover Applications*. In the proceedings of the ASME Dynamic Systems and Control Conference, DSCC 2010, Boston MA, September 13-15th 2010.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor and his colleague.

C2: Irani R. A., Bauer R. J., Warkentin A. (2010) *Design of a Single-wheel Testbed and Preliminary Results for Planetary Rover Applications*. In the proceedings of The Canadian Society for Mechanical Engineering Forum CSME 2010, Victoria BC, June 7-9th, 2010.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor and his colleague.

C1: Irani R. A., Bauer R. J., Warkentin A. (2006) *New Cutting Fluid Delivery System for Creepfeed Grinding*. In the proceedings of The Canadian Society for Mechanical Engineering Forum 2006, Kananaskis AB, May 21-24th, 2006.
Role: Conducted during my MASc therefore this paper is co-authored with my graduate supervisor and his colleague.

Patent Applications (1)

P1: **Bezanson P.**, Irani, R. A., Vettinghoff H., (filing date September 27, 2013), U.S. Patent Application No. 61883519: *Two Body Motion Compensation System for Marine Applications*.
Role: System level patent, contributions were the sensor systems, the control methodology and a variety of the embodiments. Authored sections of the patent and reviewed the contributions of others.

NATO Committees & Reports (3)

N3: Pudduck R., Burston D., Di Marco B., Goodwin J., Irani R. A., Mana L., Verbraeken T., Yigit M. C., Upshall P., and Veal A., NATO NIAG SG-187, Vol 1-4.
Role: Provided input pertaining to the shipboard equipment. Reviewed and provided detailed feedback on the work.

N2: Pudduck R., Burston D., Di Marco B., Goodwin J., Irani R. A., Mana L., Verbraeken T., Yigit M. C., Upshall P., and Veal A., *SG-186 Launch and Recovery*, NATO NIAG SG-186, Vol 1-4.
Role: Provided input pertaining to the shipboard equipment. Reviewed and provided detailed feedback on the work.

N1: Pudduck R., Burston D., Di Marco B., Goodwin J., Lebans G., Irani R. A., Mana L., Verbraeken T., Yigit M. C., Upshall P., and Veal A., *SG-171 Launch and Recovery of Surface and Sub-Surface Vehicles*, NATO NIAG SG-171, Vol 1-4.
Role: Provided input pertaining to the shipboard equipment. Reviewed and provided detailed feedback on the work.

non-Refereed Conference Proceedings (4)

nC4: Irani R. A., Bauer R. J. (2010) *Dynamic Terramechanic Model for Lightweight Mobile Robots in Sandy Soil*. In the proceedings of the Mechanical Engineering Research Conference, Halifax NS, April 29th, 2011.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor.

nC3: Irani R. A., Bauer R. J. (2010) *Design of a Single-Wheel Test bed and a Dynamic Model for Planetary Rovers in Sandy Soil*. In the proceedings of the Mechanical Engineering Research Conference, Halifax NS, April 26th, 2010.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor.

nC2: Irani R. A., Bauer R. J. (2009) *Reinventing the Wheel*. In the proceedings of the Mechanical Engineering Research Conference, Halifax NS, April 27th, 2009.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor.

nC1: Irani R. A., Bauer R. J. (2008) *Tools for the Next Generation of Mars Rovers*. In the proceedings of the Mechanical Engineering Research Conference, Halifax NS, April 25th, 2008.
Role: Conducted during my PhD therefore this paper is co-authored with my graduate supervisor.

TECHNICAL REPORTS (7)

TR7: **Westin C.**, Irani R. A., (2019). Added Mass Coefficients of Cylinders Near Free Surface. For Dynamic System Analysis Ltd (DSA Ltd).
Role: PI of the research. Secured NSERC funding (Engage), conceived the solution, oversaw the work, authored, and reviewed sections of the report and had significant input to the technical content.

TR6: Irani R. A., **McKenzie R.**, **Woodacre J.**, (2019). *iWinch* Software: Filter Analysis and Data Acquisition System. For Rolls-Royce Canada Limited, document number: 14106-1020-1010-0.
Role: PI of the research. Secured private funding, conceived solution, oversaw the work, authored sections of the report, summarized findings, and had significant input to the technical content.

TR5: **Westin C.**, Irani R. A. (2018). Cable Strumming Analysis. For Rolls-Royce Canada Limited, document number: 16275-2100-1001-1.
Role: PI of the research. Secured private funding, conceived solution, oversaw the work, authored sections of the report, summarized findings, and had significant input to the technical content.

TR4: Irani R. A. (2017). Simulated Ship Motion Data. For Rolls-Royce Canada Limited, document number: 14106-1020-1009-0.
Role: PI of the research. Secured private funding, conceived solution, performed all work, authored all sections of the report and contents.

TR3: **Woodacre J.**, Irani R. A. (2016). Application of Prediction Systems for a New Launch and Recovery System. For Rolls-Royce Canada Limited.
Role: PI of the research. Secured private funding, conceived solution, oversaw the work, authored sections of the report, summarized findings, and had significant input to the technical content.

TR2: Irani R. A., Militz0er J. (2011). *Modelling Fluid Dispensing from a Tank for the Food Service Industry*. A.C. Dispensing Equipment Inc. and National Research Council of Canada. Industrial Research Assistance Program.
Role: Authored work, developed model, performed simulation and the validation of the data.

TR1: Bauer R., Irani R. A. (2008). *Comparison of Experimental Results from a Rover Chassis Prototype with Computer Simulations*. MacDonald Dettwiler and Associates Ltd. (MDA) Space Missions.
Role: Conducted experiments, performed simulation, validations and code development. Carried out during my PhD therefore this paper is co-authored with my graduate supervisor.

THESES (4)

T4: Irani R. A. (August 2011) Dalhousie University, *Modelling Dynamic Effects in a Terramechanical Model for a Single Wheel in Sandy Soil*. (PhD Thesis).

T3: Irani R. A. (May 2006) Dalhousie University, *Dual Cutting Fluid Application in the Grinding Process*. (MASc Thesis).

T2: Danelon D., Irani R. A., Mariani S., Morency K., Paun W., vanWezel P., Zuccato A. (August 2003) University of Windsor, *SAE Mini-Baja Design and Construction*. (Primary BASc. Thesis).

T1: Irani R. A., Pudlak C., Stankovic S. (August 2003) University of Windsor, *Castings for SAE Mini-Baja Vehicle* (Secondary BASc. Thesis).

Relationship of Publications to Research Interests

The following summarizes how the recent publications fall within the current research interests.

Marine Systems:	J29, J26, J24, J21, J20, J19, J16, J15, J12, J10, J9, J8 C18, C16, C15, C12, C10, C8, C7, C6, C5 P1, N1, N2, N3, TR7, TR6, TR5, TR4, TR3
UAVs:	J13, C11, C13
CUSP:	C17, C14, C9
Robotic Manufacturing:	J28, J27, J25, J23, J22, J18, J17, J14, J11 C22, C21, C, 20, C19

B) Research Funding - Secured

Since joining Carleton University in January 2016, I have secured a total of $1,169,780 in external funding, $395,780 as a PI and as a co-PI, I have a 50% allocation of the $774,000 award. Currently, under review is one project worth $194,925 where I am a co-applicant.

Currently Held Funding

Whale Achoo – An Autonomous System to Collect a Whale's Blow — 2023
Kenneth M Molson Foundation — *$80,000*
Principal Investigator
Carleton University

Gesundheit — 2022
Kenneth M Molson Foundation — *$79,000*
Principal Investigator
Carleton University

Advancing Marine Systems: Ship Deck Equipment — 2022-2027
NSERC – Discovery Grant — *$27,000/yr*
Principal Investigator — *$135,000*
Carleton University — *total*

Previously Held Funding at Carleton University

Industrial Precision Robotic Deburring for Aerospace Manufacturing — 2021-2022 *$175,000*
Ontario Centre of Excellence
Voucher for Innovation and Productivity II (VIP II) — Awarded in 2018
co-Principal Investigator (PI - Dr. Mojtaba Ahmadi)
Carleton University
50% allocation to each PI

Sensor-based Precision Robotic Deburring for Aerospace Manufacturing — 2018-2021 *$599,000*
NSERC - Collaborative Research and Development
co-Principal Investigator (PI - Dr. Mojtaba Ahmadi)
Carleton University
50% allocation to each PI

Future Marine Launch and Recovery Systems — 2017-2022
NSERC – Discovery Grant — *$23,000/yr*
Principal Investigator — *$115,000*
Carleton University — total

Investigation of Time Varying Hydrodynamic Added Mass — 2018
NSERC - Engage — $25,000
Principal Investigator
Carleton University

Cable Strumming 2018
Contract – Rolls-Royce Canada Limited $9,500
Principal Investigator
Carleton University

Motion Matching Software 2018
Contract – Rolls-Royce Canada Limited $45,000
Principal Investigator
Carleton University

Software Preparations for Sea Trial 2018
Contract – Rolls-Royce Canada Limited $36,600
Principal Investigator
Carleton University

Load Modelling and Control of a Rotational System with a Large Inertia 2016
$13,000
Ontario Centre of Excellence
Voucher for Innovation and Productivity I (VIP I)
Principal Investigator
Carleton University

The Support and Advancement of an In-Situ Reconfigurable Marine Launch and Recovery System 2016-2017
$74,800
Contract: Kraken Launch and Recovery Systems
Principal Investigator
Carleton University

Simulated Motion Data 2017
Contract – Rolls-Royce Canada Limited *$15,000*
Principal Investigator
Carleton University

The Command & Control for Unbounded Rotation in a Novel Flight Simulator 2016
$50,000
Award – NI Academic Research Grant
Principal Investigator
Carleton University

Application of Prediction Systems for a New Launch and Recovery System 2016
$11,880
Contract – Rolls-Royce Canada Limited
Principal Investigator
Dalhousie University

The Intelligent Winch Program 2014 – 2016
Principal Investigator *$600,000*
Held while at Rolls-Royce Canada Limited
Funding Agencies:
The Research and Development Corporation of Newfoundland and Labrador (RDC) Amount: $300k
The Petroleum Research and Development of Newfoundland and Labrador (PRNL) Amount: $300k

Funding Prior to Carleton University

The Intelligent Winch Program 2014 – 2016
Principal Investigator *$600,000*
Held while at Rolls-Royce Canada Limited
Funding Agencies:
The Research and Development Corporation of Newfoundland and Labrador (RDC) Amount: $300k
The Petroleum Research and Development of Newfoundland and Labrador (PRNL) Amount: $300k

C) Other Evidence Of Research Activity

Memorandums of Understanding (MOU)

Dynamic Systems Analysis Ltd. (DSA) initiated and signed an MOU with Carleton with the expressed interest in developing a relationship with my research program. Currently, free-of-charge, DSA has provided me with their ShipMo3D software. The MOU lead to the development of a successful NSERC-Engage grant and the use of ShipMo3D has allowed for improved ship motion simulations which my research group has been using extensively.

SERVICE TO THE UNIVERSITY, THE PROFESSION AND SOCIETY

A) CARLETON UNIVERSITY ORGANIZATIONAL ROLES & SERVICE

Committee Membership or Representation

University Level

Adjudication Committee – New Faculty Excellence in Teaching Award	2020 – 2022
Adjudication Committee – CU Chair in Teaching and Innovation	2022
Adjudication Committee – Teaching Achievement Award	2021

Faculty Level

Equity Diversity and Inclusion Council (FED EDI Council)	2022 – Present
Faculty Coordinator for PEO student paper night presentation competition	2016 – 2020

Departmental Level

Dynamics and Controls Strand Committee (Chair)	2016 – Present
Hiring Committee for Lecturer I	2020 – 2021
Department Equipment Committee	2020 – 2021
Carleton Mechanical and Aerospace Society Faculty Representative	2016 – 2021
International Doctoral Tuition Scholarship (IDTS) committee	2019
Recruitment and 1st Year Affairs Committee	2018 – 2019
Curriculum Committee (Mechanical, Biomedical & Mechanical, Sustainable and Renewable Energy Engineering)	2016 – 2018
Ontario Engineering Competition Academic Mentor	2016 – 2017
Capstone Design Project Committee	2016 – 2017

Graduate Thesis Committee Membership

Mirja Rotzoll	PhD	Dept Examiner	2023-05-03
Stephanie Bennett	PhD	Faculty Examiner	2019-05-28
Zach Copeland	PhD Comprehensive	Dept Examiner	2021-12-14
Mirja Rotzoll	PhD Comprehensive	Dept Examiner	2021-05-11
Abdalla Ayad B Zreiba	PhD Comprehensive	Dept Examiner	2019-08-20
Osama Al-Mai	PhD Comprehensive	Dept Examiner	2018-08-27
Bradley M. Conrad	PhD Comprehensive	Dept Examiner	2017-04-26
Erin Austen	MASc	Dept Examiner	2019-09-03
Jasvardan Sethi	MASc	Dept Examiner	2019-05-06
Justin Kernot	MASc	Dept Examiner	2019-05-01
Justin Berquist	MASc	Internal Examiner	2017-08-24
Brock Conley	MASc	Dept Examiner	2017-04-20
Zachary Copeland	MASc	Dept Examiner	2017-01-13
Taran Sachdeva	MASc	Dept Examiner	2016-08-29
Katherine DiCola's	MASc	Dept Examiner	2016-07-11
Patrick Kehoe	MASc	Chair of Defence	2023-09-26
Autumn Bernard	MASc	Chair of Defence	2023-08-22
Olivia Chamberland	MASc	Chair of Defence	2021-12-16

Luminita Dumitrascu's	MASc	Chair of Defence	2020-11-06
Salman Shafi	MASc	Chair of Defence	2020-01-06
Gerard Desmarais	MASc	Chair of Defence	2018-08-30
Alexander Hayes	MASc	Chair of Defence	2018-06-29

University Outreach

PEO Paper Night – Carleton University Liaison	2016 – 2020
Saturday Engineering and Design Sessions (SEDS)	2018 – 2019
Carleton University March Break Day	2019
GTA Explore Carleton	2018
EngFrosh – Boat Building Judge	2016 – 2017
University Recruitment Calls	2017 – 2018
New Students Orientation Lunch	2016

B) External Committee and Organizational Roles

Engineers Canada's Advisory Group on Autonomous Systems 2020 – 2021
Submitted application to be part of Engineers Canada's advisory board

International Conference of Control, Dynamic Systems, and Robotics 2016 – 2020
Scientific Committee member for the international conference

IEEE International Symposium of Systems Engineering 2017
Technical program committee member for the international conference

Automation and Controls Workgroup 2014 – 2015
Team member to examine specific automation concerns maritime deck machinery for arctic conditions.

Arctic Planning Committee 2014 – 2015
Team member to advance maritime deck machinery for arctic conditions.

Refueling at Sea Workshop 2014
Organized a multiday workshop to collaborate with Bob Galaway of Naval Surface Warfare Center Carderock Division

Maritime Deck Machinery and Systems Workshop 2013
Organized a multiday workshop to collaborate with Barney Harris of CDI

NATO - Industrial Advisory Group (NIAG) 2013 – 2015
Committee member of Study Group 171, 186 and 187
National Representative for Canada on Study Group 186 and 187

Mechanical Engineering Research Conference, MERC 2008 – 2011
Served as Chair, co–Chair, and as an Advisor

Canadian Congress of Applied Mechanics, CANCAM 2009
Proceedings Production and Editing 2009

C) Invited Talks/Presentations

Marine Robotics, Jet Engines & Flight Simulators 2016
University of Windsor

Control Systems for Marine Robotics 2016
Dalhousie University

Marine Robotics & Deck Machinery 2015
Carleton University

Marine Robotics & Deck Machinery 2015
Dalhousie University

Unmanned Refueling and Regeneration Systems for NATO-NIAG 2015
SG187 Workgroup Meeting 4, Reykjavik, Iceland

Unmanned Underwater Vehicle (UUV) Launch and Recovery Systems 2015
Royal Institution of Naval Architects (RINA), Halifax Chapter Meeting

Launch and Recovery Options for an Unmanned Undersea Vehicle 2015
Lockheed Martin, West Palm

How to Launch and Recover an Unmanned System 2014
Rolls-Royce & Lockheed Martin, Peterborough, Canada

Launch and Recovery of a Remote Minehunting System 2014
Lockheed Martin, West Palm

Recovery Options, Hook Designs and Configurations for NATO-NIAG 2013
SG171 Workgroup Meeting 3, Brussels, Belgium

Considerations for Marine Launch and Recovery Systems 2013
Dalhousie University

D) Awards

Carleton University - Teaching Achievement Award	2020
Carleton University - New Faculty Excellence in Teaching Award	2019
Rolls-Royce - Service Excellence Award	2013
NSERC - Industrial R&D Fellowship (IRDF)	2012 – 2014
NSERC - Visiting Fellowship (VF) Canadian Government Laboratories	2011 declined
NSERC - Postgraduate Scholarship (PGS D)	2006 – 2009
Dalhousie University President's Award	2007
George C. Reid and Lucille M. Reid Scholarship	2006 – 2009
Bruce and Dorothy Rosetti Engineering Research Scholarships	2004 – 2009

E) Peer-Review Activities

Research Proposals

MITACS – Accelerate Research Program

Journals

IEEE/ASME Transactions on Mechatronics
IEEE International Systems Engineering Symposium
IEEE Journal of Oceanic Engineering
International Journal of Machine Learning and Cybernetics
Journal of Field Robotics
Journal of Intelligent and Robotic Systems
Journal of Marine Science and Technology
Journal of Ship Production and Design
Mathematical Problems in Engineering
Ocean Engineering
PLOS ONE
Robotica

Conferences

International Conference of Control, Dynamic Systems, and Robotics (CDSR)
IEEE International Symposium on Systems Engineering (ISSE)
IEEE Conference on Control Technology and Applications (CCTA)

F) Professional Development

Academic

Plagiarism Training	Elsevier
Certified Peer Reviewer Course	Elsevier
NSERC Discovery/Alliance/CREATE/Strategic/Grant Workshop	Carleton

Technical

LabView Core 1 & 2	LabView
MathWorks Multibody Simulation	Mathworks
Ship Seakeeping and Small Boat Dynamics during Launch and Recovery	ASNE

Workplace & Faculty

Male Allyship in STEM	Carleton
Worker Health & Safety Awareness Training	Carleton
Violence & Harassment Training	Carleton
Tenure & Promotion	Carleton
New Faculty Orientation	Carleton
Teaching with PowerPoint	Carleton-EDC
Welcome to My Classroom: Social Media in the Classroom	Carleton-EDC
Multiple Choice Retreat	Carleton-EDC
Getting the Most Out of Groups	Carleton-EDC

NAFISEH KAHANI

Department of Systems and Computer Engineering - Carleton University
nafisehkahani@cunet.carleton.ca

EDUCATION

- **PhD Computer Science**, Queen's University, Canada.
  Thesis: *Synthesis and Verification of Models using Satisfiability Modulo Theories.*
  Supervisor: Prof. James R. Cordy
  School of Computing 2019 PhD Research Achievement Award, and IEEE PhD Research Excellence Award.
- **MSc (Hons) Information Security Engineering**, AmirKabir University of Technology (Tehran Polytechnic), Iran.
  Thesis: *A Reactive Defense against Bandwidth Attacks using Learning Techniques*.
  Supervisor: Prof. Mehran S. Fallah
  First Class Honours, and Thesis and Dissertation Award.
- **BSc (Hons) Software Engineering**, Shahid Bahonar Kerman University, Iran.

ACADEMIC/PROFESSIONAL EXPERIENCE

Carleton University — **Assistant Professor**
Department of Systems and Computer Engineering — *2021-present*

University of Ottawa — **Postdoctoral Fellowship**
School of Electrical Engineering and Computer Science — *2020-2021*
- Research on "Machine Learning for Practical and Scalable Regression Test Selection and Prioritization"

Queen's University — **Research Assistant**
Software Technology Lab — *2014-2020*
- Research on automated model synthesis and verification of real-time embedded systems in the context of model-driven development (https://github.com/nafisehka/UMLRTSynthesizer)
- Create the "www.mdetools.com" website as a free service to the public with a search capability determining which model transformation tools support a given set of features
- Contributor of SimGen tool, which helps in the creation of 3D simulations for embedded systems testing (https://github.com/PasternakMichal/SimGen)

MCI Co — **Software Engineer**
Testing — *2010- 2013*
- Penetration test and hardening of databases (SQL, ORACLE) and web applications
- Implementation of Information Security Management Systems (ISMS- ISO 27001) for several banks
- Training Program Consultant in the area of Computer Emergency Response Teams (CERTs)

AmirKabir University — **Research Assistant**
Formal Security Lab — *2006-2009*
- Research on detecting and exploiting software and network vulnerabilities
- Implementation of a network-based E-voting protocol using anonymity methods
- Linear cryptanalysis of DES and timing cryptanalysis of RSA algorithms
- Design of a new symmetric cryptographic system

RESEARCH FUNDING- GRANTED

MITACS Elevate **2023**

- Title: Real-time Control Software, Calibration, and Assessment of a Redundant Robotic System Operating in a Supersonic Wind-Tunnel
- Role: Co-Principal Investigator
- Total: 60K CAD expiring in 2025

NSERC Discovery Grant **2021**

- Title: Machine Learning for Efficient Regression Testing in Continuous Integration Context
- Role: Principal Investigator
- Total: 137K CAD expiring in 2027

CU NSERC Research Development Grant **2021**

- Title: Reinforcement Learning for Testing and Repairing of State Machine Models
- Role: Principal Investigator
- Total: 10K CAD

MITACS **2020**

- Title: Machine Learning for Practical and Scalable Regression Test Selection and Prioritization
- Role: collaborator- Team: Dr. Lionel Briand
- Total: 818K CAD
- Industry Partner: Huawei

RESEARCH FUNDING- SUBMITTED

MITACS Accelerate **2024**

- Title: Digital Trust Test Bench
- Role: Principal Investigator
- Total: 90K CAD
- Industry Partner: Digital Identity Laboratory of Canada

Privacy Commissioner of Canada (OPC) **2024**

- Title: Enhancing Privacy in Large Language Models: A PIPEDA-Compliant Approach for Canadian Organizations
- Role: Co-Principal Investigator
- Total: 100K CAD

Engineering Information Foundation **2024**

- Title: Advancing Inclusiveness in Software Engineering Course Materials: A Machine Learning Approach
- Role: Principal Investigator
- Total: 25K USD

PUBLICATIONS

Journal Articles

[J1] A. S. Yaraghi, D. Holden, N. **Kahani**, and L. Briand, "Automated Test Case Repair Using Language Models," *IEEE Transactions on Software Engineering (TSE)- under review*

[J2] M. Ashouri-Talouki, N. **Kahani**, and M. Barati, "A Revocable Attribute-based Access Control with Non-Monotonic Access Structure," *Annals of Telecommunications- under review*

[J3] A. S. Yaraghi, M. Bagherzadeh, N. **Kahani**, and L. Briand, "Scalable and accurate test case prioritization

in continuous integration contexts," *IEEE Transactions on Software Engineering (TSE)*, pp. 1–27, 2022

[J4] M. Bagherzadeh, N. **Kahani**, and L. Briand, "Reinforcement learning for test case prioritization," *IEEE Transactions on Software Engineering (TSE)*, pp. 1–21, 2021

[J5] M. Bagherzadeh, **Kahani, N.**, K. Jahed, and J. Dingel, "Execution of partial state machine models," *IEEE Transactions on Software Engineering (TSE)*, pp. 1–27, Jul 2020

[J6] N. **Kahani**, M. Bagherzadeh, J. R. Cordy, J. Dingel, and D. Varró, "Survey and classification of model transformation tools," *Software & Systems Modeling*, pp. 1–37, January 2019

[J7] M. Bagherzadeh, N. **Kahani**, C.-P. Bezemer, A. E. Hassan, J. Dingel, and J. R. Cordy, "Analyzing a decade of linux system calls," *Empirical Software Engineering*, vol. 23, no. 3, pp. 1519–1551, 2018

[J8] M. S. Fallah and N. **Kahani**, "TDPF: a traceback-based distributed packet filter to mitigate spoofed DDoS attacks," *Security and Communication Networks*, vol. 7, no. 2, pp. 245–264, 2014

Conference Papers

[C1] R. Joshi and N. **Kahani**, "Comparative Study of Reinforcement Learning in GitHub Pull Request Outcome Predictions," in *IEEE International Conference on Software Analysis, Evolution and Reengineering (SANER)*, 2024

[C2] N. **Kahani**, M. Bagherzadeh, R. Ahmadi, and J. Dingel, "Leveraging modeling concepts and techniques to address challenges in network management," in *ACM/IEEE 26th International Conference on Model-Driven Engineering Languages and Systems (MODELS)*, 2023

[C3] M. Ashouri-Talouki, N. **Kahani**, and M. Barati, "Privacy-Preserving Attribute-Based Access Control with Non-Monotonic Access Structure," in *Cyber Security in Networking Conference (CSNet)*, 2023

[C4] C. Jary and N. **Kahani**, "An Accurate and Low-Parameter Machine Learning Architecture for Next Location Prediction," in *IEEE Future Networks World Forum (FNWF)*, 2023

[C5] J. Mendoza, J. Mycroft, L. Milbury, N. **Kahani**, and J. Jaskolka, "On the effectiveness of data balancing techniques in the context of ML-based test case prioritization," in *Proceedings of the 18th International Conference on Predictive Models and Data Analytics in Software Engineering (PROMISE)*, pp. 72–81, IEEE, 2022

[C6] N. **Kahani** and J. R. Cordy, "Bounded verification of state machine models," in *Proceedings of the 12th System Analysis and Modelling Conference (SAM'20)*, pp. 1–10, 2020

[C7] N. **Kahani** and J. R. Cordy, "Synthesis of state machine models," in *Proceedings of the ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS)*, pp. 1–12, 2020

[C8] M. Bagherzadeh, K. Jahed, N. **Kahani**, and J. Dingel, "PMExec: An execution engine of partial UML-RT models," in *34th IEEE/ACM International Conference on Automated Software Engineering: Companion Proceeding (ASE)*, pp. 1–4, 2019

[C9] N. **Kahani**, "AutoModel: a domain-specific language for automatic modeling of real-time embedded systems," in *Proceedings of the 40th International Conference on Software Engineering*, pp. 515–517, ACM, 2018

[C10] N. **Kahani** and M. S. Fallah, "A reactive defense against bandwidth attacks using learning automata," in *Proceedings of the 13th International Conference on Availability, Reliability and Security*, pp. 1–6, ACM, 2018

[C11] M. Pasternak, N. **Kahani**, M. Bagherzadeh, J. Dingel, and J. R. Cordy, "SimGen: A tool for generating simulations and visualizations of embedded systems on the Unity game engine," in *Proceedings of the ACM/IEEE 21th International Conference on Model Driven Engineering Languages and Systems*, MODELS '18, ACM, 2018

[C12] N. **Kahani**, N. Hili, J. R. Cordy, and J. Dingel, "Evaluation of UML-RT and Papyrus-RT for modelling self-adaptive systems," in *IEEE/ACM 9th International Workshop on Modelling in Software Engineering (MiSE)*, pp. 12–18, IEEE, 2017

[C13] N. **Kahani**, M. Bagherzadeh, J. Dingel, and J. R. Cordy, "The problems with Eclipse modeling tools: A topic analysis of Eclipse forums," in *Proceedings of the ACM/IEEE 19th International Conference on Model*

Driven Engineering Languages and Systems, MODELS '16, pp. 227–237, 2016

[C14] N. **Kahani**, K. Elgazzar, and J. R. Cordy, "Authentication and access control in e-health systems in the cloud," in *2016 IEEE 2nd International Conference on Big Data Security on Cloud (BigDataSecurity), IEEE International Conference on High Performance and Smart Computing (HPSC), and IEEE International Conference on Intelligent Data and Security (IDS)*, pp. 13–23, IEEE, 2016

[C15] N. **Kahani** and S. Shiri, "Detecting denial of service attacks utilizing machine learning methods," in *IEEE International Conference on the Applications of Digital Information and Web Technologies (ICADIWT)*, pp. 1–7, 2008

Journal-First Papers

[JF1] A. S. Yaraghi, M. Bagherzadeh, N. **Kahani**, and L. Briand, "Scalable and accurate test case prioritization in continuous integration contexts," in *45th International Conference on Software Engineering (ICSE), Journal-First*, 2023

[JF2] M. Bagherzadeh, N. **Kahani**, and L. Briand, "Reinforcement learning for test case prioritization," in *44th International Conference on Software Engineering (ICSE), Journal-First*, 2022

Unreviewed Publications

[UnP1] N. **Kahani**, J. S. Bradbury, and J. R. Cordy, "A review of model-driven verification techniques for self-adaptive systems: A feature-based analysis," 2018

[UnP2] N. **Kahani** and J. R. Cordy, "Comparison and evaluation of model transformation tools," 2015

Posters

[P1] N. **Kahani**, "A domain-specific language for automatic modeling of real-time embedded systems," 2018

[P2] N. **Kahani** and J. R. Cordy, "Mobile computation offloading using machine learning," 2015

TEACHING EXPERIENCE

Course Instructor
SYSC 4111, Formal Methods in Software Engineering — *Winter 2022, Winter 2023, Winter 2024*

Course Instructor
SYSC 3120, Software Requirements Engineering — *Fall 2021, Fall 2022, Fall 2023*

Course Instructor
SYSC 5807, Advanced Software Testing — *Fall 2022, Winter 2024*

Course Instructor
Computer and Network Security — *Fall 2009*

Course Instructor
Data Structures — *Winter 2010*

CONTRIBUTIONS TO TEACHING

Developed a New Undergraduate Course
SYSC 4111: Formal Methods in Software Engineering — *Winter 2022*

Developed a New Graduate Course
SYSC 5807: Advanced Software Testing — *Fall 2022*

4TH-YEAR UNDERGRADUATE ENGINEERING PROJECTS

- CodeViz: A tool for source code visualization and comprehension (2023-2024)

- A Project for detecting and resolving Code Smells (2023-2024)
- InteliReq: an intelligent requirement management tool (2023-2024)
- CodeSmell: A tool for detection and visualization of code smells for object-oriented languages (2022-2023)
- Prioritization of regression test cases in continuous integration context using machine learning techniques (2021-2022)

SUPERVISON

PhD Students

- Calvin Jary [2022- Present]
  Thesis Topic: Debuggability and Analysis of ML Models Concerning Location Services
- Ali Mohammadi [2023- Present]
  TBD
  Co-supervision with Dr. Samuel Ajila
- Fatemeh Mirshafiee [2023- Present]
  Thesis Topic: TBD
- Ahmadreza Saboor [2020- Present]
  Thesis Topic: Automatic Test Case Refactoring using Natural Language Translation Techniques
  Co-supervision with Dr. Lionel Briand
- Nazanin Bayati [2020-2021]
  Thesis Topic: Test Case Prioritization of Regression Test Cases in the Context of Continuous Integration
  Co-supervision with Dr. Lionel Briand

MASc Students

- Darren Holden [2022- Present]
  Thesis Topic: Test Case Generation and Refactoring using Language Models
- Paniz Oghabi [2023- Present]
  Thesis Topic: TBD
- Artin Biniek [2023- Present]
  Thesis Topic: TBD
- Rinkesh Joshi [2022- 2023]
  Thesis Topic: Prediction of Open Source Contribution Outcome using ML Techniques
- Arvin Samiei [2023-Present]
  Thesis Topic: Model-based Testing of Robotic Systems
- Chibuike Ekikeme [2023-Present]
  Thesis Topic: Automated Test Oracle Generation of Software Specifications in Natural Language
  Co-supervision with Dr. Samuel Ajila
- Fatemeh Bayat [2010-2012]
  Thesis Topic: A Framework to Provide Privacy Preservation for Data Queries on Outsourced Databases
- Zahra Hallajian [2010-2012]
  Thesis Topic: Intrusion Detection in Wireless Sensors Networks using Learning Automata

AWARDS AND SCHOLARSHIPS

- School of Computing 2019 PhD Research Achievement Award (2019)
- IEEE PhD Research Excellence Award (2017)
- Ontario Graduate Scholarship (OGS) (2015-2017)

- Academic All Star Recognition, Student Athlete, Fencing, Queen's University (2016)
- Master's Thesis and Dissertation Award (2009)

SERVICES AND OUTREACH

Department Service

- Software Engineering Program Coordinator, 2023-present
- ECOR1055B Coordinator, 2023
- Serving as a library representative for 2022-2023
- Served on the CRC-II in Smart, Healthy, and Sustainable Communities hiring committee
- Served on the hiring committee for an instructor position in software engineering
- Student awards selection committee

Conference Committees and Related Service

- Program Committee Member in 17th IEEE International Conference on Software Testing, Verification and Validation (ICST), 2024
- Program Committee Member in 24th ACM/IFIP International Middleware Conference, 2023
- Demos/posters *Co-chair* of 23rd ACM/IFIP International Middleware Conference, 2022
- Member of *Program Committee* within the Workshops-track of MODELS, 2022
- *Poster Session Chair* at CAN-CWiC (ACM Celebration of Women in Computing), 2019
- *Program Director* at the Computing Student Research Conference (CSearch), 2019
- *Program Chair* at 8th annual Queen's Graduate Computing Society Conference (QGCSC), 2017
- Member of a panel on "Expanding Horizons Workshop", Queen's University, 2017

Review Activities

- Refereed more than 40 submissions for the following journals and conferences
  - TSE (Transactions on Software Engineering)
  - SoSyM (Journal on Software and Systems Modeling)
  - EMSE (Empirical Software Engineering)
  - SANER (Conference on Software Analysis, Evolution, and Re-engineering)
  - IEEE Software Magazine
  - JSS (Journal of Systems and Software)
  - ICST (IEEE International Conference on Software Testing, Verification and Validation)
  - ACM/IFIP International Middleware Conference
  - MODELS (Model-Driven Engineering Languages and Systems)
  - ACM/IFIP International Middleware Conference

Thesis/Comprehensive Examination Committees

- Danial Nikbin Azmoudeh. (MASc Defence). "An Analysis of FSM Mutation Operators". Supervised by Dr. Yvan Labiche. Carleton University, Canada, January 2024
- Xinrui Zhang. (PhD Proposal Exam). Supervised by Dr. Jason Jaskolka. Carleton University, Canada, October 2023
- Baharin Aliashrafi Jodat. (Comprehensive Oral Exam). Supervised by Dr. Shiva Nejati. University of Ottawa, Canada, October 2023
- HussainiZ ubairu (PhD Proposal Exam). Supervised by Dr. Ashraf Matrawy. Carleton University, Canada, August 2023, and December 2023
- Zhao Zhang. (MASc Defence). "3D Head Modeling from a Single Photo using Deep Learning.". Supervised by Dr. WonSook Lee. University of Ottawa, Canada, August 2023

- Behrad Moeini. (Comprehensive Oral Exam). Supervised by Dr. Shiva Nejati. University of Ottawa, Canada, April 2023
- Mirja Rotzoll. (Chair of Defence). "Algebraic Input-output Equations of Four-bar Kinematic Chains: Planar; Spherical; Spatial". Supervised by Dr. John Hayes. Carleton University, Canada, April 2023
- Joshua Wilson. (Chair of Defence). "Using Bipartite Matching and Detection Transformers for Document Layout Analysis Transfer Learning". Supervised by Dr. Chung Lung. Carleton University, Canada, January 2023
- James Baak. (MASc Defence). "Modular Verification of Hierarchical Component-Based Software Systems". Supervised by Dr. Jason Jaskolka. Carleton University, Canada, December 2022
- Keerthana Muthu Subash. (MASc Defence). "Identifying Opinion Based Questions in Developer Chat Communication". Supervised by Dr. Olga Baysal. Carleton University, Canada, September 2022
- Tina Yazdizadeh. (MASc Defence). "Comparative Evaluation on Effect of ELMo in Combination with Machine Learning, and Ensemble Models". Supervised by Dr. Wei Shi. Carleton University, Canada, September 2022
- Loïc Thierry. (Comprehensive Oral Exam). Supervised by Dr. Jason Jaskolka. Carleton University, Canada, May 2022
- Stojanche Gjorcheski. (Comprehensive Oral Exam). Supervised by Dr. Jason Jaskolka. Carleton University, Canada, May 2022
- Mohammad Sadeghi. (PhD Defence). "Cost and Power Loss Aware Coalitions under Uncertainty in Transactive Energy Systems". Supervised by Dr. Melike Erol-Kantarci. University of Ottawa, Canada, April 2022
- Maaz Jamal. (MASc Defence). "Supervisory Control Using DEVS with Approximate Method & Hybrid Layer". Supervised by Dr. Gabriel Wainer. Carleton University, Canada, April 2022
- Alvi Jawad. (MASc Defence). "A Cyberattack Impact Analysis Approach for Industrial Control Systems". Supervised by Dr. Jason Jaskolka. Carleton University, Canada, December 2021
- Mohammad Sadeghi. (PhD proposal defence). "Cost and Power Loss Aware Coalitions under Uncertainty in Transactive Energy Systems". Supervised by Dr. Melike Erol-Kantarci, University of Ottawa, Canada, January 2021
- Lance PoKai Wang. (MASc defence). "Recommending GitHub Projects by Leveraging Developers' Social Networks and Genetic Algorithm". Supervised by Dr. Olga Baysal, Carleton University, Canada, May 2021

University Service

- *The Affinity Group Chair* of Women in Engineering (WIE), 2018-present
  – Organized 14 talks, and 3 social events

INVITED TALKS/PRESENTATIONS

- N. Kahani. "Test case prioritization using reinforcement learning". 44th International Conference on Software Engineering (ICSE). 2022
- N. Kahani."Software verification and validation". First-year undergraduate seminar course (ECOR1055) for the CE, SCE and SE programs. 2022
- N. Kahani."Role of requirements in software engineering". First-year undergraduate seminar course (ECOR1055) for the CE, SCE and SE programs. 2021
- "Regression testing using reinforcement learning". Consortium for Software Engineering Research (CSER). 2021

- N. Kahani."Reinforcement learning for test case prioritization". Data Science Distinguished Speaker Series (CUIDS). 2021
- N. Kahani."Synthesis of state machine models". Women in Engineering (WIE)- IEEE Kingston Section. 2020
- N. Kahani."The problems with Eclipse modeling tools". Queen's Graduate Computing Society Conference. 2017
- N. Kahani."Formal model-based verification of self-adaptive systems". NECSIS/ORF Annual Workshop. 2016

Tashfeen B. Karamat, PhD, P.Eng.
Instructor II
Department of Electronics
Carleton University

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Phone: 613-520-2600 x7079

CURRICULUM VITAE

Education

Doctor of Philosophy: Electrical

Queen's University, Kingston, ON, Canada — *Sep 2009 – Jun 2014*

- **Speciality:** Navigational Multi-Sensor Fusion, GPS, Inertial Sensors, Kalman Filtering
- **Major Subjects:** Inertial Navigation System, Global Positioning System, Adaptive Filtering
- **Research:** Improved Land Vehicle Navigation and GPS Integer Ambiguity Resolution Using Enhanced Reduced-IMU/GPS Integration

Master of Applied Science: Electrical

Royal Military College (RMC), Kingston, ON, Canada — *May 2007 – Jan 2009*

- **Speciality:** Navigational Multi-Sensor Fusion, GPS, Inertial Sensors, Kalman Filtering
- **Major Subjects:** Multi-Sensor Fusion, Digital Signal Processing, Adaptive Filtering
- **Research:** Implementation of Tightly Coupled INS/GPS Integration for Land Vehicle Navigation using Kalman Filter

Master of Engineering: Computer

Queen's University, Kingston, ON, Canada — *Sep 2004 – Jan 2006*

- **Speciality:** Digital Integrated Circuits, Computer Networks, Signal & Image Processing
- **Major Subjects:** Digital VLSI Architecture, Computer Architecture, Machine Vision
- **Research:** Design and Implementation of Logarithmic Multiplier (VLSI), Randomized Circle Detection (Machine Vision), Content Based Image Retrieval and Voice Over IP

Bachelor of Engineering: Avionics

N.E.D University, College of Aeronautical Engineering Campus, Pakistan — *1985 – 1989*

- **Speciality:** Avionics Engineering
- **Major Subjects:** Radar systems, Digital Design, Control Systems, Aircraft Systems, Communications
- **Research:** Design & Fabrication of Digital Frequency Hopping Radar

Academic Experience

Instructor II: Electronics Department

Carleton University, Ottawa, ON, Canada *Sep 2021 – Present*

I was promoted to Instructor II effective September 1, 2021 and my job responsibilities changed slightly. As an Instructor II, I am teaching two sections of ECOR 1043 Circuits in Fall and two sections in Winter. I also teach one section of ECOR 1043 in Summer. The average enrolment of each section of ECOR 1043 course is about 300 students and I managed all the administrative work associated with these courses. I taught ELEC 4504 Avionics Systems in the Winter of 2022. I am assigned a new course ELEC 4906 "Satellite-based Integrated Navigation" which I developed from scratch and taught first time in the Winter of 2023. This is included development of lectures, labs, quizzes and exams. My responsibilities also included supervision of Teaching Assistants so that they can perform their duties in an efficient manner. Additionally, I supervised the Fourth Year Capstone Design Project (ELEC 4907).

Instructor I: Electronics Department

Carleton University, Ottawa, ON, Canada *Aug 2019 – Aug 2021*

As an Instructor I, I taught ECOR 1043 Circuits, ECOR 1044 Mechatronics and ELEC 4504 Avionics Systems. I also supervised ELEC 4907 which is the fourth year Capstone design project. I developed all the course material for ECOR 1043 from scratch which included lectures, assignments, labs, quizzes and exams. I managed all the administrative work associated with these courses, of which, ECOR 1043 and 1044 courses have an average enrolment of around 300 students. My responsibilities also included supervision of Teaching Assistants so that they can perform their duties in an efficient manner.

Contract Instructor: Systems and Computer Engineering & Electronics Dept

Carleton University, Ottawa, ON, Canada *Sep 2018 – Apr 2019*

In this position, I was hired to teach SYSC 3006 Computer Organization and ELEC 2607 Switching Circuits courses. I prepared and delivered lectures, supervised lab sessions, created assignments to assess student's understanding of the material. I managed all the administrative work associate with the courses and supervised Teaching Assistants so that the can carry-out their work smoothly and help students in completing their labs in effective manner.

Adjunct Professor: Electrical & Computer Engineering Dept

Royal Military College (RMC), Kingston, ON, Canada *June 2019 – Present*

To stay at the forefront of my research field, I actively collaborate with Royal Military College (RMC) where I hold the position of an adjunct professor in the department of Electronics. RMC hosts an outstanding research and development team with leading Canadian expertise in the field of navigation. This collaboration is instrumental in ensuring that my expertise remains up-to-date and aligned with the latest advancements in navigation technologies, including GPS, INS, and integrated navigation systems for land-based, aerial, and underwater vehicles. It provides a valuable platform for me to engage with fellow researchers and contribute to the ongoing progress and knowledge dissemination in the realm of navigation.

Assistant Professor (term): Electrical & Computer Engineering Dept

Royal Military College (RMC), Kingston, ON, Canada *Aug 2017 – May 2018*

During this term appointment as Assistant Professor at RMC, I taught EEE243 Applied Programming and EEE350 Digital Design-II courses. I also helped with EEE241 Electrical Technology course as senior TA. I also had the responsibility of preparing the documentation for upcoming CEAB accreditation visit. This included collection of course materials, graduate attributes and other relevant data.

Adjunct Assistant Professor: Electrical & Computer Engineering Dept

Queen's University, Kingston, ON, Canada *Jan 2017 – Apr 2018*

During this tenure at Queen's university I taught ELEC 274 Computer Architecture, ELEC 271 Digital Systems and APSC 142 Introduction to Computing Programming courses. For ELEC 274, I developed the lectures, assignments and tutorials from scratch. I also co-developed the labs for this course which used Altera Nios II Processor on Cyclone III FPGA. Furthermore, I developed on-line quizzes with a huge data-bank of questions to help maximize randomization. As a special aid, I also developed animations and youtube videos to help teach abstruse concepts of the course.

Sessional Instructor: Electrical & Computer Engineering Dept

Royal Military College (RMC), Kingston, ON, Canada *Aug 2011 – Dec 2016*

I have been teaching at RMC where I was hired as sessional instructor. During this tenure, I taught EEE250 Digital Design-I (similar to Queen's ELEC 271), EEE474 Radar & Electronic Warfare (EW) and EEE381 Aircraft Systems & Avionics courses to undergrad students. Apart from delivering the lectures, I also developed and revised lectures, quizzes, labs and assignments. All these courses included a significant laboratory component in which students analyse, design, simulate and implement digital circuits as well as antenna, communication and radar circuits. I prepared, conducted and marked all these labs. I also taught EEE523 Integrated Navigation Systems course to graduate students. Apart from delivering lectures, I also provided guidance in the completion of the project which was a big part of the course. This course covered various navigation subsystems (including Inertial Navigation and GPS) and their integration using Kalman filters.

Graduate Teaching Assistant: Electrical & Computer Engineering Dept

Royal Military College (RMC), Kingston, ON, Canada *Sep 2015 – Dec 2016*

For the fall of 2016, I performed as a TA for GEE241 Electrical Technology (similar to Queen's ELEC 210) course. My duties included marking of assignments, quizzes and labs. I also conducted all the labs for the course. For the fall of 2015 and 2016, I was selected as a TA for EEE250 Digital Design-I course at RMC. As a TA, I supervised and guided the students during the lab periods. I checked the quizzes of the students and also marked their labs and final project (last lab) for this course. Based on my experience the previous year, I was in close contact with the main instructor and conducted regular meetings so that the course goes smoothly. During the summer of 2015 and 2016, I was also selected as a TA for a short concentrated course on Electronic Warfare (EW) titled "Radar Electronic Warfare System Technology (REWST)" meant for RCAF operators. Apart from usual TA duties during these courses, I developed GUIs for antenna and radar system to help the students in understanding the abstruse concepts of the system.

Graduate Teaching Assistant: Department of Geomatics Engineering

University of Calgary, Calgary, AB, Canada *Spring 2013*

For ENGO623 Inertial Navigation and INS/GPS Integration course, my supervisor entrusted me with preparing, managing and guiding the graduate students in their projects related to GPS and INS. I prepared raw data obtained from a real road trajectory which was used for both GPS and INS portions of the projects. The project topics included INS Mechanization, INS error modeling and INS/GPS Integration using Kalman filter.

Graduate Teaching Assistant: Electrical & Computer Engineering Dept

Queen's University, Kingston, ON, Canada *Jan 2013 – Apr 2013*

I was selected as a Graduate TA for APSC 142 Introduction to Computing Programming for Engineers course. I was responsible for monitoring and helping students in programming C language using microcomputer and robots. I also marked their labs and final project for this course. Furthermore, I oversaw the performance of undergrad TAs during the lab and assigned various duties to them for smooth conduction of the lab.

Instructor: Aeronautics (Aerospace & Avionics)

Aviation Engineering School, Pakistan *Feb 1993 – Jan 1996*

This was my first instructional appointment where I taught undergraduate and graduate students. Apart from aerospace and avionics courses I also taught electrical and computer courses. I was also involved in course scheduling, coordinating visits and arranging practical demonstrations of various aircraft avionics, and aerospace systems.

Instructor - Enrichment Studies Unit (ESU)

Queen's University, Kingston, ON, Canada *Spring 2014*
Spring 2013

I helped Queen's university in promoting higher education among young students through ESU program which offers enrichment opportunities to above average and gifted students in Grades 6 to 12. This was a challenge as I had to simplify the subject to their level of understanding without scarifying the accuracy and quality. I accomplished this through interesting animations and hands on exercises. I also arranged a field trip to Navigation lab of RMC to give the students a practical demonstration on various aspects of GPS.

Teacher - Engineer for a Year Program

Queen's University, Kingston, ON, Canada *Sep 2013 – Jun 2014*

I volunteered for the Queen's University Engineer for a Year Program, dedicated to fostering an appreciation for engineering among young students. Assigned to Leahurst College in Kingston, ON, I engaged students through captivating lectures, lively presentations, and hands-on demonstrations, illuminating intriguing facets of the engineering discipline. My involvement aimed to inspire and educate the next generation about the exciting world of engineering, instilling a passion for the field.

Professional Experience

Senior Test Engineer - WiTEST Inc.

15 Fitzgerald Rd, Suite 200, Ottawa, ON, Canada *August 2019 – September 2020*

This experience included functional and verification test solutions of semiconductor, identification and integration of test instrumentations such as signal generators, spectrum analyzers, scopes and digitizers. Furthermore, the practical experience included the design of interface and signal condition PCB's for production testing of electronics systems, design and integration of test fixtures for production and manufacturing test solutions and planning of optimized test strategies in a manufacturing environment. On the other hand, this assignment also included the development of documentation for operation and maintenance of test equipment and processes including written descriptions, instructions and user manuals, and technical drawings (schematics, block diagrams).

Deputy Director - NavINST Lab

Royal Military College (RMC), Kingston, ON, Canada *April 2015 – May 2018*

- Apart from conducting research at the Navigation & Instrumentation Lab (NavINST) of RMC, I was also involved in the supervisory and administrative duties for efficient functioning of the lab. I was leading three groups of researchers who were involved in different aspects of land vehicle navigation, guiding several graduate students in the process. My responsibilities also included:
  - Supervision and guidance of graduate and doctoral students of the lab
  - Writing of grants proposals and progress reports
  - Delivering presentations to visiting groups and funding agencies
  - Assessing and procuring various technical equipment for the research teams in the lab
  - Supervision of land vehicle experiments for navigational data collection
  - Inventory and upkeep of navigational test equipment
- For the research part, the major goal of my work was based on the improvement of navigational algorithms for land and aerial vehicles. I worked on, and supervised, various projects during this tenure which were primary related to synergistic integration of sensors including GPS, INS, LiDAR, Radar, vision, magnetometers, pressure sensors and speed sensors.

Senior Research Associate - NavINST Lab

Royal Military College (RMC), Kingston, ON, Canada *July 2014 – October 2016*

- My primary focus of research is the improvement of accuracy, availability and integrity of navigational algorithms. The navigational sensors involved in my research include GPS, INS, LiDAR, Radar, vision and speed sensors. My focus is on seamless integration of these sensors using Kalman filter for land and aerial vehicle navigation. During this tenure I have contributed to several research projects funded by Department of National Defence (DND) which include Directorate of Technical Airworthiness and Engineering Support (DTAES), Defence Research and Development Canada (DRDC) Ottawa and Aerospace Research Advisory Committee (AERAC). Some of my research projects include the following:
  - Effect of Multi-GNSS, Timing and Carrier Phase Measurements on Aircraft Positioning Accuracy and System Synchronization

- Technical Investigation of Multiple-Antenna GNSS Receivers Capabilities for Anti-Jamming in NAVWAR Systems
- Receiver autonomous Integrity Monitoring Availability Analysis
- Design and implementation of centimetre level accuracy for land vehicle navigation using carrier phase GPS measurements
- Advanced Multi-Sensor Fusion and Autonomy
- Enhanced tightly-coupled integration of GPS and INS using Extended Kalman filter
- Integration of code-based precise point positioning and reduced inertial sensor system
- Integration of vision based navigation with INS and GPS for land vehicle navigation in challenging environments
- GPS cycle slip detection and correction at measurement level

Research Assistant

Royal Military College (RMC), Kingston, ON, Canada *May 2007 – July 2014*

- During this tenure, my research included development of tightly coupled GPS/INS integration. This entailed following activities:
  - Acquiring , denoising , interpolating and synchronizing GPS and INS data
  - Development of INS mechanization
  - Development of GPS and INS error models for Kalman Filtering
  - Simulation of GPS outages and testing of algorithm on real life data

Research Assistant

Royal Military College (RMC), Kingston, ON, Canada *Nov 2006 – Apr 2007*

- My research involved development of modules for Software Defined Radio including, Quadrature Direct Digital Frequency Synthesizer (QDDFS), Complex Mixer and Quad Demodulator. Following tasks were accomplished:
  - Writing of VHDL (RTL) code for QDDFS followed by simulation, synthesis
  - Verification of the results in MATLAB
  - Implementation on Spartan3 FPGA using Xilinx tools
  - Verification of the results of FPGA implementation using ChipScope Pro

Design Kit Developer - (Co-Op)

CMC Microsystems, Kingston, ON, Canada *Apr 2005 – Aug 2005*

As a Design Kit Developer, I accomplished following:

- Developed a design kit for layout of a MEMS fabrication process co-developed by Micralyne Inc, and CMC Microsystems, Canada. It included following :
  - Mapping of structural layers of the process to the layout file and incorporation of derived layers
  - Development of process definition file and 3D view of the final layout
  - Incorporation of design rules into the technology file and automation of DRC
- Wrote a detailed user guide for the whole layout process which is being used by the leading technical universities of Canada.
- Presented my work in the 4th Canadian Workshop for MEMS, Ottawa in Aug 05.

Senior Avionics Engineer

Aviation Base Workshop, Pakistan *Jan 1996 – Aug 2003*

- Designed digital modules for Aircraft Stall Warning System, Digital Airspeed Indicator, and sequencer of flare/chaff dispensing system (on PCB & FPGAs)
- Carried out simulation, testing and verification of digital circuits used in aircraft systems including communication sets, Direction Finding Systems, Auto Pilots, GPS and Radar systems.
- Taught Electronic Counter Measures Systems and aircraft instrumentation systems.
- Managed the technical aspects of all the aircraft design and maintenance activities.
- Managed the inventory of spare parts and timely availability of all special tools and equipment.
- Supervised technicians and engineers.
- Carried out all the technical as well as managerial communication with clients and contractors.
- Prepared and delivered presentations to local and foreign delegations.

Aircraft Maintenance Engineer

Aviation Base Workshop, Pakistan *Jun 1989 – Feb 1993*

- This was my first appointment after graduation where I was responsible for airworthiness of a fleet of aircraft. My responsibilities included the following:
  - Maintenance, troubleshooting and modification of avionics systems of variety of helicopters and aircraft
  - Maintaining the record of aircraft inspections and modifications
  - Supervising technicians and ensuring their training is up-to-date
  - Writing of reports on issues related to flight-safety, accident investigation as well as various certifications

Achievements and Awards

- My book *Fundamentals of Inertial Navigation, Satellite-based Positioning and their Integration* became one of the top 25% most downloaded ebooks in the relevant field as reported by Springer in June 2016.
- Recipient of NSERC's *Alexander Graham Bell Canada Graduate Scholarship* (CGS) award for "academic excellence, research potential, communications skills and interpersonal & leadership abilities".

  Value: $105,000
- Recipient of *Duncan and Urlla Carmichael Fellowship* award for first class standing in academics during master's and doctoral studies. Value: $10,000
- Awarded *International Space University (ISU) scholarship* for Space Studies Program.

  Value: $11,600
- Recipient of *Tri-Council Recipient Recognition Award* (TCRRA). Value: $5,000
- Runner-up for the *Governor General's Academic Gold Medal* for academic excellence.
- Recipient of Honourable Mention in *IEEE Graduate Research Excellence Award* in recognition of Doctoral research in the field of Navigational Multi-Sensor Fusion.
- Awarded "Carleton University Favorite Faculty" for the 2023/2024 academic year by the Department of Housing and Residence Life Services, Carleton university.

Volunteer Experience

Electronics Department's Representative to CUASA Council

Carleton University Academic Staff Association, Ottawa ON, Canada *Nov 2021 – Present*

- Update my colleagues about Council decisions or ongoing projects.
- Encourage colleagues to participate in upcoming CUASA events.
- Solicit input about bargaining priorities and union services.
- Record my colleagues' concerns about working conditions in my department or at Carleton generally, and report back to Council.
- Participate in CUASA Council Meetings and deliberate about CUASA's action to enforce the existing Collective Agreement, respond to changing workplace conditions and membership concerns, and promote awareness and solidarity among the members

Hiring Committee Member

Systems and Computer Engineering, Carleton University Academic, Ottawa ON, Canada Dec 2021 – Present

- Collect and peruse through the CVs of candidates.
- Prepare summary of the qualifications of each candidate versus the requirements of the position.
- Make an ordered list of candidates for discussion and selection of the best candidate for further consideration.
- Participate in meetings to discuss the list of candidates and selection of deserving candidates for interview and lectures sessions.
- Contact selected candidates for scheduling of interview, lecture and meetings with department faculty.
- Assess the candidate's style of teaching during lecture
- Interview all the selected candidates and assess their abilities to teach, perform administrative duties and research potentials.
- Based on discussions with other committee and faculty members, suggest the most suitable candidate for the job.

Graduate Attribute Committee Member

Department of Electronics, Carleton University Academic, Ottawa ON, Canada *Sep 2020 – Present*

- Help streamlining the procedure to obtain GA data from instructors
- Format the GA data to make it easier to analyze and prepare reports
- Analyze the GA reports to extract trends and suggest measures for improvement.
- Participate in meetings to suggest and recommend improvements in curriculum and teaching methodologies dictated by the trends in the GA reports, data and charts.

Secretary IEEE Kingston Section

Kingston ON, Canada *Dec 2012 – Dec 2014*

- Organize the section meetings and ensure the minutes are documented properly and disseminated to all concerned.
- Announce various technical talks and ensure that all members are aware of these interesting events.
- Help in organization of Annual General Meetings and Annual Banquets.
- Being a secretary, I rendered help in all other events whenever needed.

Engineer for a Year Program

Queen's University, Kingston, ON, Canada *Sep 2013 – June 2014*

- I have volunteered for Queen's University Engineer for a Year program. The details are already given in *Academic Experience* section.

Climate Reality Leader

The Climate Reality Leadership Corps *Aug 2013 – Present*

The Climate Reality Leadership Corps is a global network of activists committed to taking on the climate crisis and solving what is by far the greatest challenge of our time. I volunteered for it and got training in climate science and communication from Nobel Laureate and former U.S. Vice President Al Gore. My effort is to tell the story of climate change and inspire communities everywhere to take action through presentations in schools, homes, places of worship, businesses, and government forums.

Miscellaneous Details

- **Language Skills:** Fluent in verbal and written English, Urdu, Hindi and Panjabi
- **Tourism:** Visited Faroe Islands, USA, Germany, United Kingdom, Ireland, Scotland, Switzerland, France, Greece, Italy, Portugal, Spain, Iceland, UAE, Egypt, Bahrain, KSA
- **Hobbies:** Photography (@feenafoto), Reading, Etymology & Vocabulary Building, Watch Enthusiast & Collector
- **Sports:** Badminton, Athletics, Basket Ball

Publications

Book

[1] A. Noureldin, T. B. Karamat, and J. Georgy, *Fundamentals of Inertial Navigation, Satellite-based Positioning and their Integration*. Heidelberg: Springer, January 2013.

Journal Articles

[1] A. Abosekeen, T. B. Karamat, A. Noureldin, and M. J. Korenberg, "Adaptive cruise control radar-based positioning in GNSS challenging environment," *IET Radar, Sonar Navigation*, vol. 13, no. 10, pp. 1666–1677, 2019.

[2] M. T. Rahman, T. B. Karamat, S. Givigi, and A. Noureldin, "Improving multisensor positioning of land vehicles with integrated visual odometry for next-generation self-driving cars," *Journal of Advanced Transportation*, vol. 2018, p. 12 pages, March 2018.

[3] T. B. Karamat, R. G. Lins, S. N. Givigi, and A. Noureldin, "Novel EKF-based vision/inertial system integration for improved navigation," *IEEE Transactions on Instrumentation and Measurement*, vol. 67, pp. 116–125, January 2018.

[4] T. B. Karamat, M. M. Atia, and A. Noureldin, "An enhanced error model for EKF-based tightly-coupled integration of GPS and land vehicle's motion sensors," *Sensors*, vol. 15, no. 9, p. 24269, 2015.

[5] M. M. Atia, S. Liu, H. Nematallah, T. B. Karamat, and A. Noureldin, "Integrated indoor navigation system for ground vehicles with automatic 3D alignment and position initialization," *Vehicular Technology, IEEE Transactions on*, vol. 64, pp. 1279–1292, April 2015.

[6] T. B. Karamat, M. M. Atia, and A. Noureldin, "Performance analysis of code-phase based relative GPS positioning and its integration with land vehicle's motion sensors," *Sensors Journal, IEEE*, vol. 14, pp. 3084–3100, September 2014.

[7] M. Karaim, T. B. Karamat, A. Noureldin, and A. El-Shafie, "GPS cycle slip detection and correction at measurement level," *British Journal of Applied Science & Technology*, vol. 4, pp. 4239–4251, August 2014.

[8] M. M. Atia, T. B. Karamat, , and A. Noureldin, "An enhanced 3D multi-sensor integrated navigation system for land-vehicles," *Journal of Navigation*, vol. 67, pp. 651–671, March 2014.

[9] S. Liu, M. M. Atia, T. B. Karamat, and A. Noureldin, "A LiDAR-aided indoor navigation system for UGVs," *Journal of Navigation*, vol. 68, pp. 253–273, September 2015.

[10] M. Cossaboom, J. Georgy, T. B. Karamat, and A. Noureldin, "Augmented Kalman filter and map matching for 3D RISS/GPS integration for land vehicles," *International Journal of Navigation and Observation*, vol. 2012, p. 16, October 2012.

[11] A. Noureldin, J. Armstrong, A. El-Shafie, T. B. Karamat, D. McGaughey, M. Korenberg, and A. Hussain, "Accuracy enhancement of inertial sensors utilizing high resolution spectral analysis," *Sensors*, vol. 12, pp. 11638–11660, August 2012.

[12] J. Georgy, T. B. Karamat, U. Iqbal, and A. Noureldin, "Enhanced MEMS-IMU/odometer/GPS integration using mixture particle filter," *GPS Solutions*, vol. 15, pp. 239–252, September 2010.

[13] U. Iqbal, T. B. Karamat, A. F. Okou, and A. Noureldin, "Experimental results on an integrated GPS and multisensor system for land vehicle positioning," *International Journal of Navigation and Observation*, vol. 2009, p. 18, February 2009.

[14] A. Noureldin, T. B. Karamat, M. D. Eberts, and A. El-Shafie, "Performance enhancement of MEMS-based INS/GPS integration for low-cost navigation applications," *Vehicular Technology, IEEE Transactions on*, vol. 58, pp. 1077–1096, March 2009.

Conference Papers

[1] M. Karaim, A. Noureldin, and T. B. Karamat, "Low-cost IMU data denoising using Savitzky-Golay filters," in *2019 International Conference on Communications, Signal Processing, and their Applications (ICCSPA)*, pp. 1–5, March 2019.

[2] A. Abosekeen, A. Noureldin, T. B. Karamat, and M. J. Korenberg, "Comparative analysis of magnetic-based RISS using different MEMS-based sensors," in *Proceedings of the 30th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS+ 2017*, (Portland OR), pp. 2944–2959, September 2017.

[3] M. T. Rahman, T. B. Karamat, S. Givigi, and A. Noureldin, "Road test results and analysis on integrating visual odometry with car motion sensors for positioning and navigation," in *Mobile Mapping Technologies*, (Cairo, Egypt), MMT, May 2017.

[4] M. Karaim, M. Youssef, T. B. Karamat, and A. Noureldin, "Adaptive multi-hypothesis vector tracking system – design and implementation," in *Proceedings of the 29th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2016*, (Portland, OR), September 2016.

[5] H. E. Ibrahim, T. B. Karamat, A. El-Rabbany, and A. Noureldin, "Integration of code-based precise point positioning and reduced inertial sensor system," in *Proceedings of the 29th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2016*, (Portland, OR), September 2016.

[6] Y. Sun, M. T. Rahman, T. B. Karamat, , and A. Noureldin, "Integrating vision based navigation with INS and GPS for land vehicle navigation in challenging environments," in *Proceedings of the 29th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2016*, (Portland, OR), September 2016.

[7] T. B. Karamat, M. M. Atia, M. Karaim, and A. Noureldin, "Aided integer ambiguity resolution using low-cost motion sensors," in *Proceedings of the 28th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2015*, (Tampa, FL), pp. 2548–2559, September 2015.

[8] S. Liu, M. M. Atia, T. B. Karamat, A. Noureldin, and S. Givigi, "LiDAR-aided integrated INS/GPS navigation system for unmanned ground vehicles in urban and indoor environments using hybrid adaptive scan matching algorithm," in *Proceedings of the 28th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2015*, (Tampa, FL), pp. 2311–2318, September 2015.

[9] T. B. Karamat, M. M. Atia, A. Noureldin, and S. Givigi, "Performance comparison analysis of FOGS and MEMS IMU under an enhanced GPS/reduced INS land vehicles navigation system," in *Proceedings of the 27th International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2014*, (Tampa, FL), pp. 141–153, September 2014.

[10] S. Liu, M. M. Atia, T. B. Karamat, S. Givigi, and A. Noureldin, "A dual-rate multi-filter algorithm for LiDAR-aided indoor navigation systems," in *Proceedings of IEEE/ION PLANS 2014*, (Monterey, CA), pp. 1014–1019, May 2014.

[11] M. Karaim, T. B. Karamat, A. Noureldin, M. Tamazin, and M. Atia, "Real-time cycle-slip detection and correction for land vehicle navigation using inertial aiding," in *Proceedings of the 26th International Technical Meeting of The Satellite Division of the Institute of Navigation-ION GNSS 2013*, (Nashville, TN), pp. 1290–1298, September 2013.

[12] T. B. Karamat, J. Georgy, U. Iqbal, and A. Noureldin, "A tightly-coupled reduced multi-sensor system for urban navigation," in *Proceedings of the 22nd International Technical Meeting of the Satellite Division of the Institute of Navigation-ION GNSS 2009*, (Savannah, GA), pp. 582–592, September 2009.

Magazine Article

[1] M. Karaim, T. B. Karamat, A. Noureldin, M. Tamazin, and M. M. Atia, "Cycle-slips: Detection and correction using inertial aiding," *GPS World Magazine*, pp. 64–69, January 2014.

Fidel Khouli, PhD, P.Eng (PEO)

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Professional and Research Experience:

2023/07 – Present (Associate Professor)
 	
2017/08 – 2023/07 (Assistant Professor)
	Faculty Member
	Department of Mechanical and Aerospace Engineering
	Carleton University, Ottawa, ON
	
	• Teaching undergraduate courses in Mechanical and Aerospace Engineering:
	  ○ MAAE 2300: Fluid Mechanics I.
	  ○ MAAE 3004: Dynamics of Machinery.
	  ○ AERO 4306: Aerospace Vehicle Performance.
	  ○ AERO 4602: Introductory Aeroelasticity.
	  ○ MAAE 4907C: Blended-Wing-Body UAV.
	  ○ MAAE 4907N: Micro Flapping-Wing Flyer (MFWF) – developed this novel 4th – year capstone project and offered it for the first time in September 2021.
	• Conducting applied engineering research that builds upon my industry experience and research at Bombardier Aerospace:
	  ○ Aeroservoelasticity: Aircraft Pilot Coupling Induced Oscillations, Modelling and Mitigation.
	  ○ Faster Ground Vibration Testing using Aircraft Taxiing on Runways.
	  ○ Dynamic Landing Loads: Effect of Aircraft Flexibility, Landing Gear Flexibility and Novel Shock-Absorber Designs using Mechanical Networks and Non-linear 1D magnetic lattices.
	• Conducting fundamental and applied engineering research with the NRC-Aerospace & RWDI Inc.:
	  ○ Using the Boundary Layer wind tunnels at Carleton University and RWDI Inc., measured, analyzed and characterized the urban air-flow in complex and scaled urban settings in order to support Transport Canada in developing regulations for certification of urban air taxis.
	  ○ Develop a flight dynamics model and inner-loop controllers for a generic urban air taxi based on the Bell Nexus 4EX to investigate the open-loop response and compare the performance of controllers in empirically-developed urban airflows in order to support Transport Canada in developing regulations for certification of urban air taxis.
	  ○ Develop IMU and GNSS sensor models, which include intrinsic errors, to be integrated into the developed flight dynamics model and inner-loop

controllers in order to assess the impact of sensor errors and the cybersecurity of connected urban air.

- Conducting fundamental engineering research in:
  - Bio-Inspired Micro Air Vehicles: Flight Physics of Flapping-Wing Flyers.
- Conducting applied engineering research with Akimbo Technologies and Solana Networks in:
  - Development of a dynamic models and control algorithms for four-wheel steering ground vehicles to be integrated in automotive cyber security investigation and research.
- Services to University and Community Outreach:
  - University/Department Representative to CRIAQ AGMs – Voting Member.
  - MASc and PhD thesis examination committee member.
  - Department representative to CUESEF allocation meetings.
  - Committee member in: Aerospace Curriculum Committee (Chair); Hiring Committee (Avionics); Accreditation/Graduate Attributes Committee; Undergraduate Scholarships Committee; Senate Library Committee of Carleton University
  - AAA Career Expo Volunteer.
  - Ontario University Fair, 2018, Toronto, ON
  - BEHIND THE SCENES – CAPSTONE PROJECTS – Department of Mechanical and Aerospace Engineering.
- Research Grants:
  - Natural Resources Canada, Secured $23,000, One Time Research Grant, Principal Investigator.
  - National Research Council, Secured $62,000 + $14,000 (Equipment & Travel) + $6,000 (COVID-19 Emergency Fund) + $12,000 (Research Extension), October 2019 – March 2023, Principal Investigator.
  - NSERC Discovery Grant, Secured $115,000 + $12,500 + ($3,680 COVID-19 supplement), April 2020 – March 2025, Principal Investigator.
  - NSERC CRD Grant, Secured $147,167, March 2020 – March 2024, Co-Applicant with Prof. Duquette (Principal Applicant)
  - Mitacs Accelerate with Bombardier Aerospace, Secured $30,000, May 2021-December 2021, Principal Investigator.
- Mitacs Accelerate with Akimbo Technologies and Solana Networks, Secured $75,000, Co-Applicant with Prof. Langlois.
- Mitacs Accelerate with Sky Canoe, Secured $90,000, Principal Investigator.

2009/07 – 2017/07	**Aero-servo-elasticity and Applied Dynamics Engineer** *Core Engineering* *Bombardier Aerospace/Business Aircraft, Montreal, Quebec* • Performed FE-based aeroservoelastic studies of control surface power control units; performed dynamics response for comfort curve analysis; performed control laws evaluation for the fly-by-wire system in terms of aeroelastic stability assessment; performed digital filter design and assessment for the fly-by-wire control laws; performed aircraft inertial sensors system identification and test correlation; researching the development of control laws for highly flexible structures; performed gradient-based optimization studies to increase dynamic stability for minimum weight • Developed plans for component ground vibration tests that involve accelerometers and electromechanical shakers placement; performed aircraft component vibration tests; determined the excitation signals. • Participated in the full ground vibration testing of the Global 7500 business jet in terms of conducting the test; monitoring the test hardware, software and sensor signals; performing signal analysis and post-processing the data to extract the experimental rigid body, flexible and control surface modes. Participated in the flight testing of the Global 7500 business jet in terms of writing the test plan, monitoring the aeroservoelastic component of the test and the performance of the control laws in real time in the Telemetry Room; performing signal analysis and post-processing the data to assess the stability margins of the aircraft when flying in Direct Control Mode • Developed a detailed flexible multibody dynamics model and a software of an articulated landing gear attached to a flexible aircraft to calculate tire forces and experimentally correlated the model. Developed detailed FE models of aircraft and performed various model condensations; performed dynamic response and vibration analyses; modelled power control units and assessed the impact of their failure; wrote new solution sequences using direct matrix abstraction procedures. Based on the developed FE models, constructed detailed aeroelastic models of aircraft that include experimental aerodynamic corrections factors; calculated dynamic and quasi-static aeroelastic stability points. Mentored junior engineers in industry standards FE modelling and analysis, aeroelasticity, multibody dynamics, CAD/CAE and engineering programming. •
2014/09 – 2016/12	**Part-Time Teaching Faculty** *Department of Mechanical and Industrial Engineering,* *Concordia University, Montreal, Quebec* • Taught the following undergraduate courses: ENGR 391 Numerical Methods in Engineering; MECH 344 Machine Element Design. • Taught the following graduate courses: MECH 6231 Helicopter Flight Dynamics; MECH 6241 Operational Performance of Aircraft.

2004/05 – 2009/06	**Research/Teaching Assistant** *Department of Mechanical and Aerospace Engineering,* *Carleton University, Ottawa, Ontario* • Developed linear 2-D cross-sectional theories of beams and a software to analyze the actuation of thin walled composite beams with embedded active piezoceramic fibre materials. • Developed a nonlinear finite element software to analyze rotor systems with embedded active piezoceramic fibre materials. • Devised a control strategy using the embedded smart materials to counter an instability encountered during maritime helicopter operation, which improves the tactical flexibility of helicopters operating from ship decks. • Co-designed and co-constructed Froude-scale rotor system to investigate its response when operating in a ship airwake. Conducted the experimental runs in the National Research Council, Ottawa, Canada wind tunnel. • Using MOOG 6F2000E motion platform and LabVIEW, designed and conducted experiments to investigate the effect of ship motion on the Froude-scale rotor system and validate the simulation tools. • Teaching Assistant: MAAE 2101, MAAE 2202, MAAE 2300, MAAE 3004.
1999/09 – 2002/04	**Teaching Assistant** *Department of Physics,* *University of Toronto at Mississauga, Mississauga, Ontario* • Conducted tutorials, laboratories and marked exams and assignments of the following courses: PHY136Y5 - Introductory Physics I; PHY137Y5 - Introductory Physics II.

Education:

2004–2009	Ph.D. in Aerospace Engineering
	Carleton University, Ottawa, ON
1999–2002	Master in Aerospace Engineering
	University of Toronto, Toronto, ON
1995–1999	Bachelor in Engineering Physics
	McMaster University, Hamilton, ON

Academic, Research and Professional Responsibilities:

I. Teaching:

Since joining Carleton University, Department of Mechanical and Aerospace Engineering, I have taught Fluid Mechanics I (MAAE 2300), Dynamics of Machinery (MAAE 3004), AERO 4306 (Aerospace Vehicle Performance), AERO 4602 (Introductory Aeroelasticity) and two capstone projects MAAE 4907C (Blended Wing Body UAV), and MAAE 4907N (Micro Flapping-Wing Flyer), which span 2nd to 4th year undergraduate courses. As a lead engineer in the fourth-year capstone project, MAAE 4907C (Blended Wing Body UAV), I successfully steered and guided the students towards developing a flight simulation model, control laws, avionics and flight testing of the Blended-Wing-Body UAV. This effort resulted in a paper that was presented at CASI AERO 2019 conference. It was based on my initiative that this capstone project became sponsored by Bombardier Business Aircraft. As another example of my teaching innovation, I proposed the capstone project MAAE 4907N (Micro Flapping-Wing Flyer) to the departmental capstone design project committee, which it approved for the academic year 2021/2022 and beyond. I offered this new capstone project in September 2021 and it successfully reached its milestones for the 2021/2022 academic year with very positive feedback from the students and the lead engineers. The project is being offered again for the 2022/2023 academic year and I continue to manage it towards its principal goal of designing, building and testing a tailless micro flapping-wing flyer with a weight that is less than or equal to 40 grams and a total wing span that is less than or equal to 25 cm that is capable of autonomously taking-off then hovering over a small area that has a radius of 5 cm for a period of at least one-minute while being subjected to occasional lateral disturbances. I also collaborated with two colleagues in the department to introduce a project component to the course MAAE 3004 (Dynamics of Machinery), which introduced hands-on experiential learning to a course that was considered by the students to be one of the most challenging and abstract courses in the third-year of their program. The project component was adopted by all subsequent offerings of the course. Additionally, I added a project component to the courses AERO 4306 (Aerospace Vehicle Performance) and AERO 4602 (Introductory Aeroelasticity) since I started teaching them, which complements the standard course deliverables such as assignments and tests and give the students the opportunity to apply the theories and models taught in the courses in a way similar to what is done in the industry. I designed the courses AERO 4306 (Aerospace Vehicle Performance) and AERO 4602 (Introductory Aeroelasticity) in terms of outlines, lecture slides and notes, assignments, tests, projects and final exams. I also developed new slides and notes for the course MAAE 2300 (Fluid Mechanics I) that were adopted by other instructors teaching the course, which is a testament to their efficacy. During the COVID-19 pandemic, my prerecorded MAAE 2300 (Fluid Mechanics I) lectures coupled with my live sessions were very well-received and appreciated by the students, with the prerecorded lectures being adopted by the instructors teaching MAAE 2300 (Fluid Mechanics I) in the subsequent semester. I strongly believe in collegiality within my department and the university in general, especially when it comes to the common good of our students and university teaching. I make sure to consult with my senior colleagues whenever I am in doubt or when seeking advice given their extensive teaching experience, and I also offer my outmost help and advice whenever they are sought by my colleagues or the department.

I take my teaching duties as a great responsibility towards my students, the department, the university and my engineering profession. I strive to do my due diligence in imparting the knowledge, skills and course material to my student with passion, mastery of the subject, respect and understanding. I adhere strictly to the equity and inclusion policy of Carleton University when teaching and dealing with my students.

I also quickly and successfully adapted to the introduction of the pure online teaching environment imposed by the COVID-19 emergency as I was quick to utilize and learn the online teaching technologies offered by Carleton University during the pandemic. I successfully migrated the courses MAAE 2300 (Fluid Mechanics I), MAAE 3004 (Dynamics of Machinery), AERO 4306 (Aerospace Vehicle Performance) and AERO 4602 (Introductory Aeroelasticity) from in-person to online teaching during the 2020/2021 and the 2021/2022 academic years.

I continuously seek to improve my teaching skills as demonstrated by my completion of the Certificate in University Teaching course offered by the Educational Development Centre at Carleton University upon commencing my position. In the design of the MAAE 4907N (Micro Flapping-Wing Flyer) capstone project, I made the effort to consult the engineering education literature and senior colleagues to adopt the best practice of management, allocation of teams, organizational structure and methods of evaluation.

II. Research:

I have supervised/co-supervised and graduated six MASc students. One of those former MASc students, Mr. Richard McKercher, started his Ph.D. under my supervision and the sponsorship of the NRC-Aerospace and RWDI Inc in September 2021. I am currently supervising/co-supervising four MASc students and two Ph.D. students. I had also co-supervised one post-doctoral research assistant with Prof. Jean Duquette under the NSERC CRD grant. I had been nominated for the Faculty Graduate Mentoring Award at Carleton University. The theses that I supervised/co-supervised are listed in Table 1 below. The thesis projects that are in the process of being completed under my supervision/co-supervision are listed in Table 2 below.

Table 1: Graduate students who completed their degree requirements under my supervision/co-supervision

Student's Name	Degree	Starting Semester	Graduation	Thesis Title	Co-Supervisor(s)
Mr. Terrin Stachiw (NSERC grant recipient)	MASc	Fall 2018	April 2020	Aircraft Dynamic Landing Loads: Investigation of the Effects of Airframe Flexibility, Landing Gear Flexibility and Novel Shock-Strut Designs (Thesis nominated for Senate Medal)	▪ Prof. Fred Afagh ▪ Prof. Robert Langlois
Mr. Lohay Al-Bess	MASc	Fall 2018	December 2021	Experimental and Computational Investigation of a Highly Flexible Airframe Taxiing Over an Uneven Runway (Thesis was accepted as is by examination committee)	None
Mrs. Maryam Al labbad	MASc	Summer 2019	September 2021	Unmanned Aerial Systems in Urban Environments – Flow Characterization	NRC-Aerospace

Mr. Richard McKercher (NSERC Grant Recipient)	MASc	Fall 2019	December 2021	Unmanned Aerial Systems in Urban Environments – Flight Dynamics and Control	NRC-Aerospace
Ms. Olivia Chamberland	MASc	Fall 2019	December 2021	Application of Machine Learning to the Prediction of the Aerodynamics of Flapping-Wings	▪ Prof. Jeremy Laliberte ▪ Prof. Jeff Dawson
Mr. Nabil Ahmed	MASc	Fall 2019	February 2022	Vehicle Modelling for Automotive Cyber-Security	▪ Prof. Robert Langlois
Mr. Tariq Maksoud	MASc	Fall 2023	May 2023	Analysis of Urban Air Taxi Inner Loop Controller Architectures Subject to Noisy Inertial Measurement Unit Input while Immersed in Empirically-Developed Urban Airflow Disturbances (Thesis was accepted as is by examination committee)	▪ Prof. Mohamed Atia (Department of Systems and Computer Engineering)
Mr. Mohammad Shams	MASc	Winter 2021	August 2023	Aircraft-Pilot-Coupling: Parametric Study Using Multibody Dynamics Modelling of Pilot Biodynamics, Pilot Seat, and Inceptor	Bombardier - Business Jets
Mr. Amir Daliri Shadbad	MASc	September 2021	September 2023	Computational and Experimental Characterization of a Novel Nonlinear Magnetic Shock Absorber with Applications to Ground Vehicles	▪ Prof. Fred Afagh ▪ Prof. Robert Langlois

Table 2: Graduate students who are completing their degree requirements under my supervision/co-supervision

Student's Name	**Degree**	**Starting Semester**	**Graduation**	**Thesis Project Title**	**▪ Co-Supervisor(s)**
Mr. Mohammad Almalak	MASc	Fall 2021	Pending	Sensors Modelling and Security for Automotive Cybersecurity Applications	▪ Prof. Robert Langlois
Mr. Cem Kalkan	Ph.D.	Fall 2019	Pending	Technoeconomic Modelling and Validation of Ammonia-Based Absorption Chillers	▪ Prof. Jean Duquette
Mr. Richard McKercher (Queen Elizabeth II Scholarship in Science and Technology recipient)	Ph.D.	Fall 2021	Pending	Unmanned Aerial Systems in Urban Environments – Flight Dynamics and Control	NRC-Aerospace
Mr. Paul Cormier	MASc	Winter 2023	Pending	Versatile and Reliable Experimental Whirl Flutter Testing for eVTOL Applications	

Mr. Daniel Nelson	MASc	September 2023	Pending	Aircraft-Pilot-Coupling: Detailed Multibody Dynamics Modelling and Mitigation Strategies	Bombardier – Business Jets
Mr. Hugo Truong	MASc	September 2023	Pending	Lagrange Multipliers for Enforcing Kinematics Constraints in Nonlinear Aeroservoelastic Systems	Bombardier – Business Jets
Mr. Mohamed Fraga	Ph.D.	Winter 2023	Pending	Experimental Nonlinear Pilot, Pilot Seat and Inceptor System Identification for Pilot Induced Oscillations	

My research program is focused on the topics of aeroservoelasticity, flight dynamics & control and applied linear/nonlinear dynamics with emphasis on aerospace engineering applications and research. However, I occasionally participate in research projects that our outside the umbrella of aerospace engineering that utilize my expertise and skills, which provides an opportunity to exchanges ideas and techniques with engineering disciplines other than mine.

With reference to Table 1, the research work of Mr. Stachiw examined the dynamic landing loads with aircraft flexibility, landing gear flexibility and novel shock-absorber designs that incorporate mechanical networks to improve passengers' comfort and reduce landing loads simultaneously. This research project is a continuation of a research work that I started at Bombardier Business Aircraft. This research project is being extended to examine the improvement in performance when incorporating one-dimensional nonlinear lattices formed of permanent magnets along the shock strut axis.

With reference to Table 1, The research work of Mr. Al-Bess experimentally and computationally examined using aircraft ground taxiing on an uneven runway to perform the ground vibration testing of an aircraft, which is a project that was inspired by Bombardier Business Aircraft/Airbus Canada. The interest of aerospace companies stems from an initiative to develop techniques to reduce the time it takes to perform the resource-intensive, time-consuming and expensive conventional ground vibration testing.

With reference to Table 1, Mrs. Al labbad used the Boundary Layer wind tunnels at Carleton University and RWDI Inc. to experimentally characterize urban airflow in complex urban environments and to develop urban airflow test cases that could be used by authorities to certify Unmanned Aerial Systems in general urban environments. Mr. McKercher researched the development of a flight dynamics model and robust inner-loop controllers for a generic urban air taxi, similar to the Bell Nexus 4EX, immersed in the empirically-developed urban airflow models with development of regulations by certification authorities being the target application. Mr. Tariq Maksoud, referenced in Table 2, is researching the effect of IMU sensor errors on the flight dynamics and control of urban air taxis, which requires augmenting existing models, developed by Mrs. Al labbad and Mr. McKercher, with sensor models and implementing sensor fusion algorithms.

The research in Aircraft-Pilot-Coupling by Mr. Mohammad Shams, referenced in Table 2, is a culmination of efforts to collaborate with Bombardier Business Aircraft. The research has developed a detailed multibody biodynamics model of the pilot that will be coupled to models of the pilot seat, the inceptor and the aeroservoelastic aircraft with the latter two models being provided by Bombardier. The model is being used to examine Aircraft-Pilot-Coupling and propose mitigation strategies and it was presented at the AIAA SciTech 2023 conference and the paper is listed in the Publications section of this document.

The research of Mr. Nabil Ahmed, referenced in Table 1, focused on the development of multibody dynamics models and control algorithms for four-wheel-steering ground vehicles to be integrated in automotive cybersecurity investigation and research being conducted by Mr. Mohammad Almalak, who

is referenced in Table 2. The project, which is sponsored by two industry partners, is being monitored by Transport Canada through progress reports.

I continue to collaborate with Prof. Laliberte (Department of Mechanical and Aerospace Engineering, Carleton University) and Prof. Dawson (Department of Biology, Carleton University) in developing a research program in Micro Flapping-Wing Flight at Carleton University. We co-supervised an MASc student, Ms. Olivia Chamberland who is referenced in Table 1, to explore the potential of using machine learning to predict the lift coefficient of flapping-wings with different geometries and wing kinematics.

I had supervised the research work of four undergraduate students listed in Table 3 below with one, Mr. Mohammad Shams, continuing as a MASc student under my supervision. The research project that Mr. Ted Gan worked on during the summer of 2019 is the predecessor of the Aircraft-Pilot-Coupling research project that Mr. Mohammad Shams is conducting at the MASc level. Mr. Ted Gan assisted in developing models for the pilot biodynamics, pilot seat and the sidestick. Mr. Connor Cacciotti supported the aircraft Taxi Vibration Testing research through his extensive participation and support in the design and the manufacturing of the experimental aspect of this research project. The work of the I-CUREUS student, Ms. Oluwatobi Adekeye, was co-supervised by Prof. Jeremy Laliberte and Prof. Jeff Dawson and then presented in the CASI AERO 2019 conference, which is listed under the Conference Publications section of this document. The supervision of the fourth-year capstone project MAAE 4907C (Blended-Wing-Body UAV) resulted in two conference presentations at CASI AERO 2019 that are also listed under the Conference Publications section of this document.

Table 3: Undergraduate Research Assistants

Student's Name	**Degree**	**Starting Semester**	**Project Title**	**Co-Supervisor(s)**
Ms. Oluwatobi Adekeye	B.Eng	I-CUREUS 2018-2019	Calibration and Testing of a Micro Air Vehicle Test Stand and its Applications in Aerodynamically Characterizing Flapping Wings	▪ Prof. Jeremy Laliberte ▪ Prof. Jeff Dawson
Mr. Ted Gan	Research Assistant	Summer 2019 FED-USRA	Aircraft Pilot Coupling: Modelling of Pilot Biodynamics, Pilot Seat and Sidestick	None
Mr. Connor Cacciotti	Research Assistant	Summer 2019 NSERC-USRA	Aircraft Taxi Vibration Testing: Effects of Shock-Strut and Landing Gear Flexibility	None
Mr. Mohammad Shams	Research Assistant	Summer 2020 NSERC-USRA	Aircraft Pilot Coupling: Modelling of Pilot Biodynamics, Pilot Seat and Sidestick	None

Furthermore, I have supervised the project of the M.Eng graduate student Mr. Mohamed Fraga where the intrinsic errors introduced by the MEMS Inertial Motion Units in Aircraft Fly-By-Wire systems were experimentally quantified. The student under my supervision built the experimental setup, collected and post-processed the data and quantified the intrinsic noise terms of the sensors. The project laid the ground work for the MASc research being conducted by the MASc candidate Mr. Tariq Maksoud under the Urban Air Mobility research theme.

III. Research Grant Applications and Industry Partnerships:

As part of my effort to further build my research program, I applied, and I am still applying, to research grants from government agencies and seeking research collaborations with the Canadian industry. These grant applications and industry partnerships are summarized in Table 4 below.

Table 4: Research Grants and Industry Partnership

Currently Held				
Grant Name	**Funding Agency**	**Year**	**Status**	**Value**
Mitacs Accelerate: Bombardier Business Aircraft	Mitacs	2024-2025	Granted	$60,000
NSERC Alliance I	NSERC	2023	Ganted	$24,000
Mitacs Accelerate: Sky Canoe	Mitacs	2022-2024	Granted	$90,000
NSERC Discovery Grant	NSERC	2020-2025	Granted	$115,000 + $12,500 + $3,680 (COVID-19 Supplement)
National Research Council (NRC) – Small Teams Proposal	NRC	2019-2023	Granted	$62,000 + $14,000 (Equipment & Travel) + $6,000 (COVID-19 Emergency Fund) + $12,000 (Research Extension)
Mitacs Accelerate: Bombardier Business Aircraft	Mitacs	2021-2022	Granted	$30,000
NSERC CRD Grant	NSERC	2020-2024	Granted (co-applicant)	$147,167
Start-up Research Funds	Carleton University	2017-	Granted	$30,000
Previously Held				
Grant Name	**Funding Agency**	**Year**	**Status**	**Value**
Critical Energy Infrastructure Monitoring	Natural Resources Canada	2017-2018	Granted	$23,000

IV. Services to the University and the Department:

I am a member of the following on-campus committees:

1. Senate Library Committee (2021-Present).
2. University/Department Representative to CRIAQ AGMs – Voting Member.
3. Department Representative to CUESEF allocation committee (2017-Present).
4. Aerospace Curriculum Committee within the Department of Mechanical and Aerospace Engineering (2017-Present): I am presently the chair of this committee. Responsible for upgrading and improving the aerospace rngineering curriculum and courses.
5. Hiring Committee (Avionics Position) with the Department of Mechanical and Aerospace Engineering (2020-Present).
6. Accreditation/Graduate Attributes Committee within the Department of Mechanical and Aerospace Engineering (2018-Present): I participated in preparing for two accreditation visits.
7. Undergraduate Scholarships Committee within the Department of Mechanical and Aerospace Engineering (2018-2021).
8. Autonomous Systems Research Centre at Carleton University (2017-Present).

I volunteered for the following events in the Department of Mechanical and Aerospace Engineering:

1. BEHIND THE SCENES, CAPSTONE Projects, 2017.
2. Referee and Reviewer for MAAE 3901 Design Project Review, 2017.

I volunteered to represent the university and the department in the following events:

1. AAA Career Expo, 2018, Ottawa, ON.
2. Ontario University Fair, 2018, Toronto, ON

I also served as a Department Examiner on the following Thesis Committees:

1. Hali Barber, "Effect of Wind in The Field of Play for Elite Sprint Kayakers", MASc Thesis (Supervisors: Metin Yaras, Guy Larose, Annick D'Auteuil), Winter 2017.
2. Rui Zhao, Overheating Prediction and Management of Lithium-Ion Batteries, PhD Thesis (Supervisors: Peter-Jie Liu and Junjie Gu), Spring 2018.
3. Michelle Guzman Neito, "High Fidelity and Efficient Computations of Dynamic Loads for Multidisciplinary Design Optimization of Flexible Transport Aircraft", MASc Thesis (Supervisor: Mostafa ElSayed), Summer 2018.
4. Gerard Desmaris, "A Theoretical and Experimental Investigation on Ejector Acoustics and Ejector Silencer Design", MASc Thesis (Supervisor: Joana Rocha), Summer 2018.
5. Chukwudi Azih, "Computation and Modelling of Convetion Heat Transfer of Supercritical Fluid", PhD Thesis (Supervisor: Metin Yaras), Fall 2018.

6. Vinay Singh, "Design and Shape Optimization of Unmanned, Semi-Rigid Airship for Rapid Descent Using Hybrid Genetic Algorithm", MASc Thesis (Supervisor: Eric Lanteigne at the University of Ottawa), Fall 2018.
7. Utku Caylan, "Computations and Measurements of the Effects of Trailing-Edge Geometry on the Wake of Bluff Bodies", MASc Thesis (Supervisor: Metin Yaras), Spring 2019.
8. Johanna McPhee, "Control, Simulation, and Testbed Development for Improving Maritime Launch and Recovery Operations", MASc Thesis (Supervisor: Rishad Irani), Summer 2019.
9. Basim Al Tlua, "Optimization and Testing of Flat-Plate Trailing Edge Serration Geometry for Reducing Broadband Airfoil Self-Noise", PhD Proposal and Comprehensive Examination (Supervisor: Joana Rocha), Fall of 2019.
10. Siqi Li, "Microstructure-Based Computational Fatigue Life Prediction of Structural Materials", MASc Thesis (Supervisor: Rong Liu, Xijia Wu), Summer 2020.
11. Ayman Al-Sukhon, "Multiscale Design Optimization of Hopper Cars Employing Functionally Graded Honeycomb Sandwich Composites", MASc Thesis (Supervisor: Mostafa El Sayed), Summer 2020.
12. Chanon Pretorius, "Aerodynamic and Structural Design of Flow Conditioning, Flow Seeding and Testing Sections of a High-Speed Wind Tunnel", MASc Thesis (Supervisor: Metin Yaras), Fall 2020.
13. Stephanie Lowell, "Sensitivity Analysis and Experimental Validation of Plunger-Type Wavemakers Modelled with a Steady Flow", MASc Thesis (Supervisor: Rishad Irani), Spring 2021.
14. Lourd Arun Raj, "An Intelligent PHM System for Bearing Fault Phase Diagnosis and Multi-Phase RUL Prediction", MASc Thesis (Supervisor: Jie Liu), Summer 2021.
15. Nicholas Tepylo, "A Hybrid De-icing Strategy Utilizing Tailored Anti-icing Coatings Paired with Electro-thermal and Electro-mechanical Ice Protection Systems for Use on Rotary-wing Aircraft", PhD Thesis (Supervisor: Ronald Miller), Fall 2021.
16. Mohamad Alzayed, "Simplified MTPA Trajectory Tracking for Permanent Magnet Synchronous Machine Drives", PhD Thesis (Supervisor: Hicham Chaoui – Department of Electronics), Winter 2022.
17. Alexander R. Schock, "Development and Application of Spatial Simulations for Shipboard Securing and Manoeuvring of Skid-equipped Rotary-wing Aircraft", PhD Comprehensive Examination (Supervisor: Robert Langlois), Fall 2021.
18. Saeid Fadaei Naeini, "Transient Dynamics of Horizontal Axis Offshore Floating Wind Turbines", PhD Comprehensive Examination (Supervisor: Fred Afagh & Robert Langlois), Fall 2021.
19. Abdulazeez Muhammad Aba, "Design Optimization of Hybrid Battery Based Gensets", MASc Thesis (Supervisor: Hicham Chaoui – Sustainable Energy and Policy Unit), Spring 2022.
20. Courtney Bashnick, "Real-Time Autonomous Model Predictive Control of Spacecraft Rendezvous and Docking with Moving Obstacles", MASc Thesis (Supervisor: Steve Ulrich), Fall 2022.
21. Samuel Moses, "Characterization of Small Light Weight LiDAR Systems with Remotely Piloted Aircraft Systems for Powerline Detection", MASc Thesis (Supervisor: Jeremy Laliberte), Fall 2022.

I also served as the Chair of the Defense of:

1. Yu Zhang, "Performance Estimation and Fault Diagnostics for the Starter of Auxiliary Power Unit", MASc Thesis (Supervisor: Jie Lie), Fall of 2018.
2. Nicholas Berezny, "Design and Implementation of a Novel Rehabilitation Robot for Acute Stroke Patients", MASc Thesis (Supervisor: Mojtaba Ahmadi), Fall of 2019.
3. Erin Austen, "Development of Kinematic and Dynamic Models for the Argo J5 Rover", MASc Thesis (Supervisor: John Hayes), Fall of 2019.
4. Rawan Alkurd, "Big Data-Driven AI-based Wireless Network Personalization", Ph.D. Thesis (Department of Systems and Computer Engineering, Supervisor: Halim Yanikomeroglu), Fall of 2020.
5. William Parsons, "Dynamic Aeroelastic Performance Optimization of Adaptive Aerospace Structures Employing Structural Geometric Nonlinearities", MASc Thesis (Supervisor: Mostafa El Sayed), Summer 2021.
6. Mila Kanevsky, "Improving Quality of 3D Printed Components for RPAS using Curved Layer Filament Fabrication", MASc Thesis (Supervisor: Jeremy Laliberte), Spring 2022.
7. Daniel Hawes, "Using Virtual Reality to Improve Learning Mindsets and Academic Performance in Post-Secondary Students", PhD Thesis (Computer Science and Information Technology), Spring 2022.

I was also the reviewer for the following Independent Studies courses:

1. Partick Liotti, "Design and Fabrication of a Hovering, Flapping-Wing Aircraft" (Supervisor: Jeremy Laliberte), Winter 2018.
2. Ze Feng (Ted) Gan, "Second Moment Closure Reynolds Stress Models with Applications to Supercritical Flows" (Supervisor: Metin Yaras), Winter 2019.
3. Alireza Abdollahi, "Characterization of microstructure and mechanical properties of similar and dissimilar fiber laser welded titanium Ti-6Al-4V and CP-Ti joints" (Supervisor: Abu Syed Kabir), Summer 2019.
4. Srikar Pranav Kumar Nelanuthala, "Signal processing, measurement analysis and calibration of MEMS microphones based on the photon correlation method" (Supervisor: Mostafa ElSayed), Spring 2022

V. Professional Affiliations and Memberships:

- Professional Engineer (P.Eng), Professional Engineers Ontario (PEO), 2010-Present
- Member, American Institute of Aeronautics and Astronautics (AIAA), 2017-Present
- Member, American Society of Mechanical Engineers (ASME), 2023-Present
- Member, Institute of Electrical and Electronics Engineers, 2017-Present

VI. Peer/Industry Reviewer:

- Reviewer/Referee, *Transactions of the Canadian Society of Mechanical Engineers.*
- Reviewer/Referee, *Journal of Mechanics Based Design of Structures and Machines.*
- Reviewer/Referee, *Multibody System Dynamics*
- Reviewer/Referee, *Journal of Applied Science and Technology*
- Reviewer/Referee, *Aerospace Science and Technology*
- Reviewer/Referee, *Springer Nature – Scientific Reports (Engineering)*
- Reviewer/Referee, NSERC-CRD Grants – Aerospace
- Reviewer/Referee, Innovation, Science and Economic Development Canada (ISED) – Major Aerospace Project Proposals.

VII. Conference Technical and Organizational Committee Member of:

- CASI AERO 2021
- CASI AERO 2019

VIII. Professional Development:

I have attended and participated in the following workshops at Carleton University to further enhance my skills as a faculty member in the Department of Mechanical and Aerospace Engineering:

- 2017-2018:
  - Tenure and Promotion Workshop (CUASA)
  - NSERC Discovery Grant Workshop (CURO)

I have also completed the following certificates at Carleton University:

- 2017-2018:
  - Certificate in University Teaching (EDC)

IX. Awards:

1. Nominated for *Faculty Graduate Mentoring Award*, 2020, Faculty of Graduate and Postdoctoral Affairs.
2. Bombardier Aerospace - Strategic Technology Grant, 2010: Nonlinear Stability Analysis Tool Investigation.

X. Publications:

I deliberately target journals and organizations that are well-established and widely recognized by my peers in the fields of aerospace engineering and applied dynamics to submit to and publish in the research work of my group. I believe this ensures high quality and gives the research work more impact and recognition among my peers. I consciously avoid lesser known journals and organizations even if it translates into a longer and more strenuous review process. During the COVID-19 pandemic, myself and

my students did not participate in any virtual conference and we opted for conferences to revert back to the in-person mode in order for us to better continue building our research network and present our research work to our peers.

- **Refereed Journal Publications:**

  Submitted:

  - L. Al-bess, F. Khouli, "Computational Investigation of a Flexible Airframe Taxiing Over an Uneven-Runway for Aircraft Vibration Testing", *SAE International Journal of Aerospace*, submitted May, 2023 – passed the first round of peer review.
  - L. Al-bess, F. Khouli, "Experimental Investigation of a Flexible Airframe Taxiing Over an Uneven Runway for Aircraft Vibration Testing:, submitted May, 2023 – under review.

  Published/Accepted:

  - M. Al Labbad, G. L. Larose, H. Barber, F. Khouli, A. S. Wall, "The Effects of Approach Flow Boundary Layer Profile and Near Field Modelling on Urban Flow Field Measurements for Urban Air Mobility Applications", under review in *Elsevier - Journal of Wind Engineering & Industrial Aerodynamics*, 2023
  - R. G. McKercher, F. Khouli, A. S. Wall, G. L. Larose, "Modelling and Control of an Urban Air Mobility Vehicle Subject to Empirically-Developed Urban Airflow Disturbances", Accepted for publication in *MDPI Aerospace*, February, 2024.
  - L. Al-bess, F. Khouli, "Experimental Investigation of a Flexible Airframe Taxiing Over an Uneven Runway for Aircraft Vibration Testing", Accepted for publication in *SAE International Journal of Aerospace*, February 2024.
  - L. Al-bess, F. Khouli, "Computational Investigation of a Flexible Airframe Taxiing Over an Uneven-Runway for Aircraft Vibration Testing", *SAE International Journal of Aerospace*, Volume 17, 2023.
  - M. Al Labbad[HQP], A. Wall, G. L. Larose, F. Khouli, H. Barber, "Experimental investigations into the effect of urban airflow characteristics on urban air mobility applications", *Elsevier - Journal of Wind Engineering & Industrial Aerodynamics*, Accepted for publication in the Journal of Wind Engineering & Industrial Aerodynamics, August 2022, https://doi.org/10.1016/j.jweia.2022.105126
  - T. Stachiw[HQP], F. Khouli, R. G. Langlois, F. F. Afagh, "Linearization of Aircraft Landing Equations of Motion with Airframe Flexibility Effects", *SAE International Journal of Aerospace*, Volume 15, Number 1, September 2021.
  - T. Stachiw[HQP], F. Khouli, R. G. Langlois, F. F. Afagh, "Landing Gear Mechanical Network Synthesis for Improving Comfort at Landing Considering Aircraft Flexibility", *AIAA – Journal of Aircraft*, Volume 58, Number 6, November 2021.
  - T. Stachiw[HQP], F. Khouli, R. G. Langlois, F. F. Afagh, J. Ricciardi, "A Computationally Low-Cost Method for Capturing Airframe Flexibility Effects in Landing Dynamic Simulations", *ASME - Journal of Computational and Nonlinear Dynamics*, Volume 16, Issue 4, April 2021.

- F. Khouli, F. F. Afagh, and R. G. Langlois, "Design, Simulation, and Experimental Results for Highly Flexible Rotors in a Ship Airwake", *AIAA - Journal of Aircraft*, Vol. 53, Issue 1, January 2016, pp. 262-275.
- F. Khouli, A. S. Wall, F. F. Afagh, and R. G. Langlois,"Influence of Ship Motion on the Aeroelastic Response of a Froude-scaled Maritime Rotor System", *Elsevier - Journal of Ocean Engineering*, Vol. 54, , November 2012, pp. 170-181.
- F. Khouli, J. Griffiths, F. F. Afagh, and R. G". Langlois,"Actuation of Slender Thin-Wall Anisotropic Open Cross-Section Beams Based on Asymptotically-Correct Vlasov Theory", *SAGE - Journal of Intelligent Material Systems and Structures*, Vol. 21, No. 5, 2010, pp. 529-540.
- F. Khouli, F. F. Afagh, and R. G. Langlois,"Application of the first order generalized alpha method to the solution of an intrinsic geometrically exact model of rotor systems", *ASME - Journal of Computational and Nonlinear Dynamic*, Vol. 4, Issue. 1, January 2009.
- F. Khouli, R. G. Langlois, and F. F. Afagh,"Analysis of active closed cross-section slender beams based on asymptotically correct thin-wall beam theory", *IOPScience - Smart Materials and Structures*, Vol. 16, 2007, pp. 221-229.

- **Magazine Articles:**

  - Terrin Stachiw, M.A.Sc, Fidel Khouli, Ph.D. Robert Langlois Ph.D. & Fred Afagh, Ph.D. Carleton University, Hemanth Kolera, MSC Software, "Rapid development of a virtual testing model for flexible aircraft landings", *HEXAGON – engineering REALITY – MSC Software Magazine*, Volume XII, Winter 2020 Issue, pp. 85-87.

- **Peer-Reviewed Conference Proceedings:**

  - A. Daliri Shadbad, F. Khouli, R. G. Langlois, F. F. Afagh, "Analytical and Experimental Investigation of the Potential for Using Novel Nonlinear Magnetic Shock Absorbers in Ground Vehicle Applications", Proceedings of the 28th International Symposium on Dynamics of Vehicles on Roads and Tracks (IAVSD) , Ottawa, August 2023.
  - A. Daliri Shadbad, R. G. Langlois, F. Khouli, F. F. Afagh, "Experimental verification of dynamics of a novel magnetic shock absorber", Proceedings of the 2023 Symposium on Mechanisms, Machines, and Mechatronics Symposium on Mechanisms, Machines, and Mechatronics (CCToMM), Quebec City, Quebec, June 2023.
  - A. Daliri Shadbad, F. F. Afagh, R. G. Langlois and F. Khouli, "Simulation and characterization of a novel nonlinear magnetic shock absorber element", Proceedings of CSME 2023, Sherbrooke, Quebec, May 2023.
  - T. Masoud, F. Khouli, M. Atia, "Analysis of an Urban Air Taxi Inner Loop Controller with Noisy IMUs in an Urban Airflow Environment", 2023 IEEE Aerospace Conference, Big Sky, Montana, March 4-11, 2023
  - M.A. Shams, F. Khouli, Sylvain Thérien, "Modeling of Passive Pilot, Pilot Seat, and Inceptor for Aircraft-Pilot-Coupling (APC) Induced Oscillation Investigations", AIAA SciTech 2023, Washington DC, January 23-27, 2023.
  - C. Kalkan[HQP], J. Duquette, F. Khouli, A. Keblawi, M. A. Ezan, "Development of a Dynamic PV/T-Driven Combined Cooling, Heating and Power System Model for Use in the Canadian Residential Sector", 12th eSim Building Simulation Conference 2022.

- T. Stachiw[HQP], F. Khouli, R. G. Langlois, F. F. Afagh, "The Use of an Inerter in an Aircraft Landing Gear Suspension for Improved Passenger and Crew Comfort at Touchdown", AIAA SciTech 2020, Orlando, Florida, January 6-10, 2020.
- T. Stachiw[HQP], F. Khouli, R. G. Langlois, F. F. Afagh, "The effect of airframe flexibility on landing gear dynamic loads", CASI AERO 2019, Laval, May 14-16, 2019.
- Z. Feng (Ted) Gan[HQP], J. (Kevin) Feng[HQP], F. Khouli, M. El Sayed, F. Nitzsche, "Development and Optimization of Flight Dynamics, Control Laws and Avionics System for a UAV with a Multi-scale Optimized Blended Wing Body Configurations", CASI AERO 2019, Laval, May 14-16, 2019.
- J. Millar[HQP], T. Tran[HQP], U. Sapre[HQP], R. Miller[HQP], K. Lee[HQP], S. Mosca[HQP], M. El Sayed, F. Khouli and F. Nitzsche, "Multidisciplinary Design Optimization of a Blended Wing Body UAV", CASI AERO 2019, Laval, May 14-16, 2019.
- P. Liotti[HQP], O. Adekeye[HQP], J. Laliberte[HQP], F. Khouli, J. Dawson "Design, fabrication and testing of a flapping-wing mechanism for bio-inspired air vehicles", CASI AERO 2019, Laval, May 14-16, 2019.
- F. Khouli, A. S. Wall, R. G. Langlois, F. F. Afagh, "Investigation of the Aeroelastic Response of a Froude-scaled Rotor System to Representative Ship Motion Using a 6DOF Stewart Motion Platform", Presented at CASI AERO 2009, Kanata, Canada, May 5-7, 2009

- F. Khouli, A. S. Wall, R. G. Langlois, and F. F. Afagh, "Investigation of the Feasibility of a Proposed Hybrid Passive an Active Control Strategy for the Transient Aeroelastic Response of Helicopter Rotor Blades During Shipboard Engage and Disengage Operations", Presented at the 64th Annual Forum of the American Helicopter Society, Montreal, Canada, April 29-May 1, 2008
- S. Wall, F. Khouli, F. F. Afagh, R. G. Langlois, and S. J. Zan, "Modelling Helicopter Blade Sailing: Model Validation Using Experimental Data", Presented at the 64th Annual Forum of the American Helicopter Society, Montreal, Canada, April 29-May 1, 2008
- F. Khouli, A. S. Wall, R. G. Langlois, F. F. Afagh, S. J. Zan, "Investigation of the Active- Twist Rotor Response of Various Rotor System Configurations During Shipboard Engagement and Disengagement Operations", In the 18th International Conference on Adaptive Structures and Technologies, Ottawa, ON, Canada, October 3-5, 2007
- F Khouli, F. F. Afagh, and R. G. Langlois, "Asymptotically-correct structural modelling of thin-walled anisotropic closed cross-section rotating slender beams", In Proceedings of an International Conference on Advances in Engineering Structures, Mechanics & Construction, Waterloo, Ontario, Canada, May 14-17, 2006, pp. 537-547

- **Private Sector Technical Reports:**

- FIDEL KHOULI. (2018). Assessment of the Feasibility of Autonomous Compact Airships for Critical Infrastructure and Remote Environmental Monitoring. Natural Resources Canada
- FIDEL KHOULI - COAUTHOR. (2017). AEROSERVOELASTICITY - Global 7000 Program (Classified). Bombardier Aerospace.
- FIDEL KHOULI. (2016). Global 7000 Direct Mode Control Laws 1.13 Assessment with Updated Direct Mode ASE Filters (Classified). Bombardier Aerospace.
- FIDEL KHOULI (CO-AUTHOR). (2016). FLIGHT FLUTTER AND BUFFET RESPONSE PLAN – Global 7000 (Classified). Bombardier Aerospace.

- FIDEL KHOULI (CO-AUTHOR). (2016). AEROSERVOELASTICITY - C-Series 300 Program (Classified). Bombardier Aerospace.
- FIDEL KHOULI. (2015). Global 7000 Vertical Stabilizer Free-Free Modal Test Plan (Classified). Bombardier Aerospace.
- FIDEL KHOULI. (2015). Global 7000 Normal Mode Control Laws Aeroservoelastic Filters (Classified). Bombardier Aerospace.
- FIDEL KHOULI. (2015). Global 7000 Direct Mode Control Laws Aeroservoelastic Filters (Classified). Bombardier Aerospace.
- FIDEL KHOULI. (2014). Global 7000/8000 Aileron Effectiveness and Aeroservoelastic Matrices for Simulator Input (Classified). Bombardier Aerospace.

Professor Robert G. Langlois, PhD, PEng

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Carleton University
1125 Colonel By Drive, Ottawa, Canada K1S 5B6
Telephone: 1-613-520-2600 extension 5714
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Degrees

- 1996/4 PhD, Mechanical Engineering, Queen's University at Kingston, Canada
- 1991/8 MASc, Mechanical Engineering, Queen's University at Kingston, Canada
- 1989/12 BASc, Mechanical Engineering, Queen's University at Kingston, Canada
- 1987/4 Engineering Diploma, St. Francis Xavier University, Antigonish, Canada

Employment

-2020/5-present Professor and Associate Dean - Student Success
Faculty of Engineering and Design, Carleton University
-2001/1-present President
R.G. Langlois Analysis
-2018/7-2020/6 Professor and Associate Chair - Undergraduate Policy and Planning
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-2017/7 - 2018/6 Professor and Associate Chair - Undergraduate Studies
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-2014/7 - 2015/6 Professor and Associate Chair - Laboratory Operations
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-2011/8 - 2014/6 Professor
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-2005/7 - 2010/6 Associate Professor with tenure
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-2004/7 - 2005/6 Associate Professor
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-2001/1 - 2004/6 Assistant Professor
Mechanical and Aerospace Engineering, Faculty of Engineering and Design, Carleton University
-1999/1 - 2001/1 Manager
Dynamic Analysis Group, Indal Technologies Inc. (now Curtiss-Wright Indal Technologies), Mississauga, Canada
-1996/5 - 1999/12 Senior Dynamicist
Dynamic Analysis Group, Indal Technologies Inc. (now Curtiss-Wright Indal Technologies), Mississauga, Canada
-1996/1 - 1996/5 Sessional Lecturer
Civil Engineering, Faculty of Applied Science, Queen's University at Kingston
-1996/1 - 1996/5 Sessional Lecturer
Mechanical Engineering, Faculty of Engineering, Royal Military College of Canada, Kingston, Canada
-1990/1 - 1995/12 Teaching Assistant
Mechanical Engineering, Faculty of Applied Science, Queen's University at Kingston, Kingston, Canada
-1995/1 - 1995/4 Research Engineer
Mechanical Engineering, Royal Military College of Canada, Kingston, Canada
-1991/9 - 1991/12 Research Engineer
Philips Research Laboratories, Eindhoven, Netherlands
-1989/5 - 1989/8 Research Assistant
Defence Research Establishment Atlantic (now Defence Research and Development Canada – Atlantic),

Dartmouth, Nova Scotia, Canada
-1988/5 - 1988/9 Research Assistant
Defence Research Establishment Suffield (now Defence Research and Development Canada – Suffield), Suffield, Alberta, Canada
-1986/9-1987/5 Teaching Assistant
Engineering, St. Francis Xavier University, Antigonish, Canada

Recognitions

-2023/1 Certificate of Merit. 2023 AIAA Modeling and Simulation Best Paper Award
A.R. Schock and R. Langlois. "Development of a Shipboard Skid-equipped Rotary-wing Aircraft Manoeuvring and Securing Simulation Package." In AIAA SCITECH 2023 Forum, p. 341. Jan. 2023, National Harbour, Maryland, USA.
-2022/2 Conference Best Presentation Award
C. Aubertin, S. Redpath, K. Greenwood, J. Green, R. Langlois, A. Chan, F. Darwaish, A.A.M. Ibey. "Reducing Vibrations to Improve Infant Patient Safety During Transportation". Pediatrics. 149 (1 Meeting Abstracts February 2022): 955.
-2020/11 Invited keynote lecture
"Mitigating the Impact of High-Speed Craft" delivered at the Seventh International Conference on Control, Dynamic Systems, and Robotics.
-2016/5 Conference best paper award
Parsons, M. and Langlois, R.G. (2016). Stability Analysis of a Two-dimensional Tethered Helicopter. Proc. of the 3rd International Conference on Control, Dynamic Systems and Robotics, Ottawa, Canada, 128-1-128-8.
-2016/5 Invited keynote lecture
"Shipboard Helicopters, Sea Monsters, Safety…and Engineering" delivered at the Third International Conference on Control, Dynamic Systems, and Robotics.
-2016/4 Invited keynote lecture
"Simulation of Flight" delivered as the annual Kenneth Molson keynote lecture at the Canadian Aeronautics and Space Museum.
-2010/6 Conference best paper award
R. Langlois. Development of an inverted pendulum shipboard postural stability model. In Proc. Int. Conf. On Human Performance at Sea, Glasgow, Scotland, Jun. 2010.
-2009/5 Conference best paper award
Morbi, M. Ahmadi, A. Chan, and R. Langlois. Assistance regulation in wearable assistive devices. Canadian Medical and Biological Engineering Society Conference. Calgary, Canada, May 2009.
-2006/10 Conference best paper award
F. Khouli, F.F. Afagh, and R.G. Langlois. Actuation of slender thin-wall anisotropic open cross-section beams based on asymptotically-correct Vlasov theory. Proc. ICAST 2006: 17th International Conference on Adaptive Structures and Technologies. Taipei, Taiwan, Oct. 2006.

Research Funding

2019-2025	Dynamics of Systems Operating in Coupled Motion Environments	NSERC	$135,000
2016-2025	Environmental Facility for Investigating Transient Dynamics of Wind Turbines – Operating Expenses (Nominated principal applicant; 2 co-applicants)	NSERC IOF	$106,000
2020-2024	Reducing Vibration to Improve Infant Patient Safety During Transport	NSERC/CIHR-CHRP	$522,000

2023-2023	Identification and attenuation of externally induced shock and vibration experienced by a free roaming robotic camera mounted system (FroMCMS) (F.Afagh was the nominated principle Applicant; 2 primary co-applicants.)	NSERC Alliance (Ross Video)	$129,250
2020-2021	Reducing Vibration to Improve Infant Patient Safety During Transport - COVID-19 Supplement	NSERC/CIHR-CHRP	$9,089
2020-2021	Vehicle Dynamics Modelling and Simulation for Use in the Development of a Self-Healing Auto Cyber Security System (SHACS) Proof-of-Concept	Mitacs/Industry (Akimbo, Solana)	$75,000
2020-2021	Dynamics of Systems Operating in Coupled Motion Environments - COVID-19 Supplement	NSERC	$4,320
2019	Self-Healing Auto Cyber Security System (SHACS) Proof-of-Concept - Vehicle Modelling (This reflects the portion of a larger grant led by industry partners that was allocated to university research)	CSSP	$25,000
2013-2018	Dynamics of Systems Operating in Motion Environments (note that the 2017 installment was deferred one year)	NSERC	$115,000
2014-2018	Impact of A Speed Hump on Transit and Emergency Vehicles Study	Contract (City of Ottawa)	$30,178
2015-2018	Standardized Seat Testing	Contract (DRDC Atlantic)	$65,400
2017-2017	Flight Simulator Development Activities	Contract (WWFC)	$6,000
2015-2016	Implementation of Critical Technologies for Cost-Effective Flight Simulators	OCE/Industry (WWFC)	$45,000
2016-2016	Consulting Services - Fleetway Crane Report	Contract (Rolls Royce)	$11,964
2014-2015	Development of Technologies for Cost-effective Flight Simulators	OCE/Industry (WWFC)	$30,000
2012-2014	Development of a Testing and Simulation Capability for Suspension Seats	Contract (DRDC Atlantic)	$353,188
2011-2013	High Speed Craft Seats Test	Contract (DRDC Atlantic)	$25,000
2012-2013	Environmental Facility for Investigating Transient	CFI/ORF/Industry	$1.25M

	Dynamics of Wind Turbines		
2011-2013	Development of the Atlas Simulator (Nominated principal applicant; 4 co-applicants)	Carleton Internal	$530,000
2011-2012	Human Postural Stability Models	Contract (DRDC Atlantic)	$90,000
2012	Dynamics of Systems Operating in Motion Environments	NSERC	$20,000
2012	Development of a Cost-Effective Small Aircraft Simulator	Mitacs/Industry (OAS,B-Con)	$30,000
2012	Identification and Optimization of Hydrodynamic Parameters	Contract (Rolls Royce)	$11,256
2011	Feasibility Assessment and Prototype Development of A Cost effective Type-specific Small Aircraft Simulator	OCE/Industry (OAS,B-Con)	$51,800
2011	Feasibility Assessment of the Development of a Cost Effective Type-Specific Small Aircraft Simulator	Mitacs/Industry (OAS,B-Con)	$30,000
2011	Ship Motion Analysis	Contract (Rolls Royce)	$5,400
2007-2011	Dynamic Interface Analysis	NSERC	$90,000
2010	Modifications to Flight Deck Motion Display System	Contract (GDC)	$9,620
2004-2008	Carleton University Centre for Advanced Studies in Visualization and Simulation Research (C. Herdman was the nominated principle Applicant; 4 primary co-applicants.)	CFI/OIT/industry	$28.3M
2007-2008	Development of a Flight Deck Motion Display (FDMD) System	OCE/Industry (GDC)	$114,900
2002-2007	Dynamic Analysis of Shipboard Helicopter Operation	NSERC	$90,000
2001-2002	Development and Validation of an On-deck Helicopter Manoeuvring Simulation	MMO/Industry	$108,000
2001	Dynamic Interface Analysis	MMO (Start-up)	$25,000

2001	Multibody Dynamics	Internal (Start-up)	$25,000

Research Contributions

Articles in Refereed (Journal) Publications

1. P. Kehoe, K. Gibb, J. Hurley, R.G. Langlois, J.R. Green, A.D.C. Chan, E. Toma, C. Aubertin, K. Greenwood, A. Ibey, S. Redpath. Simulating whole-body vibration for neonatal patients on a tire-coupled road simulator. Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine. 238(2), Feb. 2024.
2. S. Fadaei, F.F. Afagh, R.G. Langlois. A survey of numerical simulation tools for offshore wind turbine systems. Wind. 2024, 1, 1-26.
3. K. Jahani, R.G. Langlois, and F.F. Afagh. Structural dynamics of offshore wind turbines: A review. Ocean Engineering. 251, 111136, 2022.
4. T.A. Stachiw, F. Khouli, R.G. Langlois, F.F. Afagh. Landing gear mechanical network synthesis for improving comfort at landing considering aircraft flexibility. AIAA Journal of Aircraft. 58(6), Nov.–Dec. 2021.
5. T.A. Stachiw, F. Khouli, R.G. Langlois, F.F. Afagh. Linearization of aircraft landing equations of motion with airframe flexibility effects. SAE International Journal of Aerospace. 15(1), Sept. 2021
6. T.A. Stachiw, F. Khouli, R.G. Langlois, F.F. Afagh. A computationally low-cost method for capturing airframe flexibility effects in landing dynamic simulations. ASME Journal of Computational and Nonlinear Dynamics. Vol. 16, Apr. 2021.
7. I. Goswami, S. Redpath, R.G. Langlois, J.R. Green, K.S. Lee, and H.E.A. Whyte. Whole-body vibration in neonatal transport: a review of current knowledge and future research challenges. Early Human Development. Volume 146, Jul. 2020.
8. J.M. Schwering, M.J.E. Kanevsky, J. Hayes, and R.G. Langlois. Atlas motion platform split-axle mecanum wheel design. Transactions of the Canadian Society for Mechanical Engineering. 44(4), 2019.
9. Z. Alam, F. Afagh, and R. Langlois. Efficient identification of naval high speed craft shock mitigation seat modal parameters from drop-test data. Dynamic Systems, Measurement and Control. 139(3), 2017.
10. Z. Copeland, B. Jung, M.J.D. Hayes, and R.G. Langlois. Full-scale Atlas motion platform: structure, actuation, and control. International Journal of Mechanisms and Robotic Systems. 3(2-3):94-112, 2017.
11. F. Khouli, F.F. Afagh, and R.G. Langlois. Design, simulation, and experimental results for flexible rotors in a ship airwake. Journal of Aircraft. 53(1): 262-275, 2016.
12. N.R. Bourgeois and R.G. Langlois. Derivation and validation of a spatial multi-link human postural stability model. Transactions of the Canadian Society for Mechanical Engineering. 40(2): 155-167, 2016.
13. A. Weiss, R.G. Langlois, and M.J.D. Hayes. Dynamics and vibration analysis of the interface between a non-rigid sphere and omnidirectional wheel actuators. Robotica. 33(9): 1850–1868, 2015.
14. M. Bourassa, B. Burlton, and F. Afagh, and R. Langlois. Switch points for highly eccentric orbits: modelling the occurrences of sign changes in the rate of change of the eccentricity. Acta Astronautica. 111: 270-282, 2015.
15. M. Bourassa, B. Burlton, F. Afagh, and R. Langlois. Exploiting lunisolar perturbations using the grazing method: an orbit control strategy for a satellite in a critically-inclined highly eccentric orbit around the Earth. Acta Astronautica. 115: 71-81, 2015.
16. J.J. Plumpton, M.J.D. Hayes, R.G. Langlois, and B.V. Burlton. Atlas motion platform mecanum wheel Jacobian in the Velocity and Static Force Domains. Trans. Canadian Society for Mechanical Engineering. 38(2): 251-261, 2014.
17. C.A. Duncan, R.G. Langlois, W.J. Albert, and S.N. MacKinnon. The habituation of human postural responses to platform perturbations. International Journal of Industrial Ergonomics. 44(6):874-881, 2014.
18. C.A. Duncan, W.J. Albert, R.G. Langlois, and S.N. MacKinnon. Stepping response during constrained and unconstrained standing in moving environments. International Journal of Maritime Engineering. 156: 207-212, 2014.
19. A. Morbi, M. Ahmadi, A.D.C Chan, and R. Langlois. Stability-guaranteed assist-as-needed controller for powered orthoses. Transactions on Control Systems Technology. 22(2): 745-752, 2014.

20. C.A. Duncan, W.J. Albert, R.G. Langlois, and S.N. MacKinnon. Stepping response during constrained and unconstrained standing in moving environments. RINA International J. Maritime Engineering. 156(A3), 2014.
21. A.S. Wall, S.J. Zan, R.G. Langlois, and F.F. Afagh. Correlated turbulence modelling: an advancing Fourier series method. J. Wind Engineering and Industrial Aerodynamics. 123 Part A(December):155-162, 2013.
22. F. Khouli, A.S. Wall, F.F. Afagh, and R.G. Langlois. Influence of ship motion on the aeroelastic response of a Froude-scaled maritime rotor system. Ocean Engineering. 54(Nov.):170-181, 2012.
23. K. Klumper, A. Morbi, K.J. Chisholm, R. Beranek, M. Ahmadi, R. Langlois. Orientation control of Atlas: a novel motion simulation platform. Mechatronics. 22(8): 1112-1123, 2012.
24. R.H. Phillion and R.G. Langlois. Relationships between ship motion and shipboard helicopter interface forces. SNAME J. Ship Research. Accepted after minor revisions Feb. 2012.
25. A. Kahn and R.G. Langlois. Factoring cycling in transportation infrastructure: design considerations based on risk exposure. J. Institute of Transportation Engineers (JITE). 81(8):49-53, Aug. 2011.
26. A. Weiss, R.G. Langlois, and M.J.D. Hayes. Unified treatment of the kinematic interface between a sphere and omnidirectional wheel actuators. ASME J. Mech. and Robotics. 3(4):041001, Nov. 2011.
27. M.J.D. Hayes, R.G. Langlois, and A. Weiss. Atlas motion platform generalized kinematic model, Mecanica. 46(1):17-25, Jan. 2011.
28. Guigue, M. Ahmadi, R.G. Langlois, and M.J.D. Hayes. Pareto optimality and multiobjective trajectory planning for a 7-DOF redundant manipulator, IEEE Trans. Robotics. 26(4):1094-1099, Dec. 2010.
29. F. Khouli, J. Griffiths, R.G. Langlois, and F.F. Afagh. Actuation of slender thin-wall anisotropic open cross-section beams based on asymptotically-correct Vlasov theory. J. Intelligent Material Systems and Structures, 21(3):529-540, Mar. 2010.
30. A. Guigue, M. Ahmadi, M.J.D. Hayes, and R.G. Langlois. A discrete dynamic programming approximation to the multiobjective deterministic finite horizon optimal control problem. SIAM J. Control and Optimization, 48(4):2581-2599, Sept. 2009.
31. R.G. Langlois, S.N. MacKinnon, and C.A. Duncan. Modelling sea trial motion induced interruption data using an inverted pendulum articulated postural stability model. RINA J. Maritime Engineering, 151(Part A1):1-10, Jan.-Mar. 2009.
32. A. Weiss, R.G. Langlois, and M.J.D. Hayes. The effects of dual-row omnidirectional wheels on the kinematics of the Atlas spherical motion platform. Mechanism. and Machine. Theory, 44(2):349-358, Feb. 2009.
33. F. Khouli, F. Afagh, and R. Langlois. Application of the first order generalized alpha method to the solution of an intrinsic geometrically exact model of rotor systems. ASME J. Computational and Numerical Dynamics, 4:011006-1-011006-12, Jan. 2009.
34. A.S. Wall, F.F. Afagh, R.G. Langlois, and S.J. Zan. Modelling helicopter blade sailing: dynamic formulation and validation. ASME J. Applied Mechanics, 75(6):061004-1-061104-13, Nov. 2008.
35. A.S. Wall, R.G. Langlois, F.F. Afagh, and S.J. Zan. Modeling helicopter blade sailing: dynamic formulation in the planar case. ASME J. Applied Mechanics, 74(6):1104-1113, Nov. 2007.
36. F. Khouli, R.G. Langlois, and F.F. Afagh. Analysis of active closed cross-section beams based on asymptotically-correct thin-wall beam theory. IoP J. Smart Materials. and Structures, 16:221-229, Jan. 2007.
37. D.R. Linn and R.G. Langlois. Development and experimental validation of a shipboard helicopter on-deck manoeuvring simulation. AIAA J. Aircraft, 43(4):895-906, Jul.-Aug. 2006.
38. R.G. Langlois and M.J.D. Hayes. Reciprocating excitation of a flexible beam: benchmark problem. Mechanism and Machine Theory, 41(4):359-381, Apr. 2006.
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2. Amirhossein Daliri Shadbad, Fred F. Afagh, Fidel Khouli, and Robert G. Langlois. “Analytical and Experimental Investigation of Ride Quality and Performance of a Quarter and Half Car Suspension System with Novel Nonlinear Magnetic Shock Absorber”. In proceedings of the 28th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks”, August 21-15, 2023; Ottawa, ON, Canada.
3. Patrick Kehoe, Keely Gibb, Richard Egwabor, Robert Langlois, James Green, Adrian D.C. Chan, Cheryl Aubertin, Kim Greenwood, Andrew Ibey, and Stephanie Redpath; 2023; “Characterization of Noise and Vibration in a Ground Ambulance by Road Classification”. In proceedings of the 28th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks”, August 21-15, 2023; Ottawa, ON, Canada.
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Canadian Aeronautics and Space Institute (CASI) Structural Mechanics Conference, Ottawa Canada, May 2009. 12 pages.
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5. K.W. Tsui and R.G. Langlois. Development of the Virtual Flight Deck – Real Time (VFD-RT) simulation environment. In Proceedings of the American Helicopter Society 64th Annual Forum, Montreal, Canada, April-May 2008. American Helicopter Society (AHS) International. 10 pages in electronic proceedings.
6. A.S. Wall, F. Khouli, F.F. Afagh, R.G. Langlois, and S.J. Zan. Modelling helicopter blade sailing: model validation using experimental data. In Proceedings of the American Helicopter Society 64th Annual Forum, Montreal, Canada, April {May 2008. American Helicopter Society (AHS) International. 13 pages in electronic proceedings.
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15. D.R. Linn and R.G. Langlois. Development and validation of an on-deck helicopter manoeuvring simulation Phase I: simulation model. In Proceedings of the 19th Canadian Congress of Applied Mechanics (CANCAM 2003), Calgary, Canada, June 2003. 2 pages in electronic proceedings.
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23. R.G. Langlois. Analytical solution of a simple rigid flexible hybrid dynamic system. In Proceedings of the Fourteenth Canadian Congress of Applied Mechanics (CANCAM 1993), pages 221-222, Kingston, Canada, May 1993.

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1. T. Stachiw, F. Khouli, R. Langlois, F. Afagh, and H. Kolera, “Rapid development of a virtual testing model for flexible aircraft landings”, Engineering Reality, MSC Software Magazine, Winter 2020 Issue.

CURRICULUM VITAE

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PROFILE SUMMARY

Dr. Jie (Peter) Liu is a Full Professor in the Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Canada. He completed his B.Eng. in Electronics and Precision Engineering at Tianjin University (China) in 1998, his M.Sc. in Control Engineering at Lakehead University in 2005, and his Ph.D. in Mechanical Engineering at the University of Waterloo in 2008. He worked as a Postdoctoral Fellow in the Department of Mechanical Engineering at UC Berkeley in 2008-2010.

Dr. Liu is leading international research efforts in Prognostics and Health Management (PHM) with applications to several engineering systems including gas turbine engines for power generation, lithium-ion batteries for energy storage, and mechanical power transmissions. His research contributions have led to 62 journal papers and 37 conference papers. Several of his research works were considered as seminal/pioneering ones in the field and the total citations are over 5000 (Google Scholar) with highest impact factor 39.714 (Energy & Environmental Science). He was identified as one of the World's Top 2% Most-Cited Scientists (2022 Stanford-Elsevier List of the World's Most-Cited Scholars).

Dr. Liu was the recipient of Carleton University Research Achievement Award (2017), IEEE Ottawa Section Outstanding Service Award (2017), France-Canada Research Award (2013-2015), NSERC Postdoctoral Fellowship (2008-2010), NSERC Postgraduate Scholarship (2005-2008), and Governor General's Gold Medal of Canada (2006).

Dr. Liu served as Editor-in-Chief for Journal of Prognostics and Health Management (2020-present), the Senator of Carleton University (2017-2020), the IEEE Reliability Society Administrative Committee Member (2018-2020), Interim Vice President of IEEE Reliability Society (2019), the Associate Editor of IEEE Transactions on Reliability (2016-2020), the Editorial Board Member of Chinese Journal of Aeronautics (Elsevier) since 2013, and the Editorial Board Member of Chinese Journal of Mechanical Engineering (Springer) since 2018. He also served as the General Chair for 2017 SDPC Conference in Shanghai, 2018 IEEE PHM Conference in Seattle, 2019 PHM China Conference in Chongqing, 2019 IEEE PHM Conference in San Francisco, and 2019 PHM Europe Conference in Paris. He is a Fellow of IET, a Senior Member of IEEE, and a Professional Engineer of Ontario.

EDUCATION BACKGROUND

2005/09 – 2008/09 **Ph.D.**
Mechanical Engineering, University of Waterloo, Waterloo, ON, Canada
Thesis: An Intelligent System for Bearing Condition Monitoring

2003/09 – 2005/08 **M.Sc.**
Control Engineering, Lakehead University, Thunder Bay, ON, Canada
Thesis: Design and Implementation of a Time-Delayed Control System for Structural Vibration Suppression

1994/09 – 1998/07 **B.Eng.**
Electronics and Precision Engineering, Tianjin University, Tianjin, China

ACADEMIC AND RESEARCH EXPERIENCE

2021/07 – Present **Full Professor**
Mechanical & Aerospace Engineering, Carleton University, Ottawa, ON, Canada
Prognostics and Health Management, Machinery Condition Monitoring, Battery Management Systems

2015/07 – 2021/06 **Associate Professor**
Mechanical & Aerospace Engineering, Carleton University, Ottawa, ON, Canada
Prognostics and Health Management, Machinery Condition Monitoring, Battery Management Systems

2010/08 – 2015/06 **Assistant Professor**
Mechanical & Aerospace Engineering, Carleton University, Ottawa, ON, Canada
Prognostics and Health Management, Machinery Condition Monitoring, Battery Management Systems

2008/12 – 2010/07 **NSERC Postdoctoral Fellow**
Mechanical Engineering, University of California, Berkeley, CA, USA
In collaboration with NASA Ames Research Center, the research was focused on the remaining useful life prediction of lithium-ion batteries for electric vehicles and aerospace applications

2005/09 – 2008/09 **Research Assistant and Teaching Assistant**
Mechanical Engineering, University of Waterloo, Waterloo, ON, Canada

2007/09 – 2007/12 **Sessional Instructor**
Mathematics Sciences, Lakehead University, Thunder Bay, ON, Canada

2003/09 – 2005/08 **Research Assistant and Teaching Assistant**
Mechanical Engineering, Lakehead University, Thunder Bay, ON, Canada

INDUSTRIAL EXPERIENCE

2001/08 – 2003/08 **Vice President**
Wanfang Trade Inc., Weihai, China

2000/04 – 2001/07 **Production Manager**
Invensys Controls (Weihai Subsidiary), Weihai, China

1998/07 – 2000/03 **Product Design Engineer**
Invensys Controls (Weihai Subsidiary), Weihai, China

ACADEMIC and PROFESSIONAL RESPONSIBILITIES

(i) Teaching and Students Supervision

(a) Courses Taught or Being Taught

Table 1: Teaching Evaluation Summary (Overall Average: 4.32/5.00)

Year	Term	Course*	R/E**	Mean***
2022/23	Winter	MECH5302W	8/33	4.35
2022/23	Fall	MAAE2202B	N/A	N/A
2022/23	Fall	MAAE2202A	15/75	4.04
2021/22	Winter	MAAE2202C	N/A	N/A
2021/22	Fall	MAAE2202B	N/A	N/A
2021/22	Fall	MAAE2202A	N/A	N/A
2020/21	Winter	MAAE2202B	N/A	N/A
2020/21	Winter	MAAE2202A	N/A	N/A
2020/21	Fall	MECH5302F	N/A	N/A
2019/20	Winter	MAAE3500A	N/A	N/A
2019/20	Winter	MAAE3500B	N/A	N/A
2019/20	Fall	MECH5302F	27/33	4.56
2018/19	Winter	MAAE3500A	37/94	3.96
2018/19	Winter	ECOR1010D	58/277	3.95
2018/19	Fall	MECH5302F	6/13	4.72
2017/18	Winter	MAAE2202B	42/77	4.10
2017/18	Winter	ECOR1010D	18/102	4.58
2017/18	Fall	MECH5302F	9/16	4.88
2015/16	Winter	MAAE2202B	48/99	4.18
2015/16	Fall	MECH5302F	17/21	4.56
2015/16	Fall	AERO4540A	13/22	4.41

2014/15	Winter	MAAE2202B	29/73	4.16
2014/15	Fall	MECH5302F	22/28	4.24
2014/15	Fall	AERO4540A	15/21	4.52
2013/14	Winter	MAAE 2202D	21/70	3.93
2013/14	Fall	AERO 4540A	16/22	4.37
2013/14	Fall	MAAE 4500B	42/72	3.99
2012/13	Winter	MAAE 2101C	49/96	4.23
2012/13	Fall	AERO 4540A	11/14	4.44
2012/13	Fall	MAAE 4500A	50/90	4.08
2011/12	Winter	MECH 4806A	19/28	4.24
2011/12	Fall	MAAE 4500B	58/73	4.67
2011/12	Fall	MAAE 4500A	51/85	4.45
2010/11	Fall	MAAE 4500B	39/60	4.03

* MAAE 2202: Mechanics of Solids – I
MAAE 3500: Feedback Control Systems
MAAE 4500: Feedback Control Systems
AERO 4540: Spacecraft Dynamics and Control
ECOR 1010: Introduction to Engineering
MAAE 2101: Engineering Dynamics
MECH 4806: Mechatronics
MECH 5302: Instrumentation Techniques

** R/E: Respondents/Eligible Respondents

*** Mean: Ranking ranges from 1 (poor) to 5 (excellent)

Table 2: Fourth Year Capstone Engineering Design Project

Fourth Year Project	Term/Year	Number of Students
Satellite Design Project (SDP)	Fall 2022 / Winter 2023	2
Carleton University Simulator Project (CUSP)	Fall 2021 / Winter 2022	4
Carleton University Simulator Project (CUSP)	Fall 2020 / Winter 2021	4
Intelligent Telepresence and Devices (iTAD)	Fall 2019 / Winter 2020	6
Intelligent Telepresence and Devices (iTAD)	Fall 2018 / Winter 2019	4
Intelligent Telepresence and Devices (iTAD)	Fall 2017 / Winter 2018	6
Carleton University Simulator Project (CUSP)	Fall 2015 / Winter 2016	9
Carleton University Simulator Project (CUSP)	Fall 2014 / Winter 2015	10

Formula Hybrid	Fall 2013 / Winter 2014	8
Formula Hybrid*	Fall 2012 / Winter 2013	5
Carleton University Simulator Project (CUSP)	Fall 2011 / Winter 2012	6
Carleton University Simulator Project (CUSP)	Fall 2010 / Winter 2011	4

* The formula hybrid racing car won the sixth place in 2013 Formula Hybrid Competition in New Hampshire, USA, and the first place in 2013 Formula North Competition in Barrie, Canada.

(b) Supervision

	Current		**Completed**	
	Supervised	**Co-supervised**	**Supervised**	**Co-supervised**
Undergraduate			72*	
Master's	2		13	7
Doctoral	1		1	2
Postdoctoral Fellow			1	3**
Research Associate				1
Total	**3**		**87**	**13**

* Including 68 fourth year capstone design project students, 2 summer undergraduate co-op students, 1 NSERC Engage undergraduate student, and 1 NSERC USRA student.

** Including Postdoctoral Fellow Dr. Rui Zhao co-supervised with Prof. Fai Ma at UC Berkeley, Postdoctoral Fellow Dr. Houman Hanachi co-supervised with Prof. Christopher Mechefske at Queen's University, and Postdoctoral Fellow Dr. Zhonghua Zhang co-supervised with Prof. Junjie Gu.

Table 3: Graduate Supervision (In Progress)

Name	**Degree**	**Years**	**Thesis or Project Title**
Xinyi Ma	M.A.Sc.	2022 -	Industrial Bearing Health Monitoring and Failure Prognostics
Ahmed Abdelrahman	Ph.D.	2023 -	Battery Management System
Yuxin (Shane) Hu	M.A.Sc.	2023 -	Battery Management System

Table 4: Graduate Supervision (Completed)

Name	**Degree**	**Years**	**Thesis or Project Title**

Hengyangcan Gu *(Working at Life Prediction Technologies as a Data Scientist)*	M.A.Sc.	2021-2023	Novel Physics-informed Model for Bearing PHM Using ODM Debris Data
Hassan Mahmoud *(Working at Gastops Ltd. as a Data Scientist)*	M.A.Sc.	2020-2023	Industrial Scalable Rolling Element Bearing Diagnostic and Prognostic Modelling
Jianyu Liu *(Working at Life Prediction Technologies Inc. as a Research Scientist)*	M.A.Sc.	2019-2021	A Pulsating Heat Pipe Based Thermal Management System for Lithium-ion Batteries
Lourd Arun Raj *(Working at GEOTAB INC. as a Data Scientist)*	M.A.Sc.	2019-2021	An Intelligent PHM System for Bearing Fault Phase Diagnosis and Multi-Phase RUL Prediction using Oil Debris Monitors
Rui Zhao* *(Working at National Research Council of Canada as a Research Officer)*	Postdoc	2018-2019	Development of Battery Fast-heating Technology
Ping Ding *(Working at Chongqing Technology and Business University as a Research Professor)*	Postdoc	2017-2019	Structural Health Condition Monitoring and Failure Prognostics
Yu Zhang *(Working at Joyolight Group Inc. as a System Engineer)*	M.A.Sc.	2016-2018	Performance Estimation and Fault Diagnostics for the Starter of Auxiliary Power Unit
Zelig Li *(Working at Life Prediction Technologies Inc. as an Aerospace Engineer)*	M.A.Sc.	2016-2018	Physics-Based Online Assessment of Surface Roughness Severity for High-Pressure Turbines
Houman Hanachi**	Postdoc	2015-2018	Gas Turbine Engine Health State Estimation and Prognostics
Rui Zhao*** *(Recipient of NSERC Postdoctoral Fellowship 2018, Carleton University Best TA Award 2017, J.Y. &E.W. Wong Research Award 2017,*	Ph.D.	2014-2018	Overheating Prediction and Management of Lithium-Ion Batteries

Ontario Graduate Scholarship 2016, Chinese Government Award for Outstanding Self-Financed Student 2016, Carleton University Medal 2015, and Carleton GSA International Student Award 2014)			
Long Zhai *(Working at Guildline Instruments Limited as a System Engineer)*	M.A.Sc.	2015-2017	Development of Preheating and Power Inverting Systems for Lithium-Ion Batteries
Xiaozhou Zhang****	Ph.D.	2013-2017	Experimental and Modeling Studies of Creep Performance of Modified 9Cr-1Mo Steels with or without Oxidation-Resistant Coating
Qianyue Qian***	M.Eng.	2014-2017	Corrosion Detection Using Ultrasonic Testing Techniques
Kun Zhuang	M.A.Sc.	2014-2017	Indoor Positioning Using Stereo Cameras for Domestic Robots
Weidong Li *(Working at MB3 Ottawa as a Web Developer)*	M.A.Sc.	2013-2016	Vibration Signature Analysis for Gearbox Spalling Detection
Houman Hanachi *(Working at Algonquin College as a Professor; Recipient of FRQNT Postdoctoral Fellowship 2016-2018, OGS 2014, GRIT Award 2013, University Medal Nominee 2015)*	Ph.D.	2011-2015	Gas Turbine Engine Performance Estimation and Prediction
Matteo Louter*** *(Working as Machine Design Engineer at Taymer International Inc.; Recipient of Provincial Engineering Championship)*	M.A.Sc.	2013-2015	Novel Structural Design of a Piezo Transducer for Roadway Power Harvesting Applications
Xinghe Wang*** *(Working at Guildline Instruments Limited as a System Engineer)*	M.A.Sc.	2012-2015	A Self-Contained Roadway Kinetic Energy Harvesting System for Energy Recovery
Zhonghua Zhang***	Postdoc	2013-2014	Metal Oxide Materials for Polymer Electrolyte Fuel Cells
Rui Zhao***	M.A.Sc.	2012-2014	The Influence of Internal Parameters on the Electrochemical and Thermal Behaviors of Lithium Ion Batteries

Sijie Zhang*** *(Recipient of NSERC PGS D3 Scholarship 2017-2020)*	M.A.Sc.	2012-2014	A Hydrogel Based Thermal Management System for Lithium Ion Batteries
Omar Fouad***** *(Working at Abbott Ottawa as a Manufacturing Process Engineer)*	M.A.Sc.	2012-2014	Position Estimation of Mobile Robots Using Omni-Directional Cameras
Qingfeng Lou *(Working at CAE as a Software Engineer; University Medal Nominee)*	M.A.Sc.	2011-2013	Aircraft APU Starter Health Monitoring and Failure Prognostics
Yu Ji	M.A.Sc.	2011-2013	Modeling, Dynamic Simulation, and Design of Magnetic Sensors Based on Magnetic Tunnel Junction Technology
Peishan Hu**** *(Working as a Project Coordinator in Calgary*)	M.A.Sc.	2011-2013	Improvement in Metal-on-Metal Bearing of Hip Implants with Advanced Stellite Alloys
Elham Alavi****** *(Working as a Sector Support Analyst at the City of Toronto)*	M.A.Sc.	2010-2013	Bladed Disk Crack Detection Through Advanced Analysis of Bladed Passage Signals
Fabio Faragalli *(Working as a Field Engineer at SRS Industrial, Edmonton)*	M.Eng.	2010-2011	Development of a Particle Filtering Based Technique for Lithium Ion Battery Health Estimation

* Co-supervised with Prof. Fai Ma at University of California, Berkeley

** Co-supervised with Prof. Christopher Mechefske at Queen's University

*** Co-supervised with Prof. Junjie Gu

**** Co-supervised with Prof. Rong Liu

***** Co-supervised with Prof. Jurek Sasiadek

****** Co-supervised with Prof. Ming Liang at the University of Ottawa (Ms. Elham Alavi was an M.A.Sc. student registered in Mechanical Engineering at the University of Ottawa)

(ii) Scholarly Studies and Research

(a) Research Grants Since August 2010

Table 5: Research Grants and Contracts (Total: CAD $1.3M Cash; Percentage is applied for joint fund)

Type of Support	Funding Source	Title of Research	Amount	Years of Tenure

Completed Projects	Carleton University (PI)	Start-up Funds	$ 30,000	2010
	NSERC Discovery Grant (PI)	A Novel Intelligent System for Machinery Condition Monitoring and Failure Prognostics	$ 23,000 $ 23,000 $ 23,000 $ 23,000 $ 23,000	2011 2012 2013 2014 2015
	NSERC Engage Grant (PI)	Development of an Advanced Signal Processing Technique for Engine Blade/Disc Crack Detection *(Industry Partner: Life Prediction Technologies Inc.; Contacts: Dr. Ashok Koul and Dr. Avi Banerjee)*	$ 23,100	2011
	NSERC Engage Grant (PI) *(Co-PI: Prof. Junjie Gu)*	Lithium Ion Battery Pack Thermal Management Using Flexible Gel Films *(Industry Partner: Panacis Inc.; Contacts: Mr. Steve Carkner and Mr. Eric Lanoue)*	$ 25,000 (50%)	2012
	Carleton University Research Excellence Fund (Co-PI) *(PI: Prof. Shikharesh Majumdar; Other Co-PI: Prof. David Lau, Prof. Marc St.-Hilaire, and Dr. Biswajit Nandy)*	Cloud Based Smart Facilities Management	$ 40,000 (20%) $ 40,000 (20%) $ 30,000 (20%)	2011 2012 2013
	NRC Research Fund (PI)	Development of a Model Fusion Prognostic Technique for Aircraft Engine Failure Prediction *(NRC Contact: Dr. Chunsheng Yang)*	$ 10,000 $ 10,000 $ 10,000	2011 2012 2013
	NSERC Collaborative Research and Development Grant (PI)	Development of the Next-Generation Magnetic Field Sensors Based on Magnetic Tunnel Junction Technology *(Industry Partner: Guildline Instruments Limited; Contact: Mr. Richard Timmons)*	$ 22,500 $ 22,500	2012 2013
	NSERC Collaborative Research and Development Grant (PI)	Development of an Advanced Gas Turbine Engine Diagnostics, Prognostics, and Health Management System	$ 30,000 $ 30,000 $ 30,000	2013 2014 2015

		(Industry Partner: Life Prediction Technologies Inc.; Contacts: Dr. Ashok Koul, Dr. Avi Banerjee, and Dr. Ying Chen)		
	MITACS Accelerate Research Grant (PI) *(Co-PI: Prof. Junjie Gu)*	Development of a Self-Contained Roadway Power Harvesting System for Energy Recovery *(Industry Partner: BW Service Inc.; Contacts: Mr. Ebrahim Desai)*	$ 37,500 (50%) $ 37,500 (50%)	2013 2014
	Ontario-China Research and Innovation Fund (Co-PI & Project Manager) *(PI: Prof. Junjie Gu; Other Co-PI: Prof. Banu Ormeci)*	Treatment of Non-Biodegradable Organic Wastewater with Supercritical Water Oxidation Technology and Equipment *(Ontario Industry Partner: Life Prediction Technologies Inc.; Contacts: Dr. Ashok Koul, Dr. Avi Banerjee, and Dr. Ying Chen)*	$ 110,000 (33.33%) $ 100,000 (33.33%) $ 70,000 (33.33%)	2013 2014 2015
	NRC Research Fund (PI)	Development of a frequency based technology for gearbox fault detection *(NRC Contact: Dr. Azzedine Dadouche)*	$ 9,500	2014
	CANARIE Research Middleware Program Project (Co-PI) *(PI: Prof. Shikharesh Majumdar; Other Co-PI: Prof. David Lau, Prof. Marc St.-Hilaire, and Dr. Biswajit Nandy)*	Research Platform for Smart Facilities Management	$ 74,766 (20%) $ 400,973 (20%)	2014 2015
	MITACS Accelerate Cluster Grant (PI)	Development of a Truly Intelligent Robotic Vacuum Cleaner for Household Applications	$ 40,000 $ 40,000 $ 53,334	2014 2015 2016
	NSERC Collaborative Research and Development Grant (PI)	Development of an Intelligent Gas Turbine Engine Health Monitoring and Degradation Prediction System	$ 60,000 $ 60,000	2017 2018
Current Projects	NSERC Discovery Grant (PI)	Advanced Lithium Ion Battery Thermal Management and Health Management	$ 26,000 $ 26,000 $ 26,000 $ 26,000 $ 26,000 $ 26,000	2016 2017 2018 2019 2020 2021

	NSERC Collaborative Research and Development Grant (PI)	Development of a Novel Health Monitoring and Life Prognostics System for Industrial Bearings	$ 75,000 $ 75,000 $ 75,000 $ 75,000	2020 2021 2022 2023
Projects Applied for	None			

(b) Research Publications

Articles in Refereed Journals (Accepted/Published) **(student names in bold)**

[1] Su, S.S., Li, W., Mou, J.H., Garg A., Gao, L., and Liu, J. (2023) A hybrid battery equivalent circuit model, deep learning, and transfer learning for battery state monitoring. IEEE Transactions on Transportation Electrification. 9(1): 1113-1127.

[2] Xia, P.C., Huang, Y.X., Tao, Z.Y., Liu, C.L., and Liu, J. (2023) A digital twin-enhanced semi-supervised framework for motor fault diagnosis based on phase-contrastive current dot pattern. Reliability Engineering & System Safety. 235: 109256.

[3] Liu, J., **Li, Z.**, and **Hanachi, H.** (2021) A physics-based framework for online surface roughness assessment for high-pressure turbines. *Chinese Journal of Aeronautics*. 34(7): 135-156.

[4] **Wang, T.**, Liu, Z., Lu, G.L., and Liu, J. (2021) Temporal-spatio graph based spectrum analysis for bearing fault detection and diagnosis. *IEEE Transactions on Industrial Electronics*. 68(3): 2598-2607.

[5] Meng, L.H., Pecht, M., Liu, J., Wang, Y.H., and Cheng, K.Q. (2021) Health monitoring of IGBTs with a rule-based sub-safety recognition model using neural networks. *Journal of Prognostics and Health Management*. 1(1): 64-85.

[6] **Zhang, Y.**, **Hanachi, H.**, Liu, J., and Yang, C. (2020) Model-based degradation inference for auxiliary power unit start system. *Engineering Failure Analysis*. 118: 1-12.

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[8] **Zhao, R.**, Liu, J., Gu, J., Zhai, L., and Ma, F. (2020) Experimental study of a direct evaporative cooling approach for Li-ion battery thermal management. *International Journal of Energy Research*. 44: 6660-6673.

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[14] **Chen, G.Y.**, Lu, G.L., Liu, J., and Yan, P. (2019) An integrated framework for statistical change detection in running status of industrial machinery under transient conditions. *ISA Transactions*. 94: 294-306.

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[35] **Zhao, R.**, Zhang, S.J., Liu, J., and Gu, J. (2015) A review of thermal performance improving methods of lithium ion battery: Electrode modification and thermal management system. *Journal of Power Sources*. 299(20): 557-577.

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[1] **Gu, H., Mahmoud, H., Arun, R.L**., Liu, J., and **Ma, X.** (2023) Particle filter and its variants for degradation state estimation and remaining useful life prediction. *Proceedings of the 2023 Prognostics and Health Management Conference (PHM-Paris)*, Paris, France, May 31 – June 2.

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[10] Ao, W.G., **Ding, P.**, and Liu, J. (2017) Equal strength analysis of prestressed combined die for cold extrusion based on the unified strength theory. *Proceedings of the 2017 International Conference on Sensing, Diagnostics, Prognostics, and Control (SDPC 2017)*, Shanghai, China, August 16-18.

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[32] Yang, C.S., Yang, Y.B., and Liu, J. (2012) Model fusion based batch learning with application to oil spills detection. *Proceedings of the 25th International Conference on Industrial Engineering and Other Applications of Applied Intelligent Systems*, pp. 40-47.

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[34] Liu, J., Saxena, A., Goebel, K., Saha, B., and Wang, W. (2010) An adaptive recurrent neural network for remaining useful life prediction of lithium-ion batteries. *Proceedings of the Annual Conference of the Prognostics and Health Management Society*, Portland, Oregon, USA, October 10-16. **(Citation: 146)**

[35] Liu, J., Ghafari, S., Golnaraghi, F., Wang, W., and Ismail, F. (2008) Bearing fault diagnostics based on reconstructed features. *Proceedings of the forty-third Annual Meeting of the IEEE Industry Applications Society*, Edmonton, Alberta, Canada, October 5-9.

[36] Liu, J., Liu, K., Bai, H. (2005) Application of a time-delayed control system in vibration suppression. *Proceedings of IEEE International Conference on Mechatronics and Automation*, Niagara Falls, Ontario, Canada, July 29 – August 1. **(Best Paper Award Finalist)**

[37] Liu, J., and Liu, K. (2005) Several design issues on the tunable electromagnetic vibration absorber. *Proceedings of the CCToMM Symposium on Mechanisms, Machines and Mechatronics*, Montreal, Quebec, Canada, May 30 – June 2.

Technical Reports

[1] **Li, W.D.** and Liu, J. (2014) Assessment of gearbox spalling-type defects: spectral and time-frequency analysis. Reported to National Research Council of Canada, April 30.

[2] Liu, J. (2010) A RNF system with a RNN system for remaining useful life prediction. Reported to Mission Critical Technologies (MCT) Inc and NASA Ames Research Center (NASA ARC), May 14.

Invited Presentations

[1] Liu, J. (2023) Prognostics and Health Management: a fascinating world full of potentials, challenges, and opportunities, CMES Institution of Equipment Intelligent Maintenance, Dongguan, China, December 16.

[2] Liu, J. (2023) Prognostics and Health Management for Energy Systems, The 6th International Conference on Power and Energy Applications, Weihai, China, November 25.

[3] Liu, J. (2023) Prognostics and Health Management: The State of Art, The 6th International Conference on Mechatronics, Robotics and Automation, Xiamen, China, November 18.

[4] Liu, J. (2018) PHM Technologies for Aerospace System Applications, Nanjing University of Aeronautics and Astronautics, Nanjing, China, June 5.

[5] Liu, J. (2018) An Internal Cooling Design and A Heating Technique for Li-ion Batteries, Testa Headquarter at Palo Alto, California, October 22.

[6] Liu, J. (2017) PHM systems and advances, Northwestern Polytechnic University, Xi'an, China, June 29.

[7] Liu, J. (2017) Intelligent battery management systems, Beihang University, Beijing, China, April 24.

[8] Liu, J. (2015) Sensors in intelligent systems, Ingenious Talk, Sunnyside Library, Ottawa, December 2.

[9] Liu, J. (2015) Magnetic sensor-based pipeline corrosion detection under supercritical water oxidation conditions, Department of Chemical Engineering, Tianjin University, TianJin, China, August 6.

[10] Liu, J. (2015) Intelligent systems in sensing, diagnostics, prognostics, and control, School of Automotive and Traffic Engineering, Jiangsu University, Zhen Jiang, Jiang Su, China, July 29.

[11] Liu, J. (2013) Several developments in PHM test methods and NDE. Panelist, PHM Test Methods and NDE Panel, IEEE International Conference on Prognostics and Health Management, Gaithersburg, Maryland, USA, June 24-27.

[12] Liu, J. (2012) Capacitance sensor for engine blade crack detection and MTJ magnetic sensor for tomorrow's NDE applications. Panelist, Non-Destructive Evaluation Panel, IEEE International Conference on Prognostics and Health Management, Denver, Colorado, USA, June 18-21.

[13] Liu, J. (2010) An adaptive recurrent neural fuzzy system for the remaining useful life prediction of lithium ion batteries. NASA Ames Research Center, Moffett Field, California, USA, March 3.

[14] Liu, J. (2008) Small bearing, big world, an intelligent system for bearing condition monitoring. Department of Mechanical Engineering, University of Alberta, Edmonton, Alberta, Canada, October 9.

(iii) Service to the Department and the University

(a) Committee Service

- 2022 – 2023
  - Department Tenure and Promotion Committee
- 2021 – 2022
  - Department Tenure and Promotion Committee
  - Department Graduate Attributes Committee
- 2020 – 2021
  - Accreditation/Graduate Attributes Committee
  - Department Dynamics and Controls Strand Committee
- 2019 – 2020
  - University Senator
  - Department Dynamics and Controls Strand Committee
  - Department Tenure and Promotion Committee
- 2018 – 2019
  - University Senator
  - University Research Achievement Awards Committee
  - Department Graduate Seminar Series Coordinator
  - Department Tenure and Promotion Committee
- 2017 – 2018
  - University Senator
  - Department Graduate Seminar Series Coordinator
  - Department Equipment Committee
- 2015 – 2016
  - Department Staffing Committee
  - Department Curriculum Committee
- 2014 – 2015
  - Department Staffing Committee
  - Department Curriculum Committee
- 2013 – 2014
  - Department Promotion Committee

  - Department Curriculum Committee
- 2012 – 2013
  - Library Representative
  - Dynamics and Control Curriculum Review Ad-hoc Committee
- 2011 – 2012
  - Library Representative
  - Dynamics and Control Curriculum Review Ad-hoc Committee

(b) Thesis Examination Boards

Thesis Defense Chair

- Motahari, Amin, M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, August 21, 2023.
- Rick, John, Directed Study Examiner, Mechanical and Aerospace Engineering, Carleton University, July 29, 2023.
- Maksoud, T., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, May 26, 2023.
- Campbell, B., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, August 2022.
- Corrigall, L., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, July 2022.
- Parisien, A., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, September 2021.
- Cheng, Y.D., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, August 2020.
- Al-Sukhon, A., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, August 2020.
- Ooi, B., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, December 2019.
- Salman, M.A., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, March 2019.
- Aguilar, R., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, May 2018.
- Lopez-Cruz, P., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, May 2014.
- Alatrash, A., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, January 2014.
- Baldwin, C., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, January 2014.
- Joynes, I., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, September 2013.
- Hanlon, S., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, September 2013.

- He, M.G., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, May 2013.
- Morris, H., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, January 2013.

Departmental Examiner

- Arora, L., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, March 2023.
- MacMillan, W., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, December 2022.
- Festa-Bianchet, S., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, November 2022.
- Vieira, M., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, May 2022.
- Mottaghi, M., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, November 2021.
- Despond, F., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, October 2021.
- Yazdkhasti, S., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, May 2021.
- Khiabani, H., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, May 2021.
- Ali, I., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, May 2021.
- Ali, I., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, January 2020.
- Shafi, S., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, January 2020.
- A.M., Osama, Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, September 2019.
- Shi, J.F., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, January 2019.
- Ghaziaskar, A., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, December 2018.
- Claudino, P., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, December 2015.
- Bishop, G., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, September 2015.
- Han, Y.W., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, August 2015.
- Monjazeb, A., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, November 2013.

- Chisholm, K., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, July 2013.
- Zhang, X.Z., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, December 2012.
- Giordano, N., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, November 2012.
- Gao, F., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, October 2012.
- Ulrich, S., Ph.D. Thesis, Mechanical and Aerospace Engineering, Carleton University, August 2012.
- Beranek, R., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, August 2011.
- Morbi, A., Ph.D. Thesis Proposal, Mechanical and Aerospace Engineering, Carleton University, March 2011.
- Fang, H., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, January 2011.
- Mullins, F.A., M.A.Sc. Thesis, Mechanical and Aerospace Engineering, Carleton University, September 2010.

Internal Examiner

- Nguyen, K., Ph.D. Thesis, Department of Systems and Computer Engineering, Carleton University, September 2021.
- Wang, Y.W., Ph.D. Comprehensive Exam, Department of Electronics, Carleton University, August 2020.
- He, Y., Ph.D. Thesis, Department of Systems and Computer Engineering, Carleton University, June 2019.
- Radimov, N., Ph.D. Comprehensive Exam, Department of Electronics, Carleton University, April 2019.
- Zhang, C., Ph.D. Thesis, Department of Electronics, Carleton University, August 2018.
- Ding, Y.Y., M.A.Sc. Thesis, Department of Electronics, Carleton University, April 2018.
- Wei, Z.X., Ph.D. Thesis, Department of Systems and Computer Engineering, Carleton University, February 2017.
- Al-Zahrani, A., Ph.D. Thesis, Department of Systems and Computer Engineering, Carleton University, January 2015.
- Rhinelander, J., Ph.D. Thesis, Department of Systems and Computer Engineering, Carleton University, April 2013.
- Dinnissen, P., M.A.Sc. Thesis, Department of Systems and Computer Engineering, Carleton University, September 2011.

External Examiner

- Larocque-Villiers, Justin, M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, December 12, 2023.

- Hua, Zehui, Ph.D. Thesis Proposal, Department of Mechanical Engineering, University of Ottawa, November 29, 2023.
- Chen, Y., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, December 2021.
- Hendriks, J., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, March 2021.
- Al-Buraiki, O., Ph.D. Thesis Proposal, Department of Mechanical Engineering, University of Ottawa, September 2019.
- Luo, Y., Ph.D. Thesis, Department of Mechanical Engineering, University of Ottawa, February 2019.
- Xie, M.J., Ph.D. Thesis, Department of Mechanical Engineering, University of Alberta, January 2019.
- Marques De Almeida, D., M.A.Sc. Thesis, Department of Mechanical Engineering, Laurentian University, January 2019.
- Guan, Y.P., Ph.D. Thesis, Department of Mechanical Engineering, University of Ottawa, November 2018.
- Huang, H., Ph.D. Thesis, Department of Mechanical Engineering, University of Ottawa, April 2018.
- Luo, Y., Ph.D. Thesis Proposal, Department of Mechanical Engineering, University of Ottawa, December 2017.
- Luo, C.M., Ph.D. Thesis, Department of Mechanical Engineering, University of Ottawa, November 2017.
- Yu, W., Ph.D. thesis, Department of Mechanical and Materials Engineering, Queen's University, June 2017.
- Huang, H., Ph.D. thesis, Department of Mechanical Engineering, University of Ottawa, November, 2016.
- Adepegba, A.A., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, April 2016.
- Shi, J.J., Ph.D. thesis, Department of Mechanical Engineering, University of Ottawa, November, 2015.
- Guan, Y.P., Ph.D. Thesis Proposal, Department of Mechanical Engineering, University of Ottawa, October 2015.
- Ezeanochie, T., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, August 2015.
- Le, X.Q., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, June 2015.
- Sheikhi, F., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, April 2014.
- Aniagyei-Mensah, G., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, February 2014.
- Alfaify, A.Y., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, February 2014.

- Luo, C.M., Ph.D. Thesis Proposal, Department of Mechanical Engineering, University of Ottawa, January 2014.
- Mohammed, M., Ph.D. thesis, Department of Mechanical Engineering, University of Ottawa, March 2013.
- Luo, C.M., Ph.D. Comprehensive Exam (Courses), Department of Mechanical Engineering, University of Ottawa, December 2012.
- McBain, J., Ph.D. Thesis, Department of Mechanical Engineering, Laurentian University, July 2012.
- Jahandideh, S., M.A.Sc. Thesis, Department of Mechanical Engineering, University of Ottawa, December 2011.

PROFESSIONAL ACTIVITIES

(i) Professional Societies and Networks

- Editor-in-Chief, Journal of Prognostics and Health Management, 2021
- EInterim VP of IEEE Reliability Society, 2019
- Fellow of IET, since 2018
- Member of IEEE Reliability Society Administrative Committee, 2018-2019
- Associate Editor, IEEE Transactions on Reliability, 2016-2020
- Guest Editor, Special Column on "PHM with Aerospace Applications", Chinese Journal of Aeronautics (Elsevier), 2016
- Editorial Board Member of Journal of Electronic Measurement and Instrument (China), since 2015
- IEEE Senior Member, since 2013
- Editorial Board Member of Chinese Journal of Aeronautics (Elsevier), since 2013
- Professional Engineer, Ontario, since 2011

(ii) Conference Organization

- Honorary General Chair, 2023 Prognostics and Health Management Conference (PHM 2023 Paris), Paris, France, May 2023
- Honorary General Chair, 2022 Prognostics and Health Management Conference (PHM 2022 London), London, UK, May 2022
- Honorary General Chair, Prognostics and Health Management Conference (PHM 2020 Besancon), Besancon, France, May 2020
- Honorary General Chair, International Conference on Sensing, Diagnostics, Prognostics, and Control (SDPC 2020), Beijing, China, August 2020
- Honorary General Chair, International Conference on Prognostics and System Health Management Conference (PHM 2020 Jinan), Jinan, China, October 2020

- General Chair, Prognostics and Health Management Conference (PHM 2019 Paris), Paris, France, May 2019
- General Chair, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2019), San Francisco, California, USA, June 2019
- Honorary General Chair, International Conference on Sensing, Diagnostics, Prognostics, and Control (SDPC 2019), Beijing, China, August 2019
- General Chair, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2018), Seattle, Washington, USA, June 2018
- Honorary General Chair, International Conference on Sensing, Diagnostics, Prognostics, and Control (SDPC 2018), Xi'an, China, August 2018
- General Chair, Prognostics and System Health Management Conference (PHM 2018 Chongqing), Chongqing, China, October 2018
- Program Chair, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2017), Dallas, Texas, USA, June 2017
- General Chair, International Conference on Sensing, Diagnostics, Prognostics, and Control (SDPC 2017), Shanghai, China, August 2017
- Arrangements Chair and Local Host, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2016), Ottawa, Ontario, Canada, June 2016
- Tutorials Chair, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2015), Austin, Texas, USA, June 2015
- Paper Review Chair, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2014), Spokane, Washington, USA, June 2014
- Panel Chair, PHM Software, Logic, and Reasoning, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2013), Gaithersburg, Maryland, USA, June 2013
- Panel Chair, PHM Software, Logic, and Reasoning, IEEE International Conference on Prognostics and Health Management (IEEE PHM 2012), Denver, Colorado, USA, June 2012

(iii) Reviewer for Grant Applications

- NSERC Canada Research Chair: 2015
- NSERC Discovery Grant Projects: 2012 (2), 2014 (1), 2017(1), 2018 (1)
- NSERC Collaborative Research and Development Grant Projects: 2013 (2)
- Killam Research Fellowship: 2013
- Mitacs Accelerate Grant: 2016 (1), 2017 (1), 2021 (1), 2022 (1)
- NSERC Alliance Grant: 2022 (1), 2023 (1)

(iv) Reviewer for Journals

- Journal of Power Sources
- Energy & Environmental Science
- Energy
- Applied Energy
- International Journal of Energy Research

- IEEE Transactions on Reliability
- Mechanical Systems and Signal Processing
- Journal of Sound and Vibration
- Journal of Vibration and Control
- Measurement Science and Technology **(Recognized as one of Outstanding Reviewers in 2018)**
- ASME Journal of Vibration and Acoustics
- IEEE Transactions on Instrumentation and Measurement
- IEEE Transactions on Industrial Electronics
- IEEE Transactions on Automation Science and Engineering
- International Journal of Green Energy
- Engineering Failure Analysis
- ASME Journal of Computing and Information Science in Engineering (Associate Editor for a Special issue on Digitalization and Automation of Energy Systems)

(v) Awards and Honors

- IEEE Ottawa Section Outstanding Service Award (2017)
- Carleton University Research Achievement Award (RAA) (2017)
- France-Canada Research Fund (FCRF) Award (2013-2015)
- NSERC Postdoctoral Fellowship (PDF) (2008-2010)
- NSERC Postgraduate Scholarship (PGS-D3) (2005-2008)
- Governor General's Gold (GGG) Medal, Lakehead University (2005)
- Ontario Graduate Scholarship (OGS) (Declined) (2005-2006)
- University of Waterloo "Teaching Assistant Excellence Award" (2008)
- University of Waterloo "Graduate Scholarship" (2007)
- University of Waterloo "President's Graduate Scholarship" (2005-2008)
- University of Waterloo "Faculty of Engineering Graduate Scholarship" (2006-2008)
- Lakehead University "High Output and Performance Excellence" (HOPE) Award (2005)

CURRICULUM VITAE

SHICHAO LIU, Ph.D., P.Eng., SMIEEE, Associate Professor

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E-mail: shichaoliu@cunet.carleton.ca • Phone: 1-613-979-0618

EDUCATION

Ph.D in Electrical and Computer Engineering **September 2010~September 2014**

- **Department of Systems and Computer Engineering, Carleton University, Ottawa, Ontario, Canada**
- Thesis: A Gain Scheduling Approach to the Load Frequency Control in Smart Grids

M.S. in Control Theory and Control Engineering **September 2007~March 2010**

- College of Automation, Harbin Engineering University, Harbin, Heilongjiang, China
- Thesis: Stability and Stabilization of Networked Control Systems with Unreliable Communication

B.Eng. in Mechanic and Electronic Automation **September 2003~July 2007**

- College of Mechanic and Electric Engineering, Harbin Engineering University, Heilongjiang, China

EMPLOYMENT EXPERIENCE

- **Associate Professor, Carleton University**, Ottawa, Canada **2023-July~ Present**
- **Assistant Professor, Carleton University**, Ottawa, Canada **2018-August~ 2023-June**
- **Associate Professor, Beijing Jiaotong University**, Beijing, China **2016-October~ 2018-July**
- **Postdoctoral Fellow, Carleton University**, Ottawa, Canada **2014-September~ 2016 September**

RESEARCH INTERESTS

- Cyber-Physical Security of Industrial Control Systems and Applications in Microgrids
- Distributed Control and Estimation for Microgrids with Renewables
- Deep Reinforcement Learning based Control and Demand Response for Building Microgrids
- Deep Learning based Non-Intrusive Load Monitoring

RESEARCH GRANTS

- Canada-Japan Aging in Place Grant, 2023-2026, NRC, **Co-PI, $360K/$2.3 Millions**
- CFI John R. Evans Leaders Fund (JELF), 2022-2025, CFI, **PI, $150K**
- NSERC Discovery Grant, 2019-2026 (extended 2 years with funds), NSERC, **PI, $200K**
- NSERC Early Career Research Supplement, 2019-2020, NSERC, **PI, $12.5K**
- NSERC-FRQNT NOVA Program, 2022-2024, NSERC-FRQNT, **Co-PI, $35K/$220K**
- NSERC Alliance, 2022-2023, **Co-PI, $10K/$35K**
- Carleton Multidisciplinary research catalyst (MRCF) fund, 2019-2023, **Co-PI, $5K/$20K**
- Carleton Start-up Fund, 2019-Present, **PI, $30K**

PUBLICATIONS

❖ Books Edited

[1] Wenchao Meng, Xiaoyu Wang, and **Shichao Liu**. **Distributed Control Methods and Cyber Security Issues in Microgrids**. **Elsevier**, March 2020.

❖ Chapters in Edited Books

[1] **Shichao Liu,** and Xiaoyu Wang, **Analysis and Compensation of Multiple PMU Data Delays for Frequency Control in Islanded Microgrids**, Monitoring and Control using Synchrophasors in Power Systems with Renewables (Editors: Innocent Kamwa and Chao Lu), **IET Press**, pp. 358-377, March 2020.

[2] Zhijian Hu, Rong Su**, Shichao Liu,** Zeyuan Xu, and Kai Zhang, **Cyberattack-Resilient Control in Multi-Area Power Generation**, Power Systems Cybersecurity: Methods, Concepts, and Best Practices (Editors: Hassan Haes Alhelou, Nikos Hatziargyriou, and Zhaoyang Dong), **Springer**, pp. 1-19, July 2022.

❖ Papers in Refereed Journals (*: denoting supervised students at Carleton; ♦: denoting hosted visiting research students at Carleton)

[46] Pengcheng Chen*, **Shichao Liu**, Xiaozhe Wang, Innocent Kamwa, Physics-Guided Multi-Agent Deep Reinforcement Learning for Robust Active Voltage Control in Electrical Distribution Systems, **IEEE Transactions on Circuits and Systems I: Regular Papers (Impact Factor: 5.1),** vol. 71, no. 2, pp. 922-933, Feb, 2024.

[45] Osarodion E. Egbomwan*, Hicham Chaoui, **Shichao Liu**, A Physics-Constrained TD3 Algorithm for Simultaneous Virtual Inertia and Damping Control of Grid-Connected Variable Speed DFIG Wind Turbines, **IEEE Transactions on Automation Science and Engieering (Impact Factor: 5.6**), DOI: 10.1109/TASE.2024.3357204, pp. 1-12, Feb 2024

[44] Tongxiang Li, Bo Chen, **Shichao Liu**, Zheming Wang, Wen-An Zhang, and Li Yu, Fast Attack Detection for Cyber–Physical Systems Using Dynamic Data Encryption, **IEEE Transactions on Cybernetics (Impact Factor: 11.8)**, DOI: 10.1109/TCYB.2023.3332079, pp. 1-14, Dec 2023.

[43] Yang Li♦, **Shichao Liu**, Li Zhu, and Bo Chen, A neural fictitious self-play anti-jamming strategy for secondary frequency control in microgrids with imperfect observations, **International Journal of Robust and Nonlinear Control (Impact Factor: 3.9)**, DOI: 10.1002/rnc.6928, pp. 1-16, July 2023

[42] Pengcheng Chen*, **Shichao Liu**, Xiaozhe Wang, Innocent Kamwa, Physics-Shielded Multi-Agent Deep Reinforcement Learning for Safe Active Voltage Control with Photovoltaic/Battery Energy Storage Systems, **IEEE Transactions on Smart Grid (Impact Factor: 10.275),** vol. 14, no. 4, pp. 2656-2667, July, 2023.

[41] Osarodion E. Egbomwan*, **Shichao Liu**, Hicham Chaoui, Twin Delayed Deep Deterministic Policy Gradient (TD3) Based Virtual Inertia Control for Inverter-Interfacing DGs in Microgrids, IEEE Systems Journal (Impact Factor: 4.802), vol. 17, no. 2, pp. 2122-2132, June, 2023.

[40] Pindi Weng, Bo Chen, **Shichao Liu**, Li Yu, Secure nonlinear fusion estimation for cyber–physical systems under FDI attacks, **Automatica**, vol. 148, 110759, 1-9, Feb, 2023.

[39] **Shichao Liu**, Ligang Wu, Jose Leon, and Bo Chen, Guest Editorial: Machine Learning for Secure Cyber-Physical Industrial Control Systems, **IET Cyber-Physical Systems: Theory and Applications (Impact Factor: 1.5)**, vol 7, no. 1, pp. 1-3, March 2022

[38] Shiqing Weng, Pindi Weng, Bo Chen, **Shichao Liu**, and Li Yu, Distributed Secure Estimation Against Unknown FDI Attacks and Load Deviation in Multi-Area Power Systems, **IEEE Transactions on Circuits and Systems II: Express Briefs (Impact Factor: 3.619)**, vol. 69, no. 6, pp. 3007-3011, June, 2022.

[37] Qingyang Li*, Yang Li♦, **Shichao Liu**, Xiaozhe Wang, and Hicham Chaoui, Incomplete Information Stochastic Game Theoretic Vulnerability Management for Wide-Area Damping Control against Cyber Attacks, **IEEE Journal on Emerging and Selected Topics in Circuits and Systems (Impact Factor: 5.877),** vol 12, no. 1. pp. 124-134, March 2022

[36] Pengcheng Chen*, **Shichao Liu**, Bo Chen, and Li Yu, Multi-Agent Reinforcement Learning for Decentralized Resilient Secondary Control of Energy Storage Systems against DoS Attacks, **IEEE Transactions on Smart Grid (Impact Factor: 10.275),** vol. 13, no. 3, pp. 1739-1750, May 2022

[35] Pengcheng Chen*, **Shichao Liu**, Dan Zhang, and Li Yu, Adaptive Event-Triggered Decentralized Dynamic Output Feedback Control for Load Frequency Regulation of Power Systems with Communication Delays, **IEEE Transactions on Systems, Man, and Cybernetics: Systems (Impact Factor: 11.471),** Early Access, Online, December 2021

[34] Zhijian Hu♦, **Shichao Liu**, Wensheng Luo, and Ligang Wu, Intrusion-Detector-Dependent Distributed Economic Model Predictive Control for Load Frequency Regulation With PEVs Under Cyber Attacks, **IEEE**

Transactions on Circuits and Systems I: Regular Papers (Impact Factor: 4.140), pp. 3857-3868, vol. 68, no. 9, Sept. 2021

[33] Zhijian Hu♦, **Shichao Liu**, and Ligang Wu, Credibility-Based Distributed Frequency Estimation for Plug-in Electric Vehicles Participating in Load Frequency Control, **International Journal of Electrical Power and Energy Systems (Impact Factor: 5.659)**, vol. 130, 106997, Online Early Access, April 2021

[32] Pengcheng Chen♦, **Shichao Liu**, Dan Zhang, and Li Yu, A Deep Asynchronous Actor-Critic Learning based Event-Triggered Decentralized Load Frequency Control of Power Systems with Communication Delays, **International Journal of Robust and Nonlinear Control (Impact Factor: 3.897)**, vol, 32, pp. 3039-3061.

[31] **Shichao Liu**, Qingyang Li*, and Bo Chen, Game Theoretic Vulnerability Management for Secondary Frequency Control of Islanded Microgrids against False Data Injection Attacks, **IET Cyber-Physical Systems: Theory and Applications (Impact Factor: 1.5)**, vol. 7, no. 1, pp. 4-15, March 2022

[30] Rishil Kirankumar Lakhe, Hicham Chaoui, Mohamad Alzayed, and **Shichao Liu**, Universal Control of Permanent Magnet Synchronous Motors with Uncertain Dynamics, **Actuators (Impact Factor: 2.532)**, 2021, 10(3), 49: 1-19, March 2021.

[29] **Shichao Liu**, Ilias Zenelis, Yang Li♦, Xiaozhe Wang, Qingyang Li*****, and Li Zhu, Markov Game for Securing Wide-Area Damping Control against False Data Injection Attacks, **IEEE System Journal (Impact Factor: 4.802)**, vol. 15, no. 1, pp. 1356-1365, March 2021.

[28] Jiayu Shi♦, **Shichao Liu**, Bo Chen, and Li Yu, Distributed Data-Driven Intrusion Detection for Sparse Stealthy FDI Attacks in Smart Grids, **IEEE Transactions on Circuits and Systems II: Express Briefs (Impact Factor: 3.619)**, vol. 68, no. 3, pp. 993-997, March 2021.

[27] Yang Li♦, Li Zhu, Hongwei Wang, Fei Richard Yu, and **Shichao Liu**, A Cross-Layer Defense Scheme for Edge Intelligence-Enabled CBTC Systems Against MitM Attacks, **IEEE Transactions on Intelligent Transportation Systems (Impact Factor: 9.551)**, vol. 22, no. 4, pp. 2286-2298, April 2021.

[26] Qiangqiang Cheng, Yiqi Yan, **Shichao Liu**, Chunsheng Yang, Hicham Chaoui, and Mohamad Alzayed, Particle Filter-Based Electricity Load Prediction for Grid-Connected Microgrid Day-Ahead Scheduling, **Energies (Impact Factor: 3.252)**, 2020, 13(24), 6489: 1-15, December 2020.

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❖ Papers in Refereed Conference Proceedings(*: denoting supervised students at Carleton; ♦: denoting hosted visiting research students at Carleton)

[1] Pengcheng Chen*, Hicham Chaoui, Shichao Liu, An Adaptive Event-Triggered Distributed PID Control for State of Charge Balancing of Multiple Batteries Based Electric Vehicles, 2022 IEEE Electrical Power and Energy Conference, 5-7 Decemeber 2022, Victoria, BC, Canada

[2] Mohammed Ashraf*, Sima, Hamedifar*, Shichao Liu, Chunsheng Yang, "Multi-Agent Reinforcement Learning based User-Centric Demand Response with Non-Intrusive Load Monitoring", to be presented, 1st International Conference on Artificial Intelligence Security and Privacy, Guangzhou, China, 8-10 Dec 2023

[3] Abdulazeez Muhammad Abba, Hicham Chaoui, Shichao Liu, Design Optimization of Hybrid Battery Based Gensets, 2022 IEEE Electrical Power and Energy Conference, 5-7 Decemeber 2022, Victoria, BC, Canada

[4] Alanoud Alrasheedi*, Osarodion E. Egbomwan, Shichao Liu, Nowayer Alrashidi, Vulnerability Assessment of Machine Learning Based Short-Term Residential Load Forecast against Cyber Attacks on Smart Meters, 2022 IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (SmartGridComm), 25-28 October 2022, Singapore.

[5] Osarodion E. Egbomwan*, Hicham Chaoui, and **Shichao Liu**, Power Delivery Capability Improvement of Voltage Source Converters in Weak Power Grid Using Deep Reinforcement Learning with Continuous Action, 31st International Symposium on Industrial Electronics (ISIE), 1-3 June 2022, Anchorage, Alaska, USA

[6] Nahal Iliaee*, **Shichao Liu**, Wei Shi, Non-Intrusive Load Monitoring based Demand Prediction for Smart Meter Attack Detection, 2021 International Conference on Control, Automation and Information Sciences (ICCAIS), 14-17 Oct. 2021, Xi'an, China

[7] Qingyang Li*, **Shichao Liu**, and Hicham Chaoui, A Q-Learning Based Model-Free Wide-Area Damping Control under Random PMU Delays, 30th International Symposium on Industrial Electronics (ISIE), 20-23 June 2021, Kyoto, Japan

[8] Pengcheng Chen*, **Shichao Liu,** and Dan Zhang**,** A Q-Learning Based Dynamic Event-Triggered Control for Load Frequency Regulation of Power Systems with Denial-of-Service Attacks, 30th International Symposium on Industrial Electronics (ISIE), 20-23 June 2021, Kyoto, Japan

[9] Rahul Kosuru*, **Shichao Liu**, and Hicham Chaoui, Reinforcement Learning based Energy Management System for a PV and Battery Connected Microgrid System, 30th International Symposium on Industrial Electronics (ISIE), 20-23 June 2021, Kyoto, Japan

[10] Rahul Kosuru*, Pengcheng Chen, and **Shichao Liu,** A Reinforcement Learning Based Power System Stabilizer for a Grid Connected Wind Energy Conversion System, IEEE EPEC, 2020-November

[11] **Shichao Liu**, Rahul Kosuru* and Chuma Francis Mugombozi, A Moving Target Approach for Securing Secondary Frequency Control in Microgrids, IEEE CCECE, London, Ontario, 2020 August

[12] **Shichao Liu** and Xiaoyu Wang, Analysis of Frequency Control in Microgrids with Multiple Phasor Measurement Unit Delays, 7th Workshop on Modeling and Simulation of Cyber-Physical Energy Systems (MSCPES), April 2019, Montreal.

[13] Nikolay Radimov, **Shichao Liu** and Xiaoyu Wang, Extended Modulus Optimum Method for Off-Grid Inverter's Voltage Control System, 2019 IEEE CCECE, Edmonton, Canada, May 2019.

[14] Yiyuan Ding, **Shichao Liu,** Xiaoyu Wang and Zhijun Wang, Optimal Energy Management Scheme for Single-Phase Nanogrid, IEEE PES General Meeting, accepted and to be presented, Atlanta, US, August 2019
[15] **Shichao Liu**, Haikuo, Shen, Huanqing, Wang, Peter Liu, Investigation of distribution system scheduling with photovoltaic power and load variations, 2017 IEEE SMC, Banff, Canada, October 2017.
[16] **Shichao Liu**, Peter X. Liu, and Xiaoyu Wang, H∞ control of networked control systems with measurement losses, 2016 IEEE International Conference on Information and Automation, Ningbo, P. R. China, 2016.07.31-08.04
[17] **Shichao Liu**, Peter X. Liu, and A. El Saddik, Denial-of-Service (DoS) attacks on load frequency control in smart grids, 2013 IEEE PES Innovative Smart Grid Technologies (ISGT), Washington D.C, America, 2013, pp. 1-6.
[18] **Shichao Liu**, Peter X. Liu, and A. El Saddik, A stochastic security game for Kalman filtering in networked control systems (NCSs) under Denial of Service (DoS) attacks (invited paper), 2013 IFAC International Conference on Intelligent Control and Automation Science (ICONS), Chengdu, China, 2013, pp. 1-6
[19] **Shichao Liu**, Peter X. Liu, and A. El Saddik, Load frequency control for wide area monitoring and control system (WAMC) in power system with open communication links, 2012 IEEE Power Engineering and Automation Conference (PEAM), China, 18-20 Sept. 2012, pp. 1-5
[20] **Shichao Liu**, Peter X. Liu, and A. El Saddik, ``Modeling and dynamic gain scheduling for networked systems with bounded packet losses," 2011 IEEE International Workshop on Measurements and Networking Proceedings, Italy, 2011, pp. 135-139.
[21] Jian Xiong, **Shichao Liu**, and Xiaoyu Wang, ``A stability enhancement method for inverter-based distributed generation systems", presented in 2015 IEEE PES General Meeting, Denver, America
[22] Jian Xiong, Di Wu, Haibo Zeng, **Shichao Liu** and Xiaoyu Wang, ``Impact Assessment of Electric Vehicle Charging on Hydro Ottawa Distribution Networks at Neighborhood Levels ", presented in 2015 IEEE CCECE, Halifax, Canada
[23] Xinran Zhang, **Shichao Liu**, Wes Kwasnicki, Yu Cui, Xiaoyu Wang, Chao Lu, ``Wide-area HVDC damping controller design in Alberta power grid," 2014 CIGRÉ Canada Conference, Toronto, Canada, September 2014

GRADUATE STUDENT SUPERVISION

❖ Doctoral Thesis Research in Progress

- Sima Hamedifar, PhD Student, “Fuzzy Reinforcement Learning for Energy Management of Smart Home for Aging People”, 2023--Present, Supervisor
- Pencheng Chen, PhD Student, “Multi-Agent Reinforcement Learning for Microgrid Control and Operation”, 2021--Present, Supervisor
- Qingyang Li, PhD student, “Deep Reinforcement Learning based Wide Area Damping Control under Cyber Uncertainties” *(Thesis Proposal Completed*), 2020--Present, Supervisor
- Rahul Kosuru, PhD student, “Deep Reinforcement Learning based Resilient Wind Farm Control Systems”, 2020--Present, Supervisor
- Osarodion Egbomwan, PhD student, “Deep Reinforcement Learning based Virtual Inertia Control for Microgrids with Renewables”, 2020--Present, Co-supervisor (Supervisor: Prof. Hicham Chaoui)
- Emad, Elhaji, PhD student, “Learning based Model Predictive Control for Power Systems with Renewables”, 2022--Present, Co-supervisor (Supervisor: Prof. Hicham Chaoui)

❖ Master’s Thesis Research in Progress

- Nowayer Alrashidi, M.A.Sc, “Deep Learning Based Monitoring of Smart Home for Aging People”, 2023—Present, Supervisor,

- Kunal Vora, M.A.Sc, “Analysis and Control of Bifacial Photovoltaic Systems”, 2022--Present, Supervisor

❖ Master’s Thesis Research Completed

- Leo Zhao, M.A.Sc, “Memristor based Robust Control for EDFAs”, September 2021—Jan. 2024, Supervisor.
- Ashraf Mohammed, M.A.Sc, “Learning based Non-Intrusive Load Monitoring for Demand Response”, September 2021—September 2023, Supervisor
- Nahal Illiee, M.A.Sc, “Non-Intrusive Load Monitoring Based User-Centric Demand Response for Smart Home Energy Management”, August 2020--April 2022, Supervisor.
  Current Position: Risk Control Analyst at Brookfield Renewable
- Alanoud, Alrasheedi, M.A.Sc, “Vulnerability Assessment of Machine Learning Based Short-Term Residential Load Forecast against Cyber Attacks on Smart Meters”, August 2020-September 2022 , Supervisor.

❖ Visiting Research Students

- Yang Li, PhD Thesis in Progress, Beijing Jiaotong University, Funded by China Scholarship Council (CSC), May 2022--August 2023
  My role: Supervising research on Microgrid Cyber-Physical Security
- Zhijian Hu, PhD Thesis Completed, Harbin Institute of Technology (HIT), Funded by China Scholarship Council (CSC), August 2019--November 2020
  My role: Supervising research on Distributed Resilient Control.
- Pencheng Chen, M.A.Sc, Zhejiang University of Technology, Funded by Zhejiang University of Technology, August 2019--November 2019
  My role: Supervising research on Cyber-Physical Resilient Load Frequency Control.
- Jiayu Shi, M.A.Sc, Zhejiang University of Technology, Funded by Zhejiang University of Technology, August 2019--November 2019
  My role: Supervising research on Distributed Optimal Power Flow.

HONORS AND AWARDS

- 2023: Research Achievement Award, Faculty of Engineering and Design, Carleton
- 2022: Best Conference Paper Runner-up Award, EPEC 2022, IEEE Canada
- 2022: Faculty Graduate Mentoring Award Nomination, Carleton
- 2021: Recognition Award, IEEE Industrial Electronics Society (IES), 30th International Symposium on Industrial Electronics (ISIE2021), 20-23 June 2021, Kyoto, Japan.

PROFESSIONAL and SCHOLARLY ACTIVITIES

- **IEEE Senior Member**, 2020-July-Present
- **Member** of IEEE IES Technical Committee on Resilience and Security for Industrial Applications.
- **Associate Editor,** ***IEEE Trans. Industrial Cyber-Physical Systems***, Jan-2023-Present
- **Associate Editor**, ***IEEE Access***, May-2017—Present
- **Associate Editor,** ***IET Cyber-Physical Systems: Theory and Applications***, November-2020
- **Editorial Board Member,** ***Smart Cities***, Jan-2019--Present
- **Associate Editor,** ***Frontiers in Control Engineering***, August-2022--Present

- **Topic Editor**, *Actuators*, March-2021--Present
- **Topic Editor**, *Energies*, March-2021--Present
- **Finance Chair** of 2022 IEEE Electrical Power and Energy Conference (EPEC), Virtual, 05-07 December 2022.
- **TPC Member** of 13th IEEE International Conference on Smart Grid Communications, Control, and Computing Technologies for Smart Grids (SmartGridComm 2022),, In-Person and Virtual, 25-28 October 2022, Singapore.
- **Chair,** Special Session on Learning based Monitoring and Control of Industrial Cyber-Physical Systems in 31st International Symposium on Industrial Electronics (ISIE), 1-3 June 2022, Anchorage, USA.
- **Chair,** Special Session on Communication, Computing, Networking and Control of Cyber-Physical Systems in 30th International Symposium on Industrial Electronics (ISIE), 20-23 June 2021, Kyoto, Japan.

Engineering Curriculum Vitae

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November 2023

Work Experience

Lecturer II, Department of Systems and Computer Engineering, Carleton University, Ottawa: July 2021 to April 2023

May 2023-October 2023

This Fall I taught two sections of ECOR 1041 in early Fall, and I am now teaching two additional sections of ECOR 1041 in late Fall.

I am supervising a total of twelve fourth-year capstone projects: nine solo, and three co-supervised (two with Safaa Bedawi, and one with Cristina Ruiz Martin), for a total of 52 students.

May 2022-April 2023

I taught four courses. The results were above average for SYSC 2004 (two Winter sections) and Fall term's SYSC 2006, but slightly below average for SYSC 2310. Given that it was my first time teaching the course, there is room for improvement. I also presented "Collaborative Indigenous Learning Bundle 1: The First Peoples: A Brief Overview" to each of the three ECOR 1055 sections in the Fall term.

I supervised a total of eight fourth-year projects: five solo, and three co-supervised (two with Cristina Ruiz Martin, and one with Yuu Ono), for a total of 26 students. My administrative duty in the department was Computer Science Board Representative.

In July 2022, I was elected to Carleton's Senate for three years. The monthly readings and meetings have been a wonderful opportunity to learn more about Carleton University and to see the huge amount of work done by the leaders to keep the University running smoothly.

In Fall 2022 I became the CUASA representative on OCUFA (Ontario Confederation of University Faculty Association)'s Contract Faculty Committee. The monthly meetings cover updates from across Ontario and show that contract instructors are treated very differently across the institutions.

I volunteered with Girls System Mentorship Program, meeting weekly with a Grade 11 student from September to April, and with a Grade 10 student from January to April.

The courses taught were:

SYSC 2004: Object-Oriented Software Development
SYSC 2006: Foundations of Imperative Programming
SYSC 2310: Introduction to Digital Systems

The full list of courses taught as an Instructor is on page 6 of this resume.

The fourth-year project titles supervised 2022-2023:
#6 Come & Chat: Web-Based Instant Messaging System (3 students)
#24 Employee Management System (2 students)
#25 A Web Application for Online Elementary School (4 students)
#29 JobMate: Django based WebApp for Career Enhancements (3 students)
#30 QuizMI: A Web Application for Educational Quizzes (2 students: co-supervised with Cristina Ruiz Martin)
#44 Ground Vibration Simulator for Investigating Vibration Effects on the Development of Turtle Eggs (5 students: co-supervised with Yuu Ono)
#60 EZGrid: Electricity Monitoring Web Application (3 students)
#63 Multi-Variable Sports Scheduler (4 students: co-supervised with Cristina Ruiz Martin)

July 2021-April 2022

I taught four courses, with above average evaluations. In addition, I supervised three fourth-year projects, and co-supervised (with Cristina Ruiz Martin) one fourth-year project, for a total of 15 students. My administrative duties in the department are Library Representative and Computer Science Board Representative.

The courses taught were:

SYSC 2004: Object-Oriented Software Development
SYSC 2006: Foundations of Imperative Programming

The full list of courses taught as an instructor is on page 6 of this resume.

The fourth-year project titles supervised 2021-2022:
#15 Development of Software to Generate Teams for Project-Based Labs (2 students): co-supervised
#47 An Intelligent AI Chatbot in a Web-Based E-Commerce Platform (5 students)
#53 Text to Speech, Speech to Text, and Chat Bot Applications (4 students)
#67 Smart Refrigerator Application (4 students)

I also took several Carleton TLS courses:
Course Design Fundamentals (October 2021 to January 2022)
Student Support Certificate (October 2021 to February 2022)
Kinàmàgawin Indigenous Learning Certificate (January to April, 2022)
Certificate of University Teaching (January to April, 2022)

Sessional Lecturer, Department of Systems and Computer Engineering, Carleton University, Ottawa: September 2001 to June 2021

I taught six courses each calendar year. The courses ranged from first to third year undergraduate courses and have a software engineering focus. The courses I have taught are:
ECOR 1041: Computation and Programming
ECOR 1042: Data Management
ECOR 1051: Fundamentals of Engineering I
ECOR 1606: Problem Solving and Computers
ECOR 2606: Numerical Methods
SYSC 2001: Computer Systems Foundations
SYSC 2002: Data Structures and Algorithms
SYSC 2004: Object-Oriented Software Development
SYSC 2006: Foundations of Imperative Programming
SYSC 3303: Real-Time Concurrent Systems
SYSC 3310: Introduction to Real-Time Systems

The full list of courses is on pages 6 to 10 of this resume.

Nortel Networks / Northern Telecom / BNR (Bell-Northern Research)
December 1989 to April 2001

2000-2001
In May 2000, I became the Senior Project Manager for the Verification of two large DMS (Digital Multiplex Switch) Platform projects, the XA (eXtended Architecture)-Core (multi-processing DMS switch) and Spectrum (a DMS peripheral). This position involved planning, budget, lab management, and test strategy for approximately fifty testers. In addition, I retained the position I started in 1999, as the director group's Human Resources and Employee Satisfaction prime (approximately 100 employees). As the ESAT (Employee SATisfaction) prime I chaired weekly meetings with representatives from all departments. I also co-ordinated and primed all compensation and evaluation activities with the management team.

1993-2000
In 1993, I joined Nortel's DMS (Digital Multiplex Switch) Evolution program and was involved in the final stages of the software decoupling activities and creation of the DMS Platform layers in 1993-4. DMS Evolution was a two-year initiative undertaken to restructure the 25MLOC DMS Software into layers to make it easier to maintain and deliver.

From 1995 to 1997, I was the Shared Library Architect, managing the evolution of the DMS Shared Library, which contains product-level software shared among the DMS Products. From 1996 to 1998, I was the Telecom Layer Architect, managing the Telecom Layer architecture and evolution. The Telecom Layer is the top layer of the DMS Platform, shared by all DMS Products.

In 1997, I was promoted to manager of the DMS Platform Environment and Architecture group. For the first year, I held a dual management and technical role. I built the group up from two to

eight people, which included the incorporation of the Platform Environment group with the Architecture team. The Platform Environment group is responsible for stream management, change propagation management, and the NUC (Non-Upwards Compatible) change processes and tools.

In early 1998, the KVEST program (Kernel VErification and Specification Technology) was incorporated in the department. This program involves one person in Ottawa and twenty Russian contractors working on state-of-the-art research and development in the application of Formal Methods to automated test case generation.

Over the course of 1998, I had four different managers but continued building a cohesive team with little attrition. The team was hit hard during the DMS re-structuring at the end of 1998 (as the focus was on infrastructure), and two of the eight team members were laid off.

In 1999, we were able to overcome the low morale and rebuild the team, growing to ten by mid-year. With the addition of the Test Engineering group to our department, we then grew to fifteen by year-end. On the 1999 Employee Opinion Survey, our department had the highest Q12 score (indicative of those areas of employee satisfaction within manager control) in the director group and one of the highest in the Vice-President group. We also had the lowest attrition rate in our director group.

Due to the management de-layering exercise in DMS at the end of 1998, I started reporting to a director (rather than a senior manager). I also took over as prime for all Human Resource functions for the director group in 1999.

1989 to 1993

From 1989 to 1993, I worked in BNR's Computing Research Laboratory. I primed several projects studying the use of Formal Methods and CASE tools at BNR. The largest and most successful project was the formalizing of OSI Network Management standards using VDM (the Vienna Development Method). I also helped develop Object-Oriented Analysis and Design courses for BNR.

Université Catholique de Louvain: 1987-1988

From 1987 to 1988, I worked as a Research Associate in the Unité d'Informatique (Compute Science Department) at the Université Catholique de Louvain in Belgium. I worked on an ESPRIT (European Community Sponsored) project, REPLAY, which examined the feasibility of reusing existing software development plans to semi-automate ("replay") the development process. I experimented with the B Tool, a theorem prover, and with VDM. I was also a member of the VDM-Europe group and was the Program Committee Chairman for VDM'88. I am currently a member of FME (Formal Methods Europe).

In 1988-1989, I spent a year travelling, mainly in Australia and Asia. During that time, I gave seminars at the University of Queensland and at the Acedemia Sinica in Beijing.

Education

Ph.D.: 1983-1986

I received my Ph.D. in Computer Science from the University of Manchester in 1986, after three years of study under the supervision of Prof. Cliff B. Jones. The Ph.D. program was research only (i.e. I did not take any courses as part of this degree). My research involved the study of formal description techniques, especially VDM. During my first year, I investigated the use of VDM for formalizing computer graphics concepts. My final two years and Ph.D. thesis involved the development of a formal description language suitable for interactive systems, with emphasis on the user interface. This language is a combination of a subset of Statecharts and VDM.

B.Math.: 1978-1983

I received my B.Math (Honours Cooperative Computer Science) from the University of Waterloo in 1983. I graduated on the Dean's Honours List with an overall average of 94% (second highest in the faculty), and received a Commonwealth Scholarship to pursue my Ph.D. in Manchester. I also received the Female Athlete of the Year award in my graduating year for my performance in Varsity Swimming (1 gold and 2 silver medals at the CIAU [Canadian Intercollegiate Athletic Union] championships).

Publications

1. Teaching in the Dark. Lynn Marshall, chapter in *Courage, Curiosity, Teapots and Snakes: Stories of Teaching at Carleton University* https://carleton.ca/teachinglearning/courage-curiosity-teapots-and-snakes-stories-of-teaching-at-carleton-university/, Carleton University, February 2019.
2. Telecom Layer Architecture Initiatives. Jeff Cheevers, Mohamed Boraie, Lynn S. Marshall, Bernard McPhail, Beth Trobridge, *Sixth BNR/Nortel Design Forum Proceedings* (Internal), June 1995.
3. Black Tie Optional: Formal Methods Applied! An OSI Network Management Standards Application. Lynn S. Marshall, *Second BNR/NT Design Forum Proceedings* (Internal), June 1993.
4. *Harmonizing the OSI Management and Control PrT-Petri Net Models for the Specification of Network Management Interfaces*. Colin Ashford, Lynn S. Marshall, and Linda Simon, BNR Internal Report TL930027, March 1993.
5. *Use of Formal Methods in the Specification of the Behaviour of Managed Objects*. Colin Ashford and Lynn S. Marshall, BNR Internal Report TL930013, February 1993.
6. Using VDM to Specify Managed Object Relationships. Lynn S. Marshall and Linda Simon, Proceedings of *Formal Description Techniques V (FORTE'92)*, IFIP Transactions C-10, North Holland, 1993.
7. Using VDM to Specify Managed Objects. Linda Simon and Lynn S. Marshall, Proceedings of *Formal Description Techniques IV (FORTE'91)*, Elsevier, 1992.
8. Using VDM within an Object-Oriented Framework. Lynn S. Marshall and Linda Simon, Proceedings of *VDM'91: Formal Software Development Methods*, LNCS 551:619-628, Springer-Verlag, 1991.
9. Overcoming the Hurdles between Phases. John C. Anderson and Lynn S. Marshall, Position Paper accepted at *CASE'90, Fourth International Workshop on Computer-Aided Software Engineering*, December 1990.
10. Formally Describing Interactive Systems. Lynn S. Marshall, Chapter 12 (pp.293-336) in *Case Studies in Systematic Software Development*, Cliff B. Jones and F. C. Shaw, editors. Prentice-Hall International, 1990.
11. A Formal Description of Line Representation on Graphics Devices. Lynn S. Marshall, Chapter 13 (pp.337-364) in *Case Studies in Systematic Software Development*, Cliff B. Jones and F. C. Shaw, editors. Prentice-Hall International, 1990.
12. Proceedings of *VDM'88: VDM-The Way Ahead*. R. Bloomfield, L. Marshall, and R. Jones, editors. LNCS 328, Springer-Verlag, September 1988.
13. *Using VDM and B for Replay* (Final Report). Lynn S. Marshall, UCL, Belgium, September 1988.
14. Formal Specification of a Small Example Based on GKS. D. A. Duce, E. V. C. Fielding, and L. S. Marshall, *ACM Transactions on Computer Graphics*, 7(3): 180-197, July 1988.
15. *Replay Experiments Using VDM and B.* Lynn S. Marshall, UCL, Belgium, Replay Forum, February 1988.
16. *Using B to Replay VDM Proof Obligations*. Lynn S. Marshall, UCL, Belgium, Replay Review, November 1987.
17. *A Formal Description Method for User Interfaces*. Lynn S. Marshall, Ph.D. Thesis and Technical Report UMCS-87-1-2, University of Manchester, November 1986.
18. A Formal Specification of Line Representations on Graphics Devices. Lynn S. Marshall, Proceedings of *TAPSOFT'85*, LNCS 186:129-147, March 1985.
19. *A Formal Specification of Line Representations on Graphics Devices.* Lynn S. Marshall, Transfer Report, University of Manchester, September 1984.

20. *Formal Specification and Graphics Software.* D. A. Duce, E. V. C. Fielding, and Lynn S. Marshall, Transfer Report, University of Manchester and Technical Report RAL-84-068, Rutherford Appleton Laboratory, August 1984.

Courses Taught at Carleton for CUASA: July 2021 to December 2023

ECOR 1041 (0.25 credits; counted as half a course): 4
SYSC 2004: 4
SYSC 2006: 3
SYSC 2310: 1
Total: 10

Detailed List:

Fall 2023:

- ECOR 1041 A
- ECOR 1041 B
- ECOR 1041 F
- ECOR 1041 G

Winter 2023:

- SYSC 2004 C
- SYSC 2004 E

Fall 2022:

- SYSC 2006 B
- SYSC 2310 A

Winter 2022:

- SYSC 2004 C
- SYSC 2004 D

Fall 2021:

- SYSC 2006 B
- SYSC 2006 C

Courses Taught at Carleton for CUPE 4600 Unit 2: September 2001 to June 2021

ECOR 1041 (0.25 credits; counted as half a course): 1
ECOR 1042 (0.25 credits; counted as half a course): 1
ECOR 1051: 2
ECOR 1606: 21
ECOR 2606: 11
SYSC 2001: 1
SYSC 2002: 16
SYSC 2004: 10
SYSC 2006: 6
SYSC 3303: 24
SYSC 3310: 2
Total: 96

Detailed List:

Summer 2021:
- SYSC 2004 A
- SYSC 3310 A

Winter 2021:
- ECOR 1042 D

Fall 2020:
- ECOR 1041 C
- ECOR 1041 F
- ECOR 1042 A
- SYSC 2006 B
- SYSC 2006 C

Summer 2020:
- ECOR 1051 S
- SYSC 3310 A

Winter 2020:
- ECOR 1051 M
- SYSC 2006 C

Fall 2019:
- SYSC 2004 A
- SYSC 2004 B

Summer 2019:
- ECOR 1606 A
- SYSC 3303 A

Winter 2019:
- SYSC 2004 B

Fall 2018:
- ECOR 1606 A
- ECOR 1606 B
- SYSC 2006 B

Summer 2018:
- ECOR 1606 A
- SYSC 2006 A

Winter 2018:
- SYSC 2006 D

Fall 2017:
- ECOR 1606 A
- ECOR 1606 B
- SYSC 2004 A

Summer 2017:
- SYSC 2004 A
- SYSC 3303 A

Winter 2017:
- ECOR 1606 E
- ECOR 1606 F

Fall 2016:

- ECOR 2606 A
- SYSC 3303 A

Summer 2016:

- SYSC 2004 A
- SYSC 3303 A

Winter 2016:

- SYSC 3303 A

Fall 2015:

- ECOR 2606 A
- ECOR 2606 B
- ECOR 2606 C

Summer 2015:

- SYSC 2004 A
- SYSC 3303 A

Winter 2015:

- ECOR 2606 D
- ECOR 2606 E

Fall 2014:

- ECOR 2606 A
- ECOR 2606 B

Summer 2014:

- ECOR 1606 A
- SYSC 3303 A

Winter 2014:

- ECOR 1606 D
- ECOR 1606 E

Fall 2013:

- ECOR 2606 A
- ECOR 2606 C

Summer 2013:

- ECOR 1606 A
- SYSC 3303 A

Winter 2013:

- ECOR 1606 D
- ECOR 1606 E
- ECOR 1606 F

Fall 2012:

- SYSC 2004 A

Summer 2012:

- SYSC 3303 A

Winter 2012:

- ECOR 1606 B
- ECOR 1606 D

Fall 2011:

- ECOR 2606 C

Summer 2011:
- SYSC 3303 A

Winter 2011:
- SYSC 2002 D
- ECOR 1606 C

Fall 2010:
- SYSC 2002 A
- SYSC 2002 B

Summer 2010:
- SYSC 3303 A

Winter 2010:
- SYSC 2002 D

Fall 2009:
- SYSC 2002 B
- ECOR 1606 A

Summer 2009:
- ECOR 1606 A
- SYSC 3303 A

Winter 2009:
- SYSC 2002 D
- ECOR 1606 C

Fall 2008:
- SYSC 2002 A
- SYSC 2002 B

Summer 2008:
- SYSC 3303 A

Winter 2008:
- SYSC 2004 C
- SYSC 3303 A

Fall 2007:
- SYSC 2002 A
- SYSC 2004 A

Summer 2007:
- SYSC 3303 A

Winter 2007:
- SYSC 2002 D

Fall 2006:
- SYSC 2002 A

Summer 2006:
- SYSC 3303 A

Winter 2006:
- none

Fall 2005:
- SYSC 2002 A

Summer 2005:
- SYSC 3303 A

Winter 2005:

- SYSC 3303 A

Fall 2004:

- SYSC 2002 A

Summer 2004:

- SYSC 3303 A

Winter 2004:

- SYSC 3303 B

Fall 2003:

- SYSC 2002 A

Summer 2003:

- SYSC 3303 A

Winter 2003:

- SYSC 3303 B

Fall 2002:

- SYSC 2002 C

Summer 2002:

- SYSC 2002 A (94.202)
- SYSC 3303 A (94.333)

Winter 2002:

- SYSC 3303 A (94.333)

Fall 2001:

- SYSC 2001 B (94.201)

Curriculum Vitae of Ronald E. Miller

PhD, P.Eng., Professor and Chair
Department of Mechanical and Aerospace Engineering, Carleton University
https://scholar.google.ca/citations?user=MA9ZMtkAAAAJ&hl=en

Academic Credentials

- Ph.D., Mechanical Engineering, Brown University, May 1997
- Sc.M. (non-thesis Master's Degree), Mechanical Engineering, Brown University, May 1994
- B.Sc., Mechanical Engineering, University of Manitoba, May 1993

Appointments and Promotions

Position	Employer	Department	Dates
Department Chair	Carleton University, Ottawa, ON	Dept. of Mech. And Aero. Engineering	2016/07/01-present
Professor	Carleton University, Ottawa, ON	Dept. of Mech. And Aero. Engineering	2011/07/01-present
Invited Professor	EPFL, Lausanne, Switzerland	School of Engineering (Lab for Multiscale Mechanics Modeling)	2013/08/15-2014/08/15
Associate Professor	Carleton University, Ottawa, ON	Dept. of Mech. And Aero. Engineering	2004/07/01-2011/06/30
"Poste rouge" Visiting Researcher	Centre National de la recherche scientifique (CNRS), Grenoble, France	Génie Physique et Mécanique des Matériaux (GPM2)	2006/09/01-2006/12/31
Visiting Assistant Professor	Institut National Polytechnique de Grenoble (INPG), France	GPM2	2007/02/01-2007/04/30
Visiting Research Fellow	Technion (IIT), Haifa, Israel	Dept. of Mech. Engineering	2004/05/24-2004/08/24
Assistant Professor	Carleton University, Ottawa, ON	Dept. of Mech. And Aero. Engineering	2001/01/01-2004/06/30
Assistant Professor (Research)	Brown University, Providence, RI, USA	Division of Engineering	2001/06/01-2001/07/01, 2002/07/01-2002/08/01
Assistant Professor	Univ. of Saskatchewan, Saskatoon, SK	Department of Mech. Engineering	1997/07/01-2000/12/31
Post Doctoral Research Associate	Harvard University, Cambridge, MA, USA	Div. of Engineering and Applied Sciences	1997/07/01-1998/06/30

HONOURS (MEDALS, FELLOWSHIPS AND PRIZES)

- Carleton University Research Achievement Award (RAA), 2015
- "Best Professor," Carleton Student Engineering Society, (2010-2011)
- Ambassade de France au Canada, Advanced Level SSHN Fellowship, 2006
- France-Canada Research Foundation (FFCR) Research Grant, 2006
- Carleton University Research Achievement Award (RAA), 2005
- Lady Davis Fellowship, Technion University, Haifa, Israel, 2004-2005 academic year
- Ontario Premier's Research Excellence Award (PREA), 2003
- "Most Involved Professor," Carleton Student Engineering Society, 2002
- Natural Sciences and Engineering Council of Canada (NSERC) 1967 Science and Engineering Scholarship (1993-1997)
- University of Manitoba, Mechanical Engineering Gold Medal (1993)

BRIEF SUMMARY OF LIFETIME RESEARCH ACHIEVEMENTS

- Recognized world-leader in multiscale materials modeling
- Co-author of two full-length graduate level textbooks (Cambridge University Press)
- Over 70 publications in peer-reviewed scientific journals
- Over 20 other publications (book chapters and conference proceedings)
- Over 40 invited guest lectures at international universities and conferences
- 50 contributed talks at international conferences
- 10,709 citations (3,012 in the last 5 years) and an H-index of 35 (Google Scholar, Oct. 11, 2023)

CONTRIBUTIONS TO SCHOLARLY RESEARCH

In the following lists of research contributions, the names of HQP are shown underlined.

Books

"Modeling Materials: Continuum, Atomistic and Multiscale Techniques" E.B. Tadmor and R.E. Miller, Cambridge University Press, 2011.

"Continuum Mechanics and Thermodynamics: From Fundamental Concepts to Governing Equations" E.B. Tadmor, R.E. Miller and R.S. Elliott, Cambridge University Press, 2011.

***Invited** Papers in **Refereed** Journals*

1. E.B. Tadmor and R.E. Miller "Benchmarking, validation and reproducibility of concurrent multiscale methods are still needed," Viewpoint Article, *Modeling and Simulation in Materials Science and Engineering,* **25** (071001), 2017.
2. William A. Curtin and Ronald E. Miller, "A Perspective on Atomistic-Continuum Multiscale Modeling," Viewpoint Article, *Modeling and Simulation in Materials Science and Engineering,* **25** (071004), 2017.
3. Ronald E. Miller and Ellad B. Tadmor, "Hybrid Continuum Mechanics and Atomistic Methods for Simulating Materials Deformation and Failure", *MRS Bulletin*, **32**, pp 920-926, 2007.
4. W.A. Curtin and R.E. Miller, "Atomistic/Continuum Coupling Methods in Multi-Scale Materials Modeling," *Modeling and Simulation in Materials Science and Engineering,* Vol. 11(3), pp. R33-R68, 2003.
5. R.E. Miller, "Direct Coupling of Atomistic and Continuum Mechanics in Computational Materials Science," *Int'l J. for Multiscale Computational Engng.*, Vol. 1(1), pp. 5772, 2003.
6. R.E. Miller and E.B. Tadmor, "The Quasicontinuum Method: Overview, Applications and Current Directions", *J. of Computer-Aided Materials Design,* Vol. 9(3), pp. 203-23, 2002.

***Contributed** Papers in **Refereed** Journals*

Submitted

1. "Two Parameter Characterization of Semi-Circular Cracks in Anisotropic Plastic Materials," Arnav Rana, Ronald E. Miller and Xin Wang, submitted to the *Journal of the Mechanics and Physics of Solids,* 2023
2. "Prediction of PAN Oxidation in a Gas Turbine Bearing Chamber Using Coupled Chemical Kinetics and CFD Simulation of Lubricant Flow," Alireza Rezvanpour and Ronald E. Miller submitted to *Thermal Science and Engineering Progress,* 2023.

Published

1. Luca M. Ghiringhelli, Carsten Baldauf, Tristan Bereau, Sandor Brockhauser, Christian Carbogno, Javad Chamanara, Stefano Cozzini, Stefano Curtarolo, Claudia Draxl, Shyam Dwaraknath, Ádám Fekete, James Kermode, Christoph T. Koch, Markus Kühbach, Alvin Noe Ladines, Patrick Lambrix, Maja-Olivia Himmer, Sergey V. Levchenko, Micael Oliveira, Adam Michalchuk, Ronald E. Miller, Berk Onat, Pasquale Pavone, Giovanni Pizzi, Benjamin Regler, Gian-Marco Rignanese, Jörg Schaarschmidt, Markus Scheidgen, Astrid Schneidewind, Tatyana Sheveleva, Chuanxun Su, Denis Usvyat, Omar Valsson, Christof Wöll and Matthias Scheffler, "Shared metadata for data-centric materials science," *Scientific Data*, **10**, 626 (2023), https://doi.org/10.1038/s41597-023-02501-8
2. Alireza Rezvanpour and R. E. Miller, "Scaling analysis as a tool to validate CFD simulation of a lubricant flow in the bearing housing of a gas turbine," *Thermal Science and Engineering Progress*, **36**(1) 101513 (2022) https://doi.org/10.1016/j.tsep.2022.101513.
3. R. Aguiar, O. Petel and R. Miller, "Effect of a Halloysite-polyurethane nanocomposite interlayer on the ballistic performance of laminate transparent armour," *Composites Part C: Open Access*, **7**, 100231 (2022).
4. M.A.N. Dewapriya and R.E. Miller, "Molecular Dynamics Study on the Shock Induced Spallation of Polyethylene," *Journal of Applied Physics* **131**(2), 025102 (2022) https://doi.org/10.1063/5.0072249
5. M.A.N. Dewapriya and R.E. Miller, "Quantum and classical molecular dynamics simulations of shocked polyurea and polyurethane", *Computational Materials Science*, **203**, 111166 (2022) https://doi.org/10.1016/j.commatsci.2021.111166
6. Mohammadreza Heidari Pebdani and Ronald E. Miller, "Molecular dynamics simulation of pull-out Halloysite nanotube from polyurethane matrix," *Advances in Mechanical Engineering*, **13**(9), 1-10 (2021) https://doi.org/10.1177/16878140211044663
7. Zheng Liu, Xin Wang, Ronald E. Miller, Pengfei Jin, Yueyin Shen and Xu Chen, "Determination of R-curves for thermal aged 16MND5 bainitic forging steel using 3D constraint-based fracture mechanics", *Theoretical and Applied Fracture Mechanics*, **116**(103084) (2021). https://doi.org/10.1016/j.tafmec.2021.103084
8. Nuwan Dewapriya and Ronald Miller, "Molecular Level Investigation on the Spallation of Polyurea," *MRS Communications* (2021). (https://doi.org/10.1557/s43579-021-00073-5)
9. Rafaela Aguiar, Ronald E. Miller and Oren E. Petel, "Microstructural evidence of the toughening mechanisms of polyurethane reinforced with halloysite nanotubes under high strain-rate tensile loading," Scientific Reports, **11**:13161 (2021)
10. Zheng Liu, Xin Wang, Ronald E. Miller, Jiaqi Hu, and Xu Chen,"Fracture toughness of thermal aged 16MND5 bainitic forging steel under varying 3D constraint conditions: An experimental study using SENT specimens," *Theoretical and Applied Fracture Mechanics*, **114**, 103025 (2021). (https://authors.elsevier.com/c/1d9tscAT7Avvu)
11. Nuwan Dewapriya and Ronald Miller, "Molecular Dynamics Simulations of Shock Propagation and Spallation in Amorphous Polymers," *Journal of Applied Mechanics*, **88**(10): 101005 (2021). (https://doi.org/10.1115/1.4051238)

12. Nuwan Dewapriya and Ronald Miller, “Nanoscale Energy Absorption Mechanisms of Ultrathin Multilayer Structures Under Ballistic Impact Loading,” *Computational Materials Science*, **195**, 110504, 2021. (https://doi.org/10.1016/j.commatsci.2021.110504)

13. Nuwan Dewapriya and Ronald Miller, “Molecular Dynamics Study of the Penetration Resistance of Multilayer Polymer/Ceramic Nanocomposites Under Supersonic Projectile Impacts,” *Extreme Mechanics Letters*, **44**, 101238, 2021. (https://doi.org/10.1016/j.eml.2021.101238)

14. Zheng Liu, Xin Wang, Ronald Miller, Jiaqi Hu and Xu Chen “Ductile fracture properties of 16MND5 bainitic forging steel under different in-plane and out-of-plane constraint conditions: experiments and predictions,” *Engineering Fracture Mechanics*, **241**, 107359, 2021. (https://doi.org/10.1016/j.engfracmech.2020.107359)

15. Nuwan Dewapriya and Ronald Miller, “Superior Dynamic Penetration Resistance of Nanoscale Multilayer Polymer/Metal Films,” *Journal of Applied Mechanics*, **87**(12): 121009, 2020. (https://doi.org/10.1115/1.4048319)

16. Rafaela Aguiar, Ronald Miller and Oren Petel “Synthesis and Characterization of Partially Silane-Terminated Polyurethanes Reinforced with Acid-Treated Halloysite Nanotubes for Transparent Armour Systems,” *Scientific Reports,* **10**:13805, 2020.

17. Nuwan Dewapriya and Ronald Miller, “Molecular dynamics study of the mechanical behaviour of ultrathin polymer-metal multilayers under extreme dynamic conditions,” *Computational Materials Science*, **184**, 109951, 2020. (https://doi.org/10.1016/j.commatsci.2020.109951

18. Manura Liyanage, Ronald Miller and Nimal Rajapakse, “Denuded Zones in Zirconium Pressure Vessels: Oxygen’s Role Examined via Multi-scale Diffusion Model,” *Modeling and Simulation in Materials Science and Engineering*, 2020. (https://doi.org/10.1088/1361-651X/ab99cf)

19. Chris Bassindale, Ronald Miller and Xin Wang, “Effect of single initial overload and mean load on the low-cycle fatigue life of normalized 300M alloy steel,” International Journal of Fatigue, **130**, 105273, 2020. (https://doi.org/10.1016/j.ijfatigue.2019.105273)

20. Manura Liyanage, Ronald Miller and Nimal Rajapakse, “First principles study of hydrogen in lead zirconate titanate,” Smart Materials and Structures, **28**, 034002, 2019. (https://doi.org/10.1088/1361-665X/aafeed)

21. Pandula Liyanage, Ronald Miller and RKND Rajapakse, “Multi-scale approach for determining hydrogen diffusivity in zirconium,” *Modeling and Simulation in Materials Science and Engineering,* **26**, 085002, 2018 (https://doi.org/10.1088/1361-651X/aae2c8)

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24. Ronald E. Miller, Ellad B. Tadmor, Joshua S. Gibson, Noam Bernstein, and Fabio Pavia, "Molecular Dynamics at Constant Cauchy Stress," *J. Chem. Phys*., 144 (184107), 2016 (http://dx.doi.org/10.1063/1.4948711)

25. Behrouz Shiari and Ronald E. Miller, "Multiscale Modeling of Crack Initiation and Propagation at the Nanoscale," *Journal of the Mechanics and Physics of Solids*, Vol. 88, pp 35-49, 2016. (doi:10.1016/j.jmps.2015.12.003)

26. Carlos Campana and Ronald E. Miller, "Transiting the molecular potential energy surface along low energy pathways: The TRREAT algorithm," Journal of Computational Chemistry, **34**(29), pp 2502-2513, 2013. (http://onlinelibrary.wiley.com/doi/10.1002/jcc.23408/abstract)

27. Carlos Campana and Ronald E. Miller, "Physical properties of liquid hexane and derived polar by-products of hexane autoxidation: molecular dynamics calculations using the Trappe-UA force field," *Molecular Simulation*, **39**(11), pp 882-894, 2013 (http://dx.doi.org/10.1080/08927022.2013.775439)

28. E.B. Tadmor, F. Legoll, W. K. Kim, L. M. Dupuy and R. E. Miller, "Finite-Temperature Quasicontinuum," Applied Mechanics Review, **65**(1) art. No. 010803 (27 pages), 2013, http://dx.doi.org/10.1115/1.4023013.

29. R.W.L Fong, R. Miller, H.J. Saari, S.C. Vogel, "Crystallographic Texture and Volume Fraction of alpha and beta Phases in Zr-2.5Nb Pressure Tube Material During Heating and Cooling," *Metall. Mater. Trans. A*, **43**(3), pp. 806-821, 2012.

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31. E. B. Tadmor, R. S. Elliott, J. P. Sethna, R. E. Miller and C. A. Becker, "The Potential of Atomistic Simulations and the Knowledgebase of Interatomic Models," *J. of Materials* **63**(7), pp. 17-17, 2011.

32. R.E. Miller and E.B. Tadmor, "A unified framework and performance benchmark of fourteen multiscale atomistic/continuum coupling methods," Modelling Simul. Mater. Sci. Eng. **17**, art. 053001, 2009.

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35. Carlos Campana, K.P. Boyle and Ronald E. Miller, "Grain boundary motion assisted via radiation cascades in bcc Fe," *Physical Review B,* **78**(13) art. 134114, 2008.

36. Behrouz Shiari and Ronald E. Miller, "Multiscale modeling of ductile crystals at the nanoscale subjected to cyclic indentation", Acta Materialia, **56**(12), pp. 2799-2809, 2008.

37. Behrouz Shiari**,** Ronald E. Miller and Dennis Klug, "Multiscale Modeling of Materials at the Nanoscale: A Dynamic Approach," *Canadian Journal of Physics*, **86**, pp. 391-400, 2008.

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42. Denis Saraev and Ronald E Miller, "Atomic-Scale Simulations of Nanoindentation-Induced plasticity in Copper Crystals with Nanometer-Sized Nickel Coatings," *Acta Materialia*, **54**(1), pp. 33-45 2006.

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45. Denis Saraev and Ronald E Miller, "Atomistic Simulation of Nanoindentation into Copper Multilayers," *Modelling Simul. Mater. Sci. Eng.* **13,** pp. 1089-1099, 2005.

46. S. Qu, V. Shastry, W.A. Curtin and R.E. Miller, "A Finite Temperature, Dynamic, Coupled Atomistic/Discrete Dislocation Method", *Modeling and Simulation in Materials Science and Engineering,* Vol. **13(**7), pp. 1101-1118, 2005.

47. Behrouz Shiari, Ronald E. Miller and W.A. Curtin, "Coupled Atomistic/Discrete Dislocation Simulations of Nanoindentation at Finite Temperature," *ASME J. Engng. Materials and Technology - Transactions of the ASME,* Vol **127**(4), pp. 358-368, 2005.

48. Robert Peace and Ronald E. Miller, "Experimental Observations of Void Growth in the Zr-2.5Nb Pressure Tube Alloy," *J. of Nuclear Materials*, **341**, 231-234, 2005.

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58. R. E. Miller and V.B. Shenoy, "Size Dependent Elastic Properties of Nano-Sized Structural Elements," *Nanotechnology,* Vol. 11, No. 3, pp. 139-147, 2000.

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61. R.E. Miller, E.B. Tadmor, R. Phillips, and M. Ortiz, "Quasicontinuum Simulation of Fracture at the Atomic Scale", *Mod. Sim. Mat. Sci. Eng.,* Vol. 6, pp. 607-638, 1998.

62. R.E. Miller, M. Ortiz, R. Phillips, V. Shenoy, and E.B. Tadmor, "Quasicontinuum Models of Fracture and Plasticity", *Engineering Fracture Mechanics,* Vol. 61, pp. 427-444, 1998.

63. R.E. Miller, R. Phillips, G. Beltz, and M. Ortiz, "A Non-Local Formulation of the Peierls-Nabarro Dislocation Model", *J. Mech. Phys. Sol.,* Vol. 46(10), p. 1845-1868, 1998.

64. V. Shenoy, R. Miller, E.B. Tadmor, D. Rodney, R. Phillips, and M. Ortiz, "An Adaptive Methodology for Atomic Scale Mechanics - The Quasicontinuum Method", *J. Mech. Phys. Sol.,* Vol. 47, p. 611-642, 1999.

65. V.B. Shenoy, R. Miller, E.B. Tadmor, R. Phillips, and M. Ortiz, "Quasicontinuum Models of Interfacial Structure and Deformation", *Phys. Rev. Lett.* 80(4), p. 742 (1998).

66. R.E. Miller, and R. Phillips, "Critical Analysis of Local Constitutive Models for Slip and Decohesion", *Phil. Mag. A* 73(4), pp. 803-827 (1996).

Chapters in Books

1. M.A.N. Dewapriya and R.E. Miller, "Nanoscale modeling of shock response of polyurea," chapter in *Polyurea: Synthesis, Properties, Composites, Production, and Applications*, Pooria Pasbakhsh et al., Editors, Elsevier (2023), ISBN: 978-0-323-99450-7
2. R.E. Miller, "Treating Mobile Dislocations in Coupled Atomistic/Continuum Models," chapter in *Fundamentals and Applications of Multiscale Materials Modeling*, Z. Xiao Guo, Editor, Woodhead Publishing, Ltd. (2007) ISBN-13: 978 1 84569 071 7.

3. B. Shiari and R.E. Miller, "Finite Temperature Coupled Atomistic/Continuum Discrete Dislocation Dynamics Simulation of Nanoindentation" in "*Nanomechanics of Materials and Structures*", Springer (2006), ISBN: 1-4020-3950-6.
4. E.B. Tadmor and R.E. Miller, "The Theory and Implementation of the Quasicontinuum Method," chapter in *Handbook of Materials Modeling, Volume I (Methods and Models)*, Springer Science and Business Media, 2005, ISBN: 978-1-4020-3287-5.

Papers Published in Conference Proceedings

1. Zheng Liu, Xin Wang, Ronald E. Miller, Yueyin Shen and Xu Chen, "Application of 3D Constraint-Based Fracture Mechanics for the Determination of R-Curves of Thermal Aged 16MND5 Steel," *Proc. ASME 2021, Pressure Vessels and Piping Conference*, July 12-16, 2021.
2. R. Aguiar, A. Lebar, A. Oddy, R. Miller, and O. Petel, "Synthesis and mechanical characterization of polyurethane reinforced with halloysite nanotubes" AIP Conference Proceedings 2272, 120001, 2020.
3. R.W.L. Fong, S. Vogel, R. Miller, and H. Saari, "Characterization of the crystallographic textures and mechanical anisotropy factors in two modifications of Zr-2.5Nb pressure-tube materials," Proceedings of the 8th Pacific Rim International Conference on Advanced Materials and Processing (PRICM-8), Waikoloa, Hawaii, USA, August 4-9, 2013.
4. I. Shabib, and R. Miller, "Deformation characteristics and stress-strain response of copper nanotwinned structure", CSME (The Canadian Society for Mechanical Engineering) Forum 2008 conference proceedings, June 5-8, 2008, Ottawa, Ontario
5. B. Shiari, R.E. Miller, L. Zhao and W. Beres, "Multiscale Modeling of Nanoindentation: Significance of Local Temperature Rise," Proceedings of *COM 2006 - 45th International Conference of Metallurgists,* Montreal, Canada, Oct. 1-4, 2006.
6. B. Shiari, R.E. Miller, W. Beres and L. Zhao, "Coupled Atomistic/Continuum Discrete Dislocation Modeling of Nanoscratching," Proceedings of *COM 2006 - 45th International Conference of Metallurgists,* Montreal, Canada, Oct. 1-4, 2006.
7. I. Shabib, K. Chen, R. Miller, and L.R. Zhao, "*Multi-scale Modeling of the Indentation of Nickel-Aluminum nano-layers*", published in the 20th CANCAM (*Canadian Congress of Applied Mechanics*) conference proceedings, pp. 131-132, May 30-June2, 2005, Montreal, Quebec
8. B. Shiari, D.D. Klug and R.E. Miller, "Structural Flexibility of Silicon Nanobeams," proceedings of *Twelfth Canadian Semiconductor Technology Conference,* Ottawa, Canada, Aug. 16-19, 2005.
9. Behrouz Shiari, Ronald E. Miller and Dennis D. Klug, "Finite Temperature Multiscale Computational Modeling of Materials at the Nanoscale", *Proceedings of the 2005 International Conference on MEMS, NANO, and Smart Systems*, Banff, Canada, July, 2005.
10. Paul Straznicky, R.G. Langlois, M. McDill, R. Miller, S.A. Sjolander and D.A. Staley, "Integrated Team Design Projects at Carleton University," *Proc. of the 1st CDEN Design Conference*, Montreal, Quebec, July, 2004.
11. Ronald E. Miller, Leo Shilkrot and William A. Curtin, "A Study of Nano-Indentation using Coupled Atomistic and Discrete Dislocation (CADD) Modeling," *Proc. 2nd MIT Conf. on Computational Fluid and Solid Mechanics*, 2003.

12. M. de Koning, R. Miller, V.V. Bulatov and F. Abraham, "Modeling the Effects of Dislocation-Grain Boundary Interactions in Poly-Crystal Plasticity: Identification and Characterization of Unit Mechanisms", *Mat. Res. Soc. Symp. Proc.*, Vol. 677, pp. AA1.5.1-AA1.5.8, 2001.
13. A. Pillai and R.E. Miller, "Crack Behaviour at Bi-Crystal Interfaces: A Mixed Atomistic and Continuum Approach", *Mat. Res. Soc. Symp. Proc.,* Vol. 653, pp. Z2.9.1-Z2.9.7, 2001.
14. D.N. Pawaskar, R.E. Miller, R. Bai, A. Schwartzman, R. Phillips, and C.L. Briant, "Atomistic Studies of Generic Tilt Grain Boundary Structure", *Mat. Res. Soc. Symp. Proc.,* Vol. 538, pp 383-388, 1999.
15. R.E. Miller and J.W. Hutchinson, "A Continuum Plasticity Model for the Constitutive Behaviour of Foamed Metals", *Mat. Res. Soc. Symp. Proc.,* Vol. 521, pp. 39-44, 1998.
16. R. Miller, M. Ortiz, R. Phillips, V. Shenoy, and E.B. Tadmor, "Quasi-Atomistic Models of Fracture and Plasticity" (invited), *Proceedings of the Ninth International Conference on Fracture*, Sydney, Australia, April 1997.

Invited Lectures and Conference Presentations

*Invited Conference Presentations (presenting author in **bold**)*

1. "Atomic Simulations of Shock Wave Propagation in Polymers and Their Interfaces," **R.E. Miller**, Canadian Materials Science Conference, University of Manitoba, Winnipeg, Canada, June 27-30, 2023.
2. "Synthesis, characterization and molecular simulation of polymers enhanced with halloysite nanotubes," Rafaela Aguiar, Oren Petel and **Ron Miller**, TMS2023, San Diego, CA, USA, Mar. 19-23, 2023.
3. "Polymer nanocomposites for ballistic protection: synthesis, characterization and molecular simulation," **R.E. Miller**, Tec21 Winter School 2023, Grenoble Institute of Technology, Grenoble, France, Dec. 30 - Jan. 3, 2023.
4. "The OpenKIM project: Reproducibility, Portability and Metadata Standards in Molecular Simulation," **R.E. Miller,** NOMAD-FAIRDI Workshop, Berlin, Germany, July 8-12, 2019.
5. "Finite temperature and finite deformation: new tools for more efficient and accurate atomistic simulation." **R.E. Miller**, *Semi-Plenary Lecture*, 14th U.S. National Congress on Computational Mechanics, Montreal, QC, July 17-20, 2017.
6. "The Cauchystat: accurate control of the true stress in molecular dynamics simulations of martensitic phase transformations" **R.E. Miller**, the 12th International Conference on the Mechanical Behavior of Materials (ICM12), Karlsruhe, Germany, May 10-14, 2015.
7. "The Cauchystat: accurate control of the true stress in molecular dynamics simulations of martensitic phase transformations" **R.E. Miller**, presented at the workshop on "Atoms, Defects and Microstructure" at the Friedrich-Alexander-Universitat Erlangen-Nurnberg (FAU), June 23, 2014.
8. "Finite Temperature and Finite Deformation: New Tools for More Efficient and Accurate Atomistic Simulation," **R.E. Miller**, *International Center for Applied and Computational Mechanics,* 7th US-France Symposium on "Multiscale Materials Modeling: Mathematical and Computational Aspects", Rensselaer Polytechnic Institute, June 10-11, 2014

9. "Modeling the Solid State with Coupled Atomistic/Continuum Methods: An Overview of Recent Developments," **R.E. Miller**, KITP Conference: Modeling Soft Matter: Linking Multiple Length and Time Scales, Santa Barbara, California, June 4-8, 2012. http://online.kitp.ucsb.edu/online/multiscale_c12/miller/
10. "Benchmarking Multiscale Methods," **R.E. Miller**, Ellad B. Tadmor and Mitchell Luskin, MMM2008, Tallahassee, USA, October, 2008.
11. "Molecular Dynamics Simulations of Indentation into Nano-layered Materials," D. Saraev and **R.E. Miller**, *Plasticité 2006*, Sévrier (Annecy), France, March 27-29, 2006.
12. "The Quasicontinuum Method at Finite Temperature," L. Dupuy, E.B. Tadmor, **R.E. Miller** and R.B. Phillips, *Sandia CSRI workshop on Atomistic-to-Continuum (AtC) coupling methods,* March 20-21, 2006.
13. "A Finite Temperature Quasicontinuum Model", **R.E. Miller**, L. Dupuy, E.B. Tadmor and R. Phillips, *Workshop on Multiscale Modeling in Solids*, CRM, Universite de Montreal, April 27 - May 1, 2005.
14. "Smoothed Atom Mechanics: A Meshless Quasicontinuum", **R.E. Miller** and E.B. Tadmor, *TMS Annual Meeting and Exhibition,* San Francisco, California*,* February 13-17, 2005*.*
15. "A Finite-Temperature, Dynamic Coupled Atomistic/Discrete-Dislocation Model", W. A. Curtin, V. Shastry, M. Dewald, **R.E. Miller**, *TMS Annual Meeting and Exhibition,* San Francisco, California*,* February 13-17, 2005*.*
16. "Carbon-Nanotube/Polymer Composites," **R.E. Miller** and P. Sundararajan, *MMO Workshop on Nanomaterials,* November 16, 2004, University of Western Ontario, London, ON.
17. "Molecular Dynamics Simulations of Nano-Indentation in Ni-coated Cu Single Crystals," **R.E. Miller** and D. Saraev, *MMO Workshop on Nanomaterials,* November 16, 2004, University of Western Ontario, London, ON.
18. "Coupled Atomistic and Discrete Dislocation Mechanics at Finite Temperature," **R.E. Miller**, *American Physical Society April Meeting*, April, 2004, Montreal, QC.
19. "Multiscale Modeling of Nano-Indentation," **R. Miller**, L. Shilkrot and W. Curtin, *1st Workshop of the Canadian Network for Computational Materials Science*, May, 2003, Hamilton, Ontario.
20. "A Coupled Atomistic and Discrete Dislocation Plasticity Study of nano-Indentation," **R.E. Miller**, L. Shilkrot and W. Curtin, *Materials Research Society Spring Meeting*, April, 2003, San Francisco, CA.
21. "A Coupled Atomistic and Discrete Dislocation Plasticity Study of nano-Indentation," **R.E. Miller**, L. Shilkrot and W. Curtin, *Plasticity 2003*, Quebec City, QC, July 2003.
22. "Discrete Dislocation Plasticity with Fully Atomistic Defect Nucleation", **R.E. Miller**, L. Shilkrot and W. Curtin, Materials Research Society Spring Meeting, April 2001, San Francisco, CA.
23. "Three-Point Bending of Sandwich Beams with Aluminum Foam Cores: Experiments and Theoretical Failure Mechanism Maps for Beam Design," T. McCormack, **R.E. Miller** and L.J. Gibson," Composites at Lake Louise, October, 1999, Lake Louise, AB.

Invited Lectures (presented by Miller)

24. "Finite temperature and finite deformation: new tools for more efficient and accurate atomistic simulation." Department of Materials Engineering, McGill University, July 19, 2017.
25. "New Algorithms for Molecular Simulation," Nečas seminar on continuum mechanics, Mathematical Institute of the Charles University, Prague Czech Republic, May 18, 2015.
26. "New Algorithms for Molecular Simulation," University of Minnesota, Dept. of Mechanical Engineering, February 19, 2015.

27. "Finite temperature and finite deformation: new tools for more efficient and accurate atomistic simulation," Department of Mechanics, Czech Technical University, Prague Czech Republic, June 25, 2014.
28. "Multi-Scale Modeling of Materials: Molecular Dynamics Simulations without all the Atoms," University of North Texas, May 7, 2010.
29. "Benchmarking Multiscale Methods," Sandia National Laboratories CSRI Lab, Albuquerque, USA, September 23, 2008.
30. "Towards an atomistic criterion for dislocation nucleation," Sandia National Laboratories CSRI Lab, Albuquerque, USA, September 22, 2008.
31. "Towards an atomistic criterion for dislocation nucleation," University of Minnesota, Dept. of Mechanical Engineering, November 13, 2007.
32. "Multiscale Modeling of Materials," University of Milan-Bicocca, Department of Materials Science, July 9, 2007.
33. "Molecular Dynamics Simulations of Indentation into Nano-layered Materials," University of Minnesota, Dept. of Mechanical Engineering, February 28, 2006.
34. "Multi-scale Modeling: Molecular Dynamics Simulations without all the Atoms," University of Ottawa Dept. of Physics, Ottawa, ON, March 10, 2005.
35. "Carbon-Nanotube/Polymer Composites," ASM International, Ottawa Valley Chapter, January 2005 technical meeting, Ottawa, ON, Canada.
36. "Concurrent Multiscale Modeling of Deformation in Metals," University of Vermont, USA, October 22, 2004.
37. "A Coupled Atomistic and Discrete Dislocation Mechanics Study of Nano-Indentation," Technion (Israeli Institute of Technology), Haifa, Israel, July 5, 2004.
38. "Coupled Atomistic and Discrete Dislocation Mechanics at Finite Temperature," Steacie Institute for Molecular Sciences, NRC, Ottawa, ON, March 18, 2004.
39. "Multi-Scale Materials Modeling", NRC Institute for Aerospace Research, May 8, 2001.
40. "Incorporating Atomistic Features into Computer Simulations of Deformation Processes," AECL, Chalk River, ON, May 12, 2000.
41. Size Dependent Elastic Properties of Nano-Sized Structural Elements," University of Manitoba, Winnipeg, MB, February 25, 2000.
42. Size Dependent Elastic Properties of Nanometer-Sized Beams and Plates," Boston University, Boston, MA, December 3, 1999.
43. Quasicontinuum Simulation of Fracture in Metal Bi-Crystals", University of Manitoba, Department of Physics. Winnipeg, MB, February 25, 1998.

Contributed Presentations at Conferences

(Presenting author is presented in **bold**, HQP are underlined)

1. "Simulation of Polymers Enhanced with Halloysite Nanotubes," **Ron Miller**, Rafaela Aguiar and Oren Petel, Canadian Materials Science Conference, Winnipeg, MB, 2023.
2. "Atomic Simulations of Shock Wave Propagation in Polymers and Their Interfaces", Nuwan Dewapriya and **Ron Miller**, MS&T 2022, Pittsburgh, PA, USA, Oct. 9-12, 2022.
3. "Halloysite-reinforced polyurethane nanocomposite as an interlayer for transparent armour systems," **Rafaela Aguiar**, R.E. Miller and Oren Petel, Canadian Materials Science Conference, Toronto, ON, 2022.

4. "Synergistic Effects of Halloysite Nanotubes on the Tensile Dynamic Fracture Toughness of Polyurethane," **Rafaela Aguiar**, Ronald Miller and Oren Petel, *Future Materials*, July 5-7, 2021 (virtual).
5. "Nanoscale investigation of shock wave propagation through amorphous polymers and their interfaces with hard materials", **Nuwan Dewapriya** and Ronald Miller, *16th U.S. National Congress on Computational Mechanics*, Chicago, Illinois, USA, July 25-29, 2021, (virtual)
6. "Atomic-scale investigation on the mechanical behavior of ultrathin polymer/ceramic multilayers under shock loading", **Nuwan Dewapriya** and Ronald Miller, *The Mach Conference-2021 (virtual)*.
7. "Density functional theory and molecular dynamics simulations of shock wave propagation through polymer/ceramic multilayers", **Nuwan Dewapriya** and Ronald Miller, *The MRS Spring Meeting-2021 (virtual).*
8. "Molecular dynamics simulations on the mechanical behavior of multilayer polymer/metal nanostructures under impact loading", **Nuwan Dewapriya** and Ronald Miller, *The MRS Spring Meeting-2021 (virtual).*
9. "Predicting fracture stress of defective graphene samples using artificial neural networks", **Nuwan Dewapriya**, Nimal Rajapakse, Priyan Dias, and Ronald Miller, *The MRS Spring Meeting-2021 (virtual).*
10. "First-principles study of Hydrogen in Lead Zirconate Titanate," **Manura Liyange**, R. K. N. D. Rajapakse and Ronald E Miller, IUTAM Symposium on Mechanics of electro/magneto-active materials and structures, Beijing, August 26-30, 2018
11. "Effect of Oxygen on Hydrogen Diffusion in Zirconium," **Manura Liyange**, Nimal Rajapakse and Ronald E Miller, *29th Canadian Materials Science Conference*, Ottawa, Canada, June 20-23, 2017.
12. "Computational and Experimental Analysis of PAN Oxidation in Lubricating Oils," poster, **Yifan Yang** and Ronald E Miller, *100th Canadian Chemistry Conference,* Toronto, ON, May28-June 1, 2017.
13. "A Titanium Potential with the multi-state modified embedded atom method (MEAM)," **Joshua Gibson**, Srinivasan Srivilliputhur, Michael Baskes, Angela Wilson and Ronald E. Miller, *COM2015: the 54rd Conference of Metallurgists*, The Metallurgy and Materials Society of CIM, Toronto, ON, August 23-36, 2015.
14. "Constant Stress Molecular Dynamics Simulations: Controlling the True Stress when the Deformation is Large," **R.E. Miller**, *COM2014: the 53rd Conference of Metallurgists*, The Metallurgy and Materials Society of CIM, Vancouver, BC, Sept. 28 – Oct. 1, 2014.
15. "Multiscale modelling of lubricant degradation using efficient transition state searching algorithms," **J.F. Joly** and R.E. Miller, *COM2014: the 53rd Conference of Metallurgists*, The Metallurgy and Materials Society of CIM, Vancouver, BC, Sept. 28 – Oct. 1, 2014.
16. "Characterization of the crystallographic textures and mechanical anisotropy factors in two modifications of Zr-2.5Nb pressure-tube materials," **R.W.L. Fong**, S. Vogel, R. Miller, and H. Saari, 8th Pacific Rim International Conference on Advanced Materials and Processing (PRICM-8), Waikoloa, Hawaii, USA, August 4-9, 2013.
17. "TRREAT: An algorithm to search a Potential Energy Surface along low curvature pathways. Applications to molecular conformations," **Carlos Campana** and Ronald E. Miller, Society of Engineering Science, 50th Annual Technical Meeting, July 28-31, 2013, Providence, RI.
18. "A Differential Scanning Calorimetry (DSC) Study of Phase Changes in an As-Received Zr-2.5Nb Pressure Tube Material during Continuous Heating and Cooling," **R.W.L. Fong**, H. Saari, R. Miller, J. Teutsch, and S.C. Vogel , THERMEC 2011, Quebec City, Canada, Aug.1-5, 2011.
19. "Atomistic/Continuum Coupling for Static Problems: An Overview of the Field and Benchmarking Comparison," **R.E. Miller** and E.B. Tadmor, 11th U.S. National Congress on Computational Mechanics, Minneapolis, MN, July 25-28, 2011.

20. "Open Knowledgebase of Interatomic Models (OpenKIM.org): an online platform for developing, testing and archiving empirical potentials," **R.E. Miller**, E.B. Tadmor, R.S. Elliott, J.P. Sethna, C.A. Becker, 1st World Congress on Integrated Computational Materials Engineering, Seven Springs, PA, July 10-14, 2011.
21. "The Influence of Stress on Primary Defect Damage by Displacement Cascades in BCC Iron," **Boyle, K. P.**, Shabib, Ishraq and R.E. Miller, *10th Conference on Computer Simulations of Radiation Effects in Solids (COSIRES-10),* Krakow, Poland, July 19-23, 2010.
22. "Multiscale Modeling of Fatigue Crack Initiation and Propagation in Nanocrystalline Metals," **B. Shiari**, R.E. Miller, *12th International Conference on Fracture*, Ottawa, Canada, July 12-17, 2009.
23. "Effects of Temperature and Grain Size on the Properties of Copper Nanotwinned Structures," **I. Shabib**, R.E. Miller, *12th International Conference on Fracture*, Ottawa, Canada, July 12-17, 2009.
24. "Grain Boundary Motion Assisted via Displacement Cascades in bcc Fe", R.E. Miller, **K.P. Boyle**, C. Campana, *12th International Conference on Fracture*, Ottawa, Canada, July 12-17, 2009
25. "On the Nonlocal Nature of Dislocation Nucleation," **R.E. Miller** and David Rodney, Society of Engineering Sciences 2008 Conference, Champaign, IL, USA, October 2008.
26. "Benchmarking Multiscale Methods"**, R.E. Miller**, *SIAM conference on Mathematical Aspects of Materials Science*, May 11-14, 2008, Philadelphia, PA, USA.
27. "Multiscale Modeling of Nanobeams Structures for MEMS/NEMS Applications Subjected to Cyclic Loading," **Behrouz Shiari**, R.E. Miller and D. Klug, *Materials Research Society Spring Meeting*, April, 2005, San Francisco, CA.
28. "Multiscale Simulation of Dynamic Nanoindentation and Cyclic Plasticity at Finite Temperature," Behrouz Shiari and **R.E. Miller**, *Materials Research Society Fall Meeting*, November, 2004, Boston, MA.
29. "Plasticity in Ni-Cu Nano-layered Systems during Indentation: a Molecular Dynamics Study," **Denis Saraev** and R.E. Miller, *Materials Research Society Fall Meeting*, November, 2004, Boston, MA.
30. "Coupled Atomistic and Discrete Dislocation Mechanics: The CADD Model," **Behrouz Shiari** and R.E. Miller, *16th Canadian Materials Science Conference*, Ottawa, ON, June 2004.
31. **Behrouz Shiari** and R.E. Miller, "Finite Temperature Coupled Atomistic/Continuum Discrete Dislocation Dynamics Simulation of Nanoindentation," *Proc. of the International Workshop on Nanomechanics*, Pacific Grove, California, July, 2004.
32. "Atomistic Simulation of Nano-Indentation in Multi-Layered Materials," **D. Saraev** and R.E. Miller, *16th Canadian Materials Science Conference*, Ottawa, ON, June 2004.
33. "Coupled Atomistic and Discrete Dislocation Mechanics at Finite Temperature," **B. Shiari** and R.E. Miller, *2nd Workshop of the Canadian Network for Computational Materials Science*, May, 2004, Hamilton, Ontario.
34. **B. Shiari** and R.E. Miller," Evaluation of Integration Schemes for Dynamic Coupled Atomistic/Continuum Simulation," *First Canadian Network for Computational Materials Science (CNCMS I) Conference*, McMaster University, May 2003.
35. "A Study of Nano-Indentation using Coupled Atomistic and Discrete Dislocation (CADD) Modeling," **R.E. Miller**, Leo Shilkrot and William A. Curtin, *2nd MIT Conf. on Computational Fluid and Solid Mechanics*, Cambridge, MA, June, 2003.
36. "Carbon-Nanotube/Polymer Composites," Shanti Singh, Patrick Pei, P.R. Sundararajan and **R.E. Miller**, *MMO-EMK meeting*, Toronto, ON, January, 2003.
37. "A Stress-Gradient Based Criterion for Dislocation Nucleation in Crystals: Theory and Simulations," **R. E. Miller** and Amit Acharya, *Society of Engineering Science Fall Meeting*, University of Pittsburgh, October, 2002.

38. "Atomic-Scale Void Growth Simulations Using Coupled Atomistics and Discrete Dislocation Plasticity," L.E. Shilkrot, **R.E. Miller** and W.A. Curtin, *Materials Research Society Spring Meeting*, April, 2002, San Francisco, CA.
39. "Interfacing Discrete Dislocation Plasticity Models with Fully Atomistic Simulations," L.E. Shilkrot, **R.E. Miller** and W.A. Curtin, *US National Congress on Computational Mechanics,* Detroit, MI, August, 2001.
40. "Crack Behaviour at Bi-Crystal Interfaces: A Mixed Atomistic and Continuum Approach", A. Pillai and **R.E. Miller**, *Materials Research Society Fall Meeting*, December, 2000, Boston, MA.
41. "Stiffness of Nanometer-Sized Beams and Plates," **R.E. Miller** and V.B. Shenoy, *Materials Research Society Fall Meeting*, December, 1999, Boston, MA.
42. "Atomic Scale Simulation of Hexagonal Void Growth in Zirconium", **R.E. Miller**, *Sixth International Conference of Nuclear Engineers,* Coronado, CA, May 11-15, 1998.
43. "A Continuum Plasticity Model for Metal Foams", **R.E. Miller***, MRS Spring Meeting*, San Francisco, CA, April 13-17, 1998.
44. "Mixed Atomistic/Continuum Simulation of the Interactions between Grain Boundaries and Brittle Cracks", **R.E. Miller**, *MRS Fall Meeting*, Boston, MA, December 1-5, 1997.
45. "Improvements to the Peierls Framework", **R.E. Miller**, *Institute for Theoretical Physics Workshop,* UCSB, Santa Barbara, CA, March 26-28, 1997.
46. "Strain Gradient Corrections to the Peierls Framework", **R.E. Miller**, *MRS Fall Meeting*, Boston, MA, November 27-December 1, 1995.
47. "New Twists on the Peierls Framework", **R.E. Miller**, *ONR Review*, NIST, Gaithersburg, MD, April 27-28, 1995.
48. "Linking Continuum and Atomistic Dislocation Models", **R.E. Miller**, *APS March Meeting*, San Jose, CA, March 20-24, 1995.

Other Recent Contributions to Research

Conference Organizer

- Co-organizer, Minisymposium, "Interatomic Models in Materials Simulations: Theory, Standards, Infrastructure, and Applications," Society of Engineering Science Annual Technical Meeting, Oct. 8-11, 2023, Minneapolis, Minnesota, USA.
- Co-organizer, Minisymposium, "Advances in Atomistic-to-Continuum Coupling Techniques," 13th World Congress on Computational Mechanics, July 22-27, 2018, New York, USA.
- Co-organizer, Minisymposium, "Advances in Atomistic-to-Continuum Coupling Techniques," 14th U.S. National Congress on Computational Mechanics, July 17-20, 2017, Montreal, Canada.
- Technical Program Chair, 29th Canadian Materials Science Conference, Ottawa, June 20-23, 2017.
- Co-organizer, Workshop on "Modeling Metal Failure Across Multiple Scales," http://www.cecam.org/workshop-1002.html, CECAM, Lausanne, Switzerland, May 26-27, 2014.
- Co-organizer, Symposium, "From Atomistics to Reality:Spanning Scales in Simulations and Experiments", 50th Annual Technical Meeting of the Society of Engineering Science, Providence, RI, July28-31, 2013.
- Co-organizer, Minisymposium, "Recent Advances in the Quasicontinuum Method and other Atomistic/Continuum coupling Techniques", 11th U.S. National Congress on Computational Mechanics, Minneapolis, MN, July 25-29, 2011.
- Co-organizer and participant "Tiny Matters, Big Ideas: Canada-Israel workshop on nanotechnology", Ottawa, Canada, Oct. 4-5, 2010.

- Lead organizer of the symposium "Atomistic Fracture and Deformation", 12th International Conference on Fracture, Ottawa, Canada, July 12-17, 2009.

Tutorials and Short Courses

- "Modeling Materials" Short Course (Co-instructors: Ellad B. Tadmor and Ronald E. Miller)
    - Weizmann Institute of Science, Israel (On-line) August 16-27, 2020.
    - Friedrich-Alexander-Universität and the Engineering of Advanced Materials (EAM) Cluster of Excellence, Erlangen-Nürnberg, Germany, August 17-21, 2015.
    - Technical University of Hamburg-Harburg, Hamburg, Germany, March 17-21, 2014.
    - Argonne National Laboratories, Argonne, IL, USA, November 18-22, 2013.
    - 3M Corporation, St. Paul, MN, USA, November 11-15, 2013.
    - Shanghai Jiao Tong University, Shanghai, China, July 1-5, 2013.
    - DoD High performance Computing Modernization Program, PETTT program, Army Reseach Laboratory, Aberdeen, MD, June 3-7, 2013.
    - Friedrich-Alexander-Universität and the Engineering of Advanced Materials (EAM) Cluster of Excellence, Erlangen-Nürnberg, Germany, February 18-22, 2013.
    - AICES, Aachen, Germany, August 14-17, 2012.
    - DoD High performance Computing Modernization Program, PETTT program, Army Reseach Laboratory, Aberdeen, MD, July 9-13, 2012.
- "Summer School on Multiscale Modeling of Materials," Lappeenranta, Finland, June 10-14, 2007.
- "The Quasicontinuum Method," Centre Européen de Calcul Atomique et Moléculaire, Lyon, France, June 9-11, 2004, co-instructors: Ellad B. Tadmor and Ronald E. Miller.
- "Fundamental Methods of Multi-Scale Modeling", Materials Research Society Tutorial, Boston, MA, November 25, 2001. Co-Instructors: A. Quong, K.J. Cho, F. Gilmer, H. Zbib, R.E. Miller.
- "Fundamental Methods of Multi-Scale Modeling", Materials Research Society Tutorial, San Francisco, CA, April 14, 2001. Co-Instructors: A. Quong, K.J. Cho, F. Gilmer, H. Zbib, R.E. Miller.

Knowledge Transfer Activities

- Editor, "Knowledgebase of interatomic models," www.openkim.org
- Organizing Committee Member, "Kim Review," www.kimreview.org

RESEARCH GRANT INFORMATION

Grants while at Carleton:

Source	Project	Years	Amount
NSERC Alliance (option 2)	Development of a solar-driven adsorption thermal energy storage system concept for space heating applications in northern remote indigenous communities (PI: Jean Duquette, Co-applicants Miller, Schott, Papineau-Koritar	2023-2028	25% of $1,109,000
NSERC RTI	Precise Measurement and Analysis of Specific Surface Area and Pore Size Distribution of Micro and Nanoparticles (PI: Reza Kholghy, Co-applicants: Miller, Duquette, Pouragha)	2023	25% of $150,000
NSERC Alliance	Quantitative, In-Line Spectroscopic Monitoring of Lubricating Oils in Diesel Engines (PI: Miller, Co-applicant: Jeff Manthorpe)	2022-2026	50% of $198,167
GasTops, Ltd.	Quantitative, In-Line Spectroscopic Monitoring of Lubricating Oils in Diesel Engines (PI: Miller, Co-applicant: Jeff Manthorpe)	2022-2026	50% of $99,083
Borealis Foundation Endowment Fund	Solar Adsorption Thermal Energy Storage (SATES) for Remote Communities	2022-2024	$10,000/year for 2 years
Mitacs and BMT Canada Ltd.	Structural Integrity Assessments for Strain-Based Design of Pipelines (Principal Investigator: Xin Wang, Co-Applicant: Miller)	2021-2024	50% of $276,000
NSERC DG	From nano-mechanics to materials design: using first principles data to engineer high-performance materials and systems	2019-2025	$28,000/year for 6 years
Carleton Univ, MRCF	Carleton Centre for a Carbon Free Future (PI: Miller, 4 co-applicants)	2019-2022	25% of $75,000
NSERC RTI	Photonic Doppler velocimeter for dynamic material characterization (Principal Investigator: O. Petel, Co-Applicant: Miller)	2019	50% of $107,702
NSERC Engage	Modeling loss of fatigue life in aircraft landing gear due to residual stresses from hard landings	2018	$25,000
NSERC CRD	Condition Monitoring of Lubricating Oils in Diesel Engines	2018-2021	$197,334
OCE VIP II	Condition Monitoring of Lubricating Oils in Diesel Engines	2018-2019	$77,966

Source	Project	Years	Amount
GasTops, Ltd.	Condition Monitoring of Lubricating Oils in Diesel Engines	2018-2021	$131,160
Carleton Univ. RAA	Plasticity at the Nanoscale	2015	$15,000
NSERC Discovery Accelerator Supplement	Multiscale simulations of nano-plasticity: Dislocation nucleation and motion in nanostructures and nanocrystalline materials.	2014-2016	$40,000/year for 3 years
NSERC Discovery Grant	Multiscale simulations of nano-plasticity: Dislocation nucleation and motion in nanostructures and nanocrystalline materials.	2014-2018	$44,000/year for 5 years
NSERC CRD and GasTops, Ltd.	Modeling and Measuring the Effects of Shear on Lubricating Oil Breakdown	2013-2017	$66,750/year for 4 years
OCE, Collaborative Research Program and GasTops, Ltd.	Modeling oil breakdown	2011-2013	$148,000/year for 2 years
RS Designs (industrial partner)	Combustion Ignition Processes	2011-2014	$15,000/year for 4 years (cash and in-kind)
NSERC Engage	Modeling oil breakdown (with GasTOPS Ltd.)	2011	$25,000
Mitacs Accelerate (Student: Nick Giordano)	Engine Ignition Enhancment (with RSDesigns)	2011	$15,000
AECL, Chalk River	MD simulation of Stress Corrosion Cracking	2010	$20,000
NSERC Discovery	Plasticity on the nanoscale: The role of dislocation nucleation in nanocrystalline metals and nanoindentation	2007-2012	$29,800/year for 5 years
NSERC Discovery	Multi-scale modeling of plasticity and fracture of metals.	2002-2006	$30,800/year for 5 years
France-Canada Research Foundation	Plasticity on the nanoscale: the role of dislocation nucleation in nanocrystalline metals and nanoindentation.	2006-2007	$10,000
Carleton Univ. RAA	Fundamentals of Multiscale Modeling	2005	$15,000

Source	Project	Years	Amount
PREA	Atomic-Scale Modeling of the Strength and Plasticity of Metals	2003	$100,000
NRC-IAR	Coupled Atomistic and Discrete Dislocation Modeling of Indentation into Nano-Structured Multilayers.	2003-2004	$26,840
US-AFOSR thru Brown Univ.[1]	Virtual Testing and Design of Materials: A Multi-Scale Approach	2002-2003	$134,000
MMO-EMK	Design, Preparation and Characterization of Carbon-Nanotube/Polymer Composites, Co-Applicant with Dr. Pudupadi R. Sundararajan,	2004	$50,000
MMO-EMK	Design, Preparation and Characterization of Carbon-Nanotube/Polymer Composites, Co-Applicant with Dr. Pudupadi R. Sundararajan,	2002	$50,000
MMO	Development of Carbon-Nanotube/Polymer Composites for Structural Applications	2001	$40,000
Carleton U.	New Faculty Start-Up Funds	2001	$30,000

While at U. of Saskatchewan

Source	Project	Years	Amount
CFI New Opp.	"A Scanning Transmission Electron Microscope for the University of Saskatchewan," Lead applicant with S. Yannacopoulos, R. Kerrich, J. Hendry, Y. Pan and R. Silerova	2000	$700,000
Sask. SIF (CFI matching)	"A Scanning Transmission Electron Microscope for the University of Saskatchewan," Lead applicant with S. Yannacopoulos, R. Kerrich, J. Hendry, Y. Pan and R. Silerova	2000	$900,000
Industrial CFI funds: Ipsco Inc.	"A Scanning Transmission Electron Microscope for the University of Saskatchewan," Lead applicant with S. Yannacopoulos, R. Kerrich, J. Hendry, Y. Pan and R. Silerova	2000	$10,000

[1]Brown University was the lead institution on a "Multi-University Research Initiative" (MURI) program funded by AFOSR. A committee at Brown received proposals and budgets from researchers at other universities to participate in the research, and then allocated the money to these researchers.

Source	Project	Years	Amount
Industrial CFI funds: Hitachi Canadian Industries	"A Scanning Transmission Electron Microscope for the University of Saskatchewan," Lead applicant with S. Yannacopoulos, R. Kerrich, J. Hendry, Y. Pan and R. Silerova	2000	$65,000
Industrial CFI funds: Cameco Corp.	"A Scanning Transmission Electron Microscope for the University of Saskatchewan," Lead applicant with S. Yannacopoulos, R. Kerrich, J. Hendry, Y. Pan and R. Silerova	2000	$75,000
AECL	In-kind contribution of a 3-zone furnace for Instron tensile machine	2000	$15,000 (in kind)
USTEP	Summer student funding subsidy, for summer research assistant Anwar Upal	2000	$2080
U of Sask.	New Faculty Graduate Student Support Fund	1998	$12,000
NSERC Discovery	"Understanding the Effects of Microstructure on the Properties of Metals - An Atomistic Approach."	1998-2001	$25,100/year for 4 years
U of Sask.	"Atomic Scale Modeling of Tubular Void Growth in Zirconium."	1998	$5,000
U of Sask. College of Engineering	Start-Up Funds	1998	$5,500

CONTRIBUTIONS TO THE SUPERVISION AND TRAINING OF HQP

Current Graduate Students

Current Student	Degree	Topic	Dates
Mahshid Jafari	Ph.D.	Raman Spectroscopy of Lubricant Anti-Oxidants (co-supervisor: Jeff Manthorpe)	2023-
Cassia Barbosa Gomes	Ph.D.	Atomistic Simulation of Polymer Nanocomposites	2022-
Arnav Rana	Ph.D.	Anisotropic Fracture of Pipeline Steels (co-supervisor: Xin Wang)	2021-
Ali Shahrouzian	Ph.D.	Adsorption Thermal Storage Systems (co-supervisor: Jean Duquette)	2020-
Marianna Vieira	Ph.D.	Chemical Kinetics Models of Anti-Oxidant Degradation	2018-

Graduated Students (Carleton)

Graduated Student	Degree	Topic	Dates
Rafaela Aguiar	Ph.D.	Halloysite-Polyurethane Nanocomposites (co-supervisor: Oren Petel)	2017-21
John Rivada	M.Sc	Synthesis of Anti-Oxidant Byproducts (Co-supervisor: Jeff Manthorpe)	2019-21
Mohammadreza Heidari Pebdani	M.Sc.	Molecular Simulation of Halloysite-Polyurethane Nanocomposites	2017-21
Manura Liyanage	Ph.D.	Diffusion of Hydrogen in Metals (co-supervisor: Nimal Rajapakse)	2016-20
Niall McCallum	M.A.Sc.	Shear stability of viscosity index improvers	2015-18
Sean Romano	M.A.Sc.	Molecular Dynamics Simulation of Metallic Glasses	2017-19
Roxana Barcelo Singh	M.A.Sc.	Molecular Dynamics Simulation of Metallic Glasses	2014-16
Frederic Laforge	M.A.Sc.	Oil Oxidation (Industrial Partner: GasTOPS Ltd.)	2012-15
Nenad Vuksic	M.A.Sc.	Stress corrosion cracking in Zr	2010-14

Graduated Student	Degree	Topic	Dates
Rondy Fong (part-time) Co-supervisor: Henry Saari	Ph.D.	Hydrogen Absorption in Zirconium Alloys	2004-13
Behrouz Shiari	Ph.D.	Atomistic/Continuum Coupling	2004-09
Ishraq Shabib	Ph.D.	Parallel Molecular Dynamics Simulations	2005-09
Florin Saceleanu	M.A.Sc.	Computer modeling of internal combustion engines (Industrial partner: RSDesigns, Kemptville)	2010-13
Nicholas Giordano	M.A.Sc.	Emissions and efficiency of internal combustion engines (Industrial partner: RSDesigns, Kemptville)	2010-12
Aman Sandha	M.Eng.	Computational Geometry	2005-06
Ishraq Shabib	M.A.Sc.	Indentation of Nano-structured Multilayers	2003-05
YanJuan Zhou	M.A.Sc.	Dislocation nucleation in crystals	2003-05
Shallu Bhalla Co-Supervisor: P. Sundararajan	M.A.Sc.	Carbon nanotube-polymer composites	2002-04
Patrick Pei Co-Supervisor: P. Sundararajan	M.A.Sc.	Carbon nanotube-polymer composites	2001-03
Yemi Akangbe	M.A.Sc.	Dislocations in Ni-based superalloys	2001-03

Graduated Students (University of Saskatchewan)

Graduated Student	Degree	Topic	Dates
Robert Peace	M.A.Sc.	Void Growth in Zr Alloys	2000-02
Darryl McCullough Co-supervisor: S. Yannacopoulos	M.A.Sc.	Creep of 12CrMoVW Steels	1999-2002
Arun Pillai	M.A.Sc.	Bi-crystal fracture	1998-2000

Other HQP (Carleton):

Type	Name	Dates
Post-Doctoral Fellow	Alireza Rezvanpour	2020 -
	Shima Najafi Nobar	2021 – 2023

	Tim Mack	2020 - 2022
	Nuwan Dewapriya	2019 - 2022
	Khaled Sebakhy	2018 - 2019
	Yifan Yang	2015 - 2017
	Joshua Gibson	2014 – 2016
	Jean-Francois Joly	2013 – 2016
	Carlos Campana	May 2011 – Nov. 2013
	Carlos Campana (Co-supervisor: Kevin Boyle, Canmet, NRCan)	Jan. 2008 – Sept. 2008
	Denis Saraev	2003-2005
	Behrouz Shiari	2002-2004
	Shanti Singh (Co-supervisor: P.R. Sundararajan)	2002-2003
Undergraduate	Nicole Mutima	2021
	Hassan Ferdous	2016
	Fabian Erazo	2012
	Matthew Mou	2012
NSERC USRA	Jeffrey Teutsch	2009
	Craig Merrett	2005 & 2006
	Steve Kenny	2002
	Gillian Harris	2002
Visiting Scholar	Zheng (Nick) Liu	Sep. 2019 – May 2021
	Vijay Choyal	Dec. 2020 – Aug. 2022
	Ryo Kobyashi	Mar. 2011 – Aug. 2011
	Shishan Qiao	Oct. 2000 – Apr. 2001

Hashim A. Hashim Mohamed, Ph.D., P.Eng., SMIEEE

232 Beatrice Dr, Nepean, ON K2J-4P1 | Hashim.Mohamed@carleton.ca | +1-343-576-8055 | **carleton.ca/rncsl/**

PROFILE

- **Canadian / Egyptian**, P.Eng. of Ontario (PEO#: 100522684), and Senior Member of IEEE
- **Published**: 29 top rank peer-reviewed journals, 17 peer-reviewed international conferences, and 4 technical reports
- According to **Google Scholar**: Over 1,000 citations, an h-index of 19, and an i10-index of 27
- **Supervision** (in progress or completed): 3 PhD, 3 MASc, 1 MENG, and 7 UG - (See Section 8)
- **Grants**: Principal Investigator (PI) or co-PI in various grants (See Section 6)
- **Teaching**: Graduate / Undergraduate courses & Directed / Independent Studies (See Section 4)
- Experience with CEAB accreditation as a Member, Departmental accreditation committee (See Section 11)
- Associate Editor in Journals and Technical Committee Member in Conferences (See Section 11)

1. EDUCATION

Ph.D. **Robotics and Control, GPA (4/4)** **2016 - 2019**

Electrical and Computer Engineering,

Western University (**UWO**), London, ON, Canada (CA)

✍ Hashim A. Hashim Mohamed, "Nonlinear Attitude and Pose Filters with Superior Convergence Properties", **Ph.D**., University of Western Ontario, Jul.2019, Electronics Thesis and Dissertation Repository (6244).

M.Sc. **Systems and Control Engineering, GPA (3.9/4)** **2013 - 2014**

Systems Engineering,

King Fahd Univ of Petroleum & Minerals (**KFUPM**), Dhahran, Saudi-Arabia (SA).

✍ Hashim A. Hashim Mohamed, "Improved robust adaptive control of high-order nonlinear systems with guaranteed performance", **M.Sc**., King Fahd University Of Petroleum & Minerals, Dec.2014.

B.Sc. **Mechatronics Engineering - First Rank with Honour, GPA (3.85/4)** **2004 - 2009**

Mechanical Engineering,

Helwan University (**HU**), Cairo, Egypt (EG)

2. WEBLINKS

2.1 Professional

- **Personal Webpage**: https://carleton.ca/hhashim/
- **Lab Webpage**: https://carleton.ca/rncsl/
- **LinkedIn**: https://www.linkedin.com/in/h-a-hashim/

2.2 Academic

- **Google Scholar**: https://scholar.google.ca/citations?user=oHa3gFgAAAAJ&hl=en
- **ResearchGate**: https://www.researchgate.net/profile/Hashim-Hashim
- **ORCID**: https://orcid.org/0000-0003-2376-0603

2.3 Media (Education & Research Talks)

- **YouTube** (Over 47,000 Subscribers and 4.2 Million Views): https://www.youtube.com/c/HashimEduTech
  - Author's technical courses in: Control Systems, Artificial Intelligence, Digital Systems, Microcontrollers & Electronics, Programming, Automation and Servo Systems, CAD, etc.
  - Research talks presented in high-end conferences
  - Experimental implementation and results
  - Videos accessed by users from 150+ countries (source: YouTube Metrics)
- **Research Presentations**: https://carleton.ca/rncsl/media/

3. WORK EXPERIENCE

Assistant Professor (Tenure Track), **Jan.2022 - Present**
Department of Mechanical and Aerospace Engineering,
Carleton University, ON, Canada

Assistant Professor (Tenure Track) **Aug.2019 - Dec.2021**
Software Engineering, Department of Engineering and Applied Science,
Thompson Rivers University (TRU), BC, Canada

Teaching and Research Assistant, **Jan.2016 - Jul.2019**
Electrical and Computer Engineering,
Western University (UWO), ON, Canada

Lecturer Assistant, **Sep.2015 - Dec.2015**
Mechatronics, Department of Mechanical Engineering,
Helwan University, Cairo, Egypt

Teaching and Research Assistant, **Jan.2013 - Aug.2015**
Department of Systems Engineering,
King Fahd University of Petroleum & Minerals (KFUPM), Saudi-Arabia

Teaching Assistant, **Sep.2010 - Dec.2012**
Mechatronics, Department of Mechanical Engineering,
Helwan University, Cairo, Egypt

Systems Designer Engineer, **Aug.2009 - Aug.2010**
MISC Industrial Automation Systems, Cairo, Egypt

4. SUMMARY OF TEACHING EXPERIENCE

4.1 Publications in Education

- **H. A. Hashim**, C. Tatarniuk, and B. Harasymchuk, "First Year Engineering Design: Course Design, Projects, Challenges, and Outcomes," In Proc. of the the 2022 IEEE Frontiers in Education (FIE) (**IEEE FIE'22**) conference, Uppsala, Sweden, pp. 1-9, **2022**. (Grand Challenges in Engineering Education)

4.2 Courses Designed

- MECH 5906 Directed Study - Optimal Fitlering - (Graduate level) - Carleton University - 2023
- MECH 5804 - Applied Artificial Intelligence - (Graduate level) - Carleton University - 2022
- MECH 5906 Directed Study - Vision-based Perception Robotics - (Graduate level) - Carleton University - 2022
- AERO 4504 - Avionics - (Undergraduate level) - Carleton University - 2023
- EENG 3010 - Introduction to Control Systems - (Undergraduate level)- Thompson Rivers University - 2020
- CENG 2010 - Computer Architecture & Assembly Language - (Undergraduate level) - Thompson Rivers University - 2019
- ENGR 1100 - Engineering Design I - (Undergraduate level) - Thompson Rivers University - 2019

4.3 Courses Taught

Assistant Professor and Lecturer, Carleton Univ., ON, Canada **Jan.2022 - Present**

- MECH 5804 - Applied Artificial Intelligence - (Graduate level)
- MECH 5906 Directed Study - Optimal Fitlering - (Graduate level)
- MECH 5906 Directed Study - Vision-based Perception Robotics - (Graduate level)
- AERO 4504 - Avionics - (Undergraduate level)
- MAAE 3500 - Feedback Control Systems - (Undergraduate level)

Assistant Professor and Lecturer, TRU, BC, Canada **Aug.2019 - Dec.2021**

- EENG 3010 - Introduction to Control Systems - (Undergraduate level)
- CENG 2010 - Computer Architecture & Assembly Language - (Undergraduate level)
- ENGR 1100 - Engineering Design I - (Undergraduate level)

4.4 Capstone Projects (4th Year Students – 1 Year Project)

- 2022-2023 – Course number: ECOR4907A, Number of Students: 35

  Groups: Design Integration, Aerodynamics and Propulsion, Avionics and Flight Controls, and Safety.

  Title: "Advanced Aircraft Design Project", My Role: Leading Avionics and Flight Controls Group (7 students)

4.5 Teaching Evaluation Summaries

Overall Carleton summary (5 = Strongly Agree ; 4 = Agree ; 3 = Normal ; 2 = Disagree ; 1 = Strongly Disagree)

	Hashim Mohamed				Subject			Faculty		
	Term Year	AVG	SD	Response	AVG	SD	Response	AVG	SD	Response
MECH-5804F	Fall 2023	4.56	0.44	19 / 25	4.20	0.69	255 / 699	4.00	0.7	8370 / 22366
MECH-4504A	Winter 2023	4.39	0.43	22 / 31	3.99	0.67	437 / 1081	4.04	0.68	14070 / 39329
MECH-3500C	Winter 2023	4.00	0.55	17 / 44	3.94	0.78	1003 / 2767	4.04	0.68	14070 / 39329
MECH-5804F	Fall 2022	4.65	0.29	15 / 27	4.20	0.59	262 / 701	4.02	0.7	7821 / 21112

AVG = Average ; **SD** = Standard Deviation ; **Response** = Responded / Total Enrollment

Overall TRU summary (1 = Strongly Agree ; 2 = Agree ; 3 = Disagree ; 4 = Strongly Disagree)

- EENG 3010 (third year, first semster):
  Fall yr 2021 (Mean = 1.45 & STD = 0.54) ; Response rate 71%
  Winter yr 2020 (Mean = 1.56 & STD = 0.49) ; Response rate 100%
- CENG 2010 (second year, first semster):
  Fall yr 2019 (Mean = 1.44 & STD = 0.48) ; Response rate 45%
- ENGR 1100 (first year, first semster):
  Fall yr 2020 (Mean = 1.71 & STD = 0.58) ; Response rate 69%
  Fall yr 2019 (Mean = 1.64 & STD = 0.63) ; Response rate 58%

4.5. CERTIFICATE IN UNIVERSITY TEACHING AND LEARNING

Language of Difficult Conversations (8 hours), Western University, ON, CA	2019
The Language of Conference/Research Presentations (6 hours), Western University, ON, CA	2018
Teaching in The Canadian Classroom (16 hours), Western University, ON, CA	2017
Communication in The Canadian Classroom (16 hours), Western University, ON, CA	2017
Several workshops such as: potent presentation, getting feedback on teaching, and equal access in classroom	2016-2019

4.6. YouTube Online Full Courses

- AI Series: Evolutionary Techinques (Graduate)
- AI Series: ANN and Deep Learning (Graduate)
- Digital Logic Circuit (Undergraduate)
- Coding Microcontrollers with C (Undergraduate)
- Proteus Simulation for Electronics (Undergraduate)
- C/C++ Programming (Undergraduate)
- Maple Soft (Undergraduate)
- PLC and Servo (Undergraduate)
- AI Series: Fuzzy Logic Control (Graduate)
- Continuous Control System (Undergraduate)
- Assembly Language for Microcontrollers (Undergraduate)
- Basic Electronics (Undergraduate)
- Solidworks (Undergraduate)
- MATLAB and SIMULINK (Undergraduate)
- Python (Undergraduate)

5. MEMBERSHIP

1. P.Eng. of Ontario (PEO#: 100522684), 2022 - Present
2. Member of Carleton University Cybersecurity Deck, (2023 - Present) Here
3. IEEE Senior Member, 2021 - Present
4. IEEE Control Systems Society, 2021 - Present

6. GRANTS AND PROJECTS

Note: PI = Principle Investigator. Total awarded funding = $413,500 CAD

6.1 Awarded Grants

G07. - Funding Agency Name: National Research Council (NRC) Canada **2023-2025**
- Funding Type: Contract - Flight Research Laboratory (FRL), Aerospace Research Center (ARC)
- Role: **PI**, Status: **Awarded**, Amount: **$100,000.00** (**%100**), Applicants: 1, Competitive: YES
- Title: Development of AI-based Advanced Motion Planning Algorithms for a Full-scale Helicopter,

G06. - Funding Agency Name: NSERC of Canada **2022-2027**
- Funding Type: NSERC Discovery Grants
- Role: **PI**, Status: **Awarded**, Amount: **$145,000** (**%100**), Co-Applicants: None, Competitive: YES
- Title: Advanced Navigation Solutions for UAV Autonomous Mobility,

G05. - Funding Agency Name: NSERC of Canada **2022-2027**
- Funding Type: NSERC Discovery Launch Supplements
- Role: **PI**, Status: **Awarded**, Amount: **$12,500** (**%100**), Co-Applicants: None, Competitive: YES
- Title: Advanced Navigation Solutions for UAV Autonomous Mobility,

G04. - Funding Agency Name: Mitacs **2022**
- Funding Type: Business Strategy Internship, Industry Partner: HOVER.DIRECT Inc.
- Role: **PI**, Status: **Awarded**, Amount: **$15,000** (**%100**), Co-Applicants: None, Competitive: YES
- Title: Hover Drone Delivery Operations BSI,

G03. - Funding Agency Name: Carleton University **2022-2025**
- Funding Type: Dean's Office and Department of Mechanical and Aerospace Engineering
- Role: **PI**, Status: **Awarded**, Amount: **$85,000** (**%100**), Co-Applicants: None, Competitive: NO
- Title: Carleton University start-up research grant.

G02. - Funding Agency Name: Ministry of Health **2021-2022**
- Funding Type: Interior Universities Research Coalition, British Columbia
- Role: **Co-PI**, Status: **Awarded**, Amount: **$50,000** (**%33**), Applicants: 3, Competitive: YES
Dr. Mohamed Shehata (PI) UBC-Okanagan, Dr. Jocelyn Srigley (Co-Applicant)
- Title: The Effect of Technology-Based Hand Hygiene Compliance Monitoring in Long-Term Care Facilities.

G01. - Funding Agency Name: Thompson Rivers University **2020-2021**
- Funding Type: Thompson Rivers University Internal Research Fund,
- Role: **PI**, Status: **Awarded**, Amount: **$6,000** (**%100**), Co-Applicants: None, Competitive: YES
- Title: Fast Adaptation for Pose and SLAM Estimation,

6.2 Awarded Mitacs Globalink (MG) (Projects) - PI, Co-Applicants: None, Competitive: YES

MG06. Artificial Neural Network (ANN) Intelligent Localization methods for UAVs, **Awarded** **2024**
International Student: Saurabh Prajapati, Countery: India

MG05. Deep Convolutional Neural Network Mechanisms for Wind Prediction and Safe UAV Flights, **Awarded** **2024**
International Student: Jaime Tenbrinke, Countery: India

MG04. Immune Cells Classification Using Deep Neural Networks, **Awarded** (Student Declined) **2024**

MG03. Out-of-Distribution Neural Networks Detection for Drone Perception, **Awarded** **2023**
International Student: Sachin Bhadang, Countery: India

MG02. Reinforcement Learning for Unmanned Vehicles Rendezvous and Docking, **Awarded** **2023**
International Student: Aryaman Gupta, Countery: India

MG01. Intelligent Localization Systems for UAVs Using Neural Learning, **Awarded** (Student Declined) **2023**
International Student: Arka Pal , Countery: India

6.3 Unsuccessful Mitacs Globallink Projects

MG02. UAV Perception based on Neural Networks Out-of-Distribution **2024**

MG01. UAVs Rendezvous and Docking using Reinforcement Learning **2024**

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7. Research Collaborations (Past and Present)

7.1 Carleton Connections

- Dr. Mojtaba Ahmadi, equipment grant related to aerial manipulation for drones with hands-on applications, (see Section 6.2)
- Dr. Mehdi Pouragha, research grant related to distributed control of multi-agent micro-robots for smart granular soil, (see Section 6.2)

7.2 External Academic Connections

- Dr. Mohamed Shehata, joint research project related to Hand Hygiene Compliance Monitoring, (Awarded $50,000 for a research grant from Interior Universities Research Coalition, BC as a Co-PI, see G02 Section 6)

8. STUDENT SUPERVISION

PhD - Doctoral student; MASc - Master's of Applied Science student; MENG - Master's of Engineering student; UG - Undergraduate student

	Completed		In Progress		Total
	Supervised	Co-Supervised	Supervised	Co-Supervised	
Post Doc	0	0	0	0	**0**
PhD	0	0	3	0	**3**
MASc	1	0	2	0	**3**
MENG	1	0	0	0	**1**
UG + Research	7	0	0	0	**7**
Total	**9**	**0**	**5**	**0**	**14**

8.1 In Progress: Graduate / Undergraduate Students at Carleton

Student Name	Research Topic	Comments
In Progress Students at Carleton		
PhD		
Fatemeh Zamani PH3. 2023 - 2027	Learning-based MPC for UAVs	- Supervisor Co-supervisor: C. Shen
Ali M. Ali PH2. 2023 - 2027	Target tracking and UAV relative localization	- Supervisor
Hussein Naser PH1. 2022 - 2026	Control of Robotic Assistive Devices	- Supervisor Co-supervisor: M. Ahmadi

Student Name	Research Topic	Comments
In Progress Students at Carleton		
MASc		
Noor Kamra MS3. 2023 - 2025	Relative localization for UAVs	- Supervisor
Khashayar Ghanizadegan MS2. 2023 - 2025	Advanced stochastic vision aided navigation algorithms for multi-UAV missions	- Supervisor

8.2 Completed Students at Carleton: Graduate / Undergraduate Students

Student Name	Research Topic	Comments
Completed Students at Carleton		
MASc		
Arezo Shevidi MS1. 2022 - 2024	Quaternion Sliding Mode-based Backstepping Control Design for Quadrotors in the Presence of Unknown Uncertainties	- Supervisor

Student Name	Research Topic	Comments
Completed Students at Carleton		
MENG		
Aditya Jonnalagadda MENG1. 2023	Wildfire Prediction using Deep Neural Network	- Supervisor

Student Name	Research Topic	Comments
Completed Students at Carleton		

UG		
Sachin Bhadang UG7. Summer 2023	Out-of-Distribution Neural Networks Detection for Drone	- Supervisor
Aryaman Gupta UG6. Summer 2023	Intelligent Localization Systems for UAVs Using Neural Learning	- Supervisor
Moise Mwema UG5. Summer 2022	QUEST-based Kalman filter and LQR for Satellite Attitude Control	- Supervisor

8.3 Completed Students Outside Carleton: Graduate / Undergraduate Students

Student Name	Research Topic	Comments
Completed Students at Thompson Rivers University		
UG		
Murium Tawhid UG4. Summer 2021	Nonlinear estimation for SLAM on the Lie Group	- Supervisor
Ajay Singh UG3. Summer 2021	Vision-aided Navigation	- Supervisor - Awarded TRU travel Grant
Trevor Drayton UG2. Summer 2020	Fast Adaptation Nonlinear Observer for SLAM	- Supervisor - Awarded TRU travel Grant
Trenton S. Sieb UG1. Summer 2020	FLC tuned with Gravitational Search Algorithm for Nonlinear Pose Filter	- Supervisor

8.4 Students Awards

- Ali M. Ali, Best Presentation Award in 2023 IEEE World AI IoT Congress (AIIoT) (**2023**)
- Ajay Singh (UG), Awarded TRU Travel Grant (**2021**)
- Trevor Drayton (UG), Awarded TRU Travel Grant (**2020**)

9. RESEARCH INTERESTS

- Guidance, navigation, and control,
- Vision-aided inertial navigation systems,
- Robot localization and mapping with inertial vision systems,
- Filtering and estimation solutions: stochastic and deterministic,
- Sensor fusion,
- Distributed control of multi-agent systems,
- Artificial intelligence, optimization techniques and metaheuristic algorithms (single and multi objective),
- Deep learning tools.

10. PUBLICATIONS: HQP=Supervised Trainee, J# = Journal, C# = Conference, R# = Technical Report

Published		
Journal Articles	**Conference Proceedings**	**Technical Reports**
29	**17**	**4**

UNDER-REVIEW

U A. M. Ali, A. Gupta, and H. A. Hashim, "Deep Reinforcement Learning for Sim-to-Real Policy Transfer of VTOL-UAVs Offshore Docking Operations," Applied Soft Computing, pp. 1-11, 2024. (Manuscript Number: ASOC-D-23-07015)

U A. V. Jonnalagadda, and H. A. Hashim, "SegNet: A Segmented Deep Learning based Convolutional Neural Network Approach for Drones Wildfire Detection," Remote Sensing Applications: Society and Environment, pp. 1-26, 2024. (Manuscript Number: RSASE-D-23-01416.R1) Major Revision

U D. Wanner, H. A. Hashim, S. Srivastava, and A. Steinhauer, "UAV Avionics Safety and Certification, Accidents, Redundancy, Integrity and Reliability: A Comprehensive Review," Drone Systems and Applications, pp. 1-20, 2024. (Manuscript Number: dsa-2023-0091.R1) (Out of course supervision AERO 4504 Avionics Systems) Major Revision

U A. M. Ali, C. Shen, and H. A. Hashim, "A Linear MPC with Control Barrier Functions for Differential Drive Robots," IET Control Theory and Applications, pp. 1-13, 2024. (Manuscript Number: CTA-2023-11-0412.R1) Major Revision

U L. Tirel, A. M. Ali, and H. A. Hashim, "Multi Agent Deep Reinforcement Learning to Optimize Industrial Assembly Lines," IEEE Transactions on Artificial Intelligence, pp. 1-11, 2024. (Manuscript Number: TAI-2023-Aug-A-00728.R2) Major Revision

U A. Shevidi, and H. A. Hashim, "Robust Quaternion-based Adaptive Backstepping Fast Terminal Sliding Mode Control for Quadrotor UAVs," International Journal of Systems Science, pp. 1-16, 2024. (Manuscript Number: 235303257)

U A. E.E. Eltoukhy, H. A. Hashim, M. Hussein, S.H. Chung, and T. Zayed, "Mixed-Integer Linear Programming for Optimum Route Planning in Modular Integrated Construction," Automation in Construction, January, 2022. (Manuscript Number: AUTCON-D-21-01376)

PUBLISHED

2024

J29 **H. A. Hashim**, A. E.E. Eltouckhy, and K. G. Vamvoudakis, "UWB Ranging and IMU Data Fusion: Overview and Nonlinear Stochastic Filter for Inertial Navigation," IEEE Transactions on Intelligent Transportation Systems, Vol. 25, No. 1, pp. 359-369, **2024**. ***IEEE***

J28 **H. A. Hashim** and K. G. Vamvoudakis, "Adaptive Neural Network Stochastic-Filter-based Controller for Attitude Tracking with Disturbance Rejection," IEEE Transactions on Neural Networks and Learning Systems, Vol. 35, No. 1, pp. 1217-1227, **2024**. ***IEEE***

C17 A. Shevidi and **H. A. Hashim**, "Adaptive Backstepping and Non-singular Sliding Mode Control for VTOL-UAVs with Unknown Time-varying Uncertainties," In Proc. of the 2024 IEEE American Control Conference (**IEEE ACC'24**), Toronto, Ontario, Canada, pp. 1-7, **2024**. (Top Technical Control Conference)

C16 A. M. Ali, **H. A. Hashim**, and C. Shen, "MPC for Safety-Critical Tracking of VTOL-UAVs," In Proc. of the 2024 IEEE American Control Conference (**IEEE ACC'24**), Toronto, Ontario, Canada, pp. 1-6, **2024**. (Top Technical Control Conference)

2023

J27 **H. A. Hashim,** A. E.E. Eltouckhy, and A. Odry, "Observer-based Controller for VTOL-UAVs Tracking using Direct Vision-Aided Inertial Navigation Measurements," ISA Transactions, Vol. 137, pp. 133-143, **2023**. ***Elsevier***

J26 M. Abouheaf, **H. A. Hashim**, M. Mayyas, and K. G. Vamvoudakis, "An Online Model-Following Projection Mechanism Using Reinforcement Learning," IEEE Transactions on Automatic Control, Vol. 68, No. 11, pp. 6959-6966, **2023**. ***IEEE***

J25 W. Al-Masri, A. Wadi, M. F. Abdel-Hafez, **H. A. Hashim**, and A. El-Hag, "Partial Discharge Localization in Power Transformers Using Invariant Extended Kalman Filter ," IEEE Transactions on Instrumentation and Measurement, Vol. 72, No. 1, pp. 1-10, **2023**. ***IEEE***

J24 O. Chamberland, M. Reckzin, and **H. A. Hashim**, "An Autoencoder with Convolutional Neural Network for Surface Defect Detection on Cast Components," Journal of Failure Analysis and Prevention, Vol. 23, No. 4, pp. 1633-1644, **2023**. ***Springer*** (Out of course project supervision MECH 5804 - Applied Artificial Intelligence)

J23 **H. A. Hashim**, "Exponentially Stable Observer-based Controller for VTOL-UAV without Velocity Measurements," International Journal of Control, Vol. 96, No. 8, pp. 1946-1960, **2023**. ***Taylor & Francis***

J22 A. Wadi, M. F. Abdel-Hafez, **H. A. Hashim**, and A. A. Hussein, "An Invariant Method for Electric Vehicle Battery State-of-Charge Estimation Under Dynamic Drive Cycles," IEEE Access, Vol. 11, pp. 8663-8673, **2023**. ***IEEE***

C15 **H. A. Hashim**, A. E.E. Eltouckhy, and K. G. Vamvoudakis, "Nonlinear Observer for Inertial Navigation using Ultra-wideband and IMU Sensor Fusion," In Proc. of the 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IEEE IROS'23**), Detroit, Michigan, USA, pp. 3085-3090, **2023**. (Top Technical Robotics Conference)

C14 M. Abouheaf, K. G. Vamvoudakis, M. Mayyas, and **H. A. Hashim**, "An Observer-Based Reinforcement Learning Solution for Model-Following Problems," In Proc. of the 62th IEEE Conference on Decision and Control (**IEEE CDC'23**), Marina Bay Sands, Singapore, pp.1-8, **2023**. (**Invited Paper** - Top Technical Control Conference)

2022

J21 **H. A. Hashim**, M. Abouheaf, and K. G. Vamvoudakis, "Neural-adaptive Stochastic Attitude Filter on SO(3)," IEEE Control Systems Letters, Vol. 6, No. 1, pp. 1549-1554, **2022**. ***IEEE*** (This paper was presented at the Top Technical American Control Conference)

J20 **H. A. Hashim** and A. E.E. Eltouckhy, "Nonlinear Filter for Simultaneous Localization and Mapping on a Matrix Lie Group Using IMU and Feature Measurements," IEEE Transactions on Systems, Man, and Cybernetics: Systems, Vol. 52, No. 4, pp. 2098-2109, **2022**. ***IEEE***

J19 **H. A. Hashim** and A. E.E. Eltouckhy, "Landmark and IMU Data Fusion: Systematic Convergence Geometric Nonlinear Observer for SLAM and Velocity Bias," IEEE Transactions on Intelligent Transportation Systems, Vol. 23, No. 4, pp. 3292-3301, **2022**. ***IEEE***

C13 A. Odry, I. Kecskes, D. Csik, **H. A. Hashim**, and P. Sarcevic, "Adaptive Gradient-Descent Extended Kalman Filter for Pose Estimation of Mobile Robots with Sparse Reference Signals," In Proc. of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IEEE IROS'22**), Kyoto, Japan, pp. 4010-4017, **2022**. (Top Technical Robotics Conference)

C12 M. Mwema and **H. A. Hashim**, "QUEST-based Kalman filter and LQR for Satellite Attitude Control," In Proc. of the 10th IEEE International Conference on Control, Mechatronics and Automation (**IEEE ICCMA'22**), Luxembourg, Luxembourg, pp. 135-141, **2022**.

C11 **H. A. Hashim**, C. Tatarniuk, and B. Harasymchuk, "First Year Engineering Design: Course Design, Projects, Challenges, and Outcomes," In Proc. of the the 2022 IEEE Frontiers in Education (FIE) (**IEEE FIE'22**) conference, Uppsala, Sweden, pp. 1-9, **2022**. (Grand Challenges in Engineering Education)

C10 M. Labbadi, **H. A. Hashim**, A. E.E. Eltoukhy, and M. Djemai, "Barrier Function-based Adaptive Nonsingular Fast Terminal Sliding Mode Control for Disturbed UAVs," In Proc. of the 2022 IEEE European Control Conference (**IEEE ECC'22**), London, United Kingdom, pp. 975-980, **2022**. (Top Technical Control Conference)

2021

J18 **H. A. Hashim**, M. Abouheaf, and M. A. Abido, "Geometric Stochastic Filter with Guaranteed Performance for Autonomous Navigation based on IMU and Feature Sensor Fusion," Control Engineering Practice, Vol. 116, pp. 104926, **2021**. ***Elsevier*** (Featured Article September 2022 by Control Engineering Practice)

J17 **H. A. Hashim**, "A Geometric Nonlinear Stochastic Filter for Simultaneous Localization and Mapping," Aerospace Science and Technology, Vol. 111, pp. 106569, **2021**. ***Elsevier***

J16 **H. A. Hashim**, "Guaranteed Performance Nonlinear Observer for Simultaneous Localization and Mapping," IEEE Control Systems Letters, Vol. 5, No. 1, pp. 91-96, **2021**. ***IEEE***

J15 **H. A. Hashim**, and F. L. Lewis, "Nonlinear Stochastic Estimators on the Special Euclidean Group SE(3) using Uncertain IMU and Vision Measurements," IEEE Transactions on Systems, Man, and Cybernetics: Systems, Vol. 51, No. 12, pp. 7587-7600, **2021**. ***IEEE***

J14 **H. A. Hashim**, L. J. Brown, and K. McIsaac, "Nonlinear Pose Filters on the Special Euclidean Group SE(3) with Guaranteed Transient and Steady-state Performance," IEEE Transactions on Systems, Man, and Cybernetics: Systems, Vol. 51, No. 5, pp. 2949-2962, **2021**. ***IEEE***

C9 A. Singh, M. Tawhid, and **H. A. Hashim**, "Nonlinear Observer for Inertial Navigation and Bias Estimation with Guaranteed Performance," In Proc. of the 24th IEEE International Conference on Intelligent Transportation Systems (**IEEE ITSC'21**), Indianapolis, IN, United States, USA, pp. 3405-3411, **2021**. (Top Technical Intelligent Transportation Conference)

C8 **H. A. Hashim**, "Asymptotically Stable Observer-based Controller for Attitude Tracking with Systematic Convergence ," In Proc. of the 25th IEEE International Conference on System Theory, Control and Computing (**IEEE ICSTCC'21**), Iasi, Romania, pp. 39-45, **2021**.

C7 M. Tawhid, A. Singh, and **H. A. Hashim**, "Stochastic Observer for SLAM on the Lie Group," IFAC-PapersOnLine, Vol. 54, No. 20, pp. 759-764, (**IFAC'21**), Texas, USA, **2021**.

C6 **H. A. Hashim**, "GPS-denied Navigation: Attitude, Position, Linear Velocity, and Gravity Estimation with Nonlinear Stochastic Observer," In Proc. of the 2021 IEEE American Control Conference (**IEEE ACC'21**), New Orleans, Louisiana, USA, pp. 1146-1151, **2021**. (Top Technical Control Conference)

2020

J13 **H. A. Hashim**, "Systematic Convergence of Nonlinear Stochastic Estimators on the Special Orthogonal Group SO(3)," International Journal of Robust and Nonlinear Control, Vol. 30, No. 10, pp. 3848-3870, **2020**. ***Wiley***

C5 T. P. Drayton, A. Jaiyeola, N. Hoque, M. Maurer, and **H. A. Hashim**, "Fast Adaptation Nonlinear Observer for SLAM," In Proc. of the 24th IEEE International Conference on System Theory, Control and Computing (**IEEE ICSTCC'20**), Sinaia, Romania, pp. 495-500, **2020**.

C4 A. Singh, T. S. Sieb, J. H. Howe, and **H. A. Hashim**, "Nonlinear Attitude Filter on SO(3): Fast Adaptation and Robustness," In Proc. of the 16th IEEE International Conference on Automation Science and Engineering (**IEEE CASE'20**), Hong Kong, pp. 869-874, **2020**.

C3 T. S. Sieb, A. Singh, L. Guidos, and **H. A. Hashim**, "FLC tuned with Gravitational Search Algorithm for Nonlinear Pose Filter," In Proc. of the 2020 IEEE International Conference on Systems, Man, and Cybernetics (**IEEE SMC'20**), Toronto, Canada, pp. 2864-2869, **2020**.

R4 **H. A. Hashim**, "Attitude Determination and Estimation using Vector Observations: Review, Challenges and Comparative Results," pp. 1 – 51, **2020**.

R3 **H. A. Hashim**, "Special Orthogonal Group SO(3), Euler Angles, Angle-axis, Rodriguez Vector and Unit-quaternion: Overview, Mapping and Challenges," pp. 1 – 52, **2020**.

2019

J12 **H. A. Hashim**, L. J. Brown, and K. McIsaac, "Nonlinear Stochastic Position and Attitude Filter on the Special Euclidean Group 3," Journal of the Franklin Institute, Vol. 356, No. 7, pp. 4144-4173, **2019**. ***Elsevier***

J11 **H. A. Hashim**, L. J. Brown, and K. McIsaac, "Nonlinear Stochastic Attitude Filters on the Special Orthogonal Group 3: Ito and Stratonovich," IEEE Transactions on Systems, Man, and Cybernetics: Systems, Vol. 49, No. 9, pp. 1853-1865, **2019**. ***IEEE***

J10 **H. A. Hashim**, S. El-Ferik, and F. L. Lewis, "Neuro-adaptive cooperative tracking control with prescribed performance of unknown higher-order nonlinear multi-agent systems," International Journal of Control, Vol. 92, No. 2, pp. 445-460, **2019**. ***Taylor & Francis***

J9 **H. A. Hashim** and M. A. Abido, "Location Management in LTE Networks using Multi-Objective Particle Swarm Optimization," Computer Networks, Vol. 157, No. 1, pp. 78-88, **2019**. ***Elsevier***

J8 E. Aqeeli, **H. A. Hashim**, A. Haque, and A. Shami, "Optimal Location Management in LTE Networks using Evolutionary Techniques," International Journal of Communication Systems, Vol. 32, No. 15, e4100, **2019**. ***Wiley***

J7 **H. A. Hashim**, L. J. Brown, and K. McIsaac, "Guaranteed Performance of Nonlinear Attitude Filters on the Special Orthogonal Group SO(3)," **IEEE Access**, Vol. 7, No. 1, pp. 3731-3745, **2019**. ***IEEE***

C2 **H. A. Hashim**, L. J. Brown, and K. McIsaac, "Guaranteed Performance of Nonlinear Pose Filter on SE(3)," In Proc. of the 2019 IEEE American Control Conference (**IEEE ACC'19**), Philadelphia, PA, USA, pp. 1108-1113, **2019**. (Top Technical Control Conference)

R2 **H. A. Hashim**, "Distributed Adaptive Consensus Control of High Order Unknown Nonlinear Networked Systems with Guaranteed Performance," pp. 1 – 11, **2019**.

2018

J6 S. El-Ferik, **H. A. Hashim**, and F. L. Lewis, "Neuro-Adaptive Distributed Control With Prescribed Performance for the Synchronization of Unknown Nonlinear Networked Systems," IEEE Transactions on Systems, Man, and Cybernetics: Systems, Vol. 48, No. 12, pp. 2135-2144, **2018**. ***IEEE***

J5 B. Ayinde and **H. A. Hashim**, "Energy-efficient Deployment of Relay Nodes in Wireless Sensor Networks using Evolutionary Techniques," International Journal of Wireless Information Networks, Vol.25, No.2, pp.157-172, **2018**. ***Springer***

C1 **H. A. Hashim**, L. J. Brown, and K. McIsaac, "Nonlinear Explicit Stochastic Attitude Filter on SO(3)," In Proc. of the 57th IEEE Conference on Decision and Control (**IEEE CDC'18**), Miami Beach, FL, USA, pp.1210-1216, **2018**. (Top Technical Control Conference)

2015-2017

J4 **H. A. Hashim**, S. El-Ferik, and F. L. Lewis, "Adaptive synchronisation of unknown nonlinear networked systems with prescribed performance," International Journal of Systems Science, Vol. 48, No. 4, pp.885-898, **2017**. ***Taylor & Francis***

R1 **H. A. Hashim**, S. El-Ferik, B. Ayinde, and M. Abido, "Optimal Tuning of Fuzzy Feedback filter for L1 Adaptive Controller Using Multi-Objective Particle Swarm Optimization for Uncertain Nonlinear MIMO Systems," arXiv preprint arXiv: 1710.05423, pp. 1-13, **2017**.

J3 **H. A. Hashim**, B. Ayinde, and M. Abido, "Optimal placement of relay nodes in wireless sensor network using artificial bee colony algorithm," Journal of Network and Computer Applications, Vol.64, No.21, pp. 239-248, **2016**. ***Elsevier***

J2 **H. A. Hashim**, S. El-Ferik, and M. A. Abido, "A fuzzy logic feedback filter design tuned with PSO for $\mathcal{L}_1$ adaptive controller," Expert Systems with Applications, Vol. 42, No. 23, pp. 9077-9085, **2015**. ***Elsevier***

J1 **H. A. Hashim** and M. Abido, "Fuzzy Controller Design Using Evolutionary Techniques for Twin Rotor MIMO System: A Comparative Study," Computational intelligence and neuroscience, vol.2015, Article ID 704301, pp.1-11, **2015**.

10.1 Research Media on YouTube

Complete playlist

- https://youtube.com/playlist?list=PLhx4zaYkEjI8gK-aFkgy36b14rjd4Jpa0

Some Research talks/videos at international events by date of presentation

- 2023 OCT (IEEE IROS'23 USA) – Hashim – Navigation Observer using UWB and IMU: https://youtu.be/snj-m7H8itk
- 2022 NOV (IEEE IROS'22 Japan) – Akos – Pose Estimation Mobile Robots: https://youtu.be/tnvQL6gQZOc
- 2022 NOV (IEEE ICCMA'22 Luxembourg) – Moise – QUEST-based Kalman filter and LQR: https://youtu.be/Gv8ykbikp-I
- 2022 NOV (IEEE FIE'22 Sweden) – Catherine – First Year Engineering Design: https://youtu.be/98rbKKN59NE
- 2022 JUN (IEEE ACC'22 USA) – Hashim – Neural Stochastic Attitude Filter: https://youtu.be/oK22We1wlzs
- 2021 OCT (IEEE ICSTCC'21 Romania) – Hashim – Observer-based Controller for Attitude: https://youtu.be/iVbbZPs_3kc
- 2021 SEP (IEEE ITSC'21 USA) – Ajay – Navigation Deterministic Filter: https://youtu.be/nqNroZQHOko
- 2021 SEP (IFAC MECC'21 USA) – Marium – SLAM Stochastic Filter: https://youtu.be/k4GGCNtyS34
- 2021 AUG (Cont. Eng. Prac. Elsevier) – Navigation Experimental Validation: https://youtu.be/ISUsnQbvz74
- 2021 MAY (IEEE ACC'21 USA) – Hashim – Navigation Stochastic Observer: https://youtu.be/Jb4JlueFQ2c
- 2020 OCT (IEEE ICSTCC'20 Romania) – Trevor – SLAM Observer: https://youtu.be/8C49kVdewQM
- 2020 OCT (IEEE SMC'20 Canada) – Trenton – Pose Filter: https://youtu.be/5cWtTUny8XY
- 2020 AUG (IEEE CASE'20 Hong Kong) – Ajay – Attitude Estimation: https://youtu.be/MEScsm9qNC4

11. ADMINISTRATIVE DUTIES

Since staring my academic career, I have been examiner on (11 (Carleton) + 4 (Outside Carleton)) Thesis Committee (MASc, PhD Proposal, and PhD Defense)

At Carleton			
Student Name	**Role**	**Supervisor**	**Topic**
12. Mary Patrick, MASc Defense, Jan-2024	Defence Chair	Jeremy Laliberte and Xin Wang	Bio-Inspired Adaptive Control of Robotic Manipulators for Space Debris Removal and On-Orbit Servicing
11. Aron Mohammadi, MASc Defense, Jan-2024	Internal Examiner	Xiao Huang and Richard Kearsey	Characterization and Performance Evaluation of High Entropy Nitride Coatings Produced by Cathodic Arc Evaporation
10. Farzad Roozitalab, PhD Comprehensive, Aug-2023	Internal Examiner	Kristen Schell	Machine Learning Approaches for Improved Wind Power Forecasting: Insights from Meteorological Feature Extraction
9. Steffan Lloyd, MASc Defense, May-2023	Internal Examiner	Mojtaba Ahmadi	Precision Robotic Machining: Modelling and Control Innovations for Improved Performance
8. Alexandra Lothrop, MASc Defense, May-2023	Defence Chair	Xiao Huang	Characterization and Performance Evaluation of High Entropy Nitride Coatings Produced by Cathodic Arc Evaporation
7. Alexsander Costa, MASc Defense, Jan-2023	Internal Examiner	Jeremy Laliberte	Deep Learning and Synthetic Imagery for Migratory Bird Species Identification Using Drones
6. Padmassun Rajakareyar, MASc Defense, Dec-2022	Defence Chair	Mostafa El-Sayed	Thermo-Elastic Mechanics of Morphing Lattice Structures with Application in Shape Optimization of BLI Engine Intakes
5. Mahboubeh Zarei, PhD Comprehensive, Sep-2022	Internal Examiner	Robin Chhabra	Fault and Anomaly Detection and Isolation in Wheeled Mobile Robots Using Symmetric Track Fusion in a Network of Sensors
4. Masoud Karimi, PhD Comprehensive, Jun-2022	Internal Examiner	Mojtaba Ahmadi	An Adaptable Framework for the Control of Robotic Assistive Devices
3. Borna Monazzah, PhD Comprehensive, May-2022	Internal Examiner	Robin Chhabra	A Geometric Approach to Robust Control of Orbital Manipulators for Non-Cooperative Debris Mitigation
2. Hannah Thomson, MASc Defense, May-2022	Internal Examiner	Oren Patel	A Methodology to Evaluate Strain within Tissue Slabs under Complex Loading
1. Nick Berezny, PhD Comprehensive, Nov-2021	Internal Examiner	Mojtaba Ahmadi	Integration of a user-adaptive control system for stroke rehabilitation robotics

Outside Carleton			
Student Name	**Role**	**Supervisor**	**Topic**
4. Alfa Budiman, MSc Defense, Nov-2023	External Examiner	Pierre Payeur and Eric Lanteigne	Optimized Task Coordination for Heterogenous Multi-Robot Systems, University of Ottawa, Canada
3. Sadia Zannat, MSc Defense, Oct-2022	External Examiner	Mohamed Tawhid	A Novel Hybrid Metaheuristic Algorithm for Solving Feature Selection Problem, Thompson Rivers University, Canada
2. Eranga Fernando, PhD Defense, Aug-2022	External Examiner	George Mann and Oscar De-Silva	Range Assisted Inertial Navigation System for Multi-Rotor Micro Aerial Vehicles, Memorial Univ. of Newfoundland, Canada

1. Abdulrazak Elzaidi, PhD Defense, Dec-2021	External Examiner	Vlastimil Masek	Marine Icing Sensor Array for Measuring Ice Thickness, Memorial Univ. of Newfoundland, Canada

11.1 Committee / Admin Activities

Departmental Tenure & Promotion Committee **Apr.2023-Present**
Dept. of Mechanical and Aerospace Engineering, Carleton University, ON, Canada

Committee Member of Newly Established Mechatronics Program **May.2023-Dec.2023**
Carleton University, ON, Canada

Curriculum Committee (MECH, BIOM) **Apr.2022-Present**
Dept. of Mechanical and Aerospace Engineering, Carleton University, ON, Canada

Dynamics and Controls Strand Committee, **Apr.2022-Present**
Dept. of Mechanical and Aerospace Engineering, Carleton University, ON, Canada

Chair of Engineering Design Committee **Sep.2019-Dec.2021**
Dept. of Engineering and Applied Science, TRU, BC, Canada,
- Presented Engineering Design Committee work to CEAB.
- Review, provide guidance, and approve engineering design project proposals in accordance with CEAB.
- Review engineering design work of students to facilitate continual improvement process.

Member of Engineering Accreditation Board **Sep.2019-Dec.2021**
Dept. of Engineering and Applied Science, TRU, BC, Canada,
- Understand CEAB Graduate Attributes (GAs) and contribute to defining of GA indicators (GAIs).
- Map GA and GAIs to course learning outcomes.
- Participate in accreditation data collections.
- Helped the program in CAEB presentations: preparation, filming, and video editing.

Member of Recruitment & Retention Committee **Sep.2019-Dec.2021**
Dept. of Engineering and Applied Science, TRU, BC, Canada,
- Designed promotional videos posted on university website, YouTube, Instagram, and FB.
- Reach out to high schools and represented the new program in several events.
- Invited and gave short educational tutorials to high school students about software engineering.

11.3 Adjudication Activities

- Undergraduate Research Apprenticeship fund applications (NSERC USRA and UREAP), TRU, BC, CA, **2021- 2022**
- Norkam Secondary School, Fall Semester Projects, Kamloops, BC, CA, **2019**

11.4 External Activities

11.4.1 NSERC and other granting bodies Below

I highlight reviewer activity for Grant Reviews, only high-level information is provided to ensure confidently of the applicants

- NSERC Discovery Grant - Reviewer
- Mitacs Accelerate - Reviewer

11.5 Associate Editor

[E3]. IEEE Canadian Journal of Electrical and Computer Engineering, **2021- Present**
[E2]. IET Cyber-systems and Robotics, **2021- Present**
[E1]. Journal of Drone Systems and Applications, published by Canadian Science Publishing (former NRC Research Press), **2022- Present**

11.6 Technical Program Committee

[C1]. DroNet 2022 - 8th ACM, Portland, Oregon, USA **2022**

11.7 Journal & Conference Reviewer

Journals: IEEE Transactions on Cybernetics, IEEE Transactions on Systems, Man, and Cybernetics: Systems, IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Automatic Control, International Journal of Robust and Nonlinear Control, Aerospace Science and Technology, IET Control Theory and Applications, IEEE Robotics and Automation Letters (RA-L), Journal of the Franklin Institute, Neurocomputing, IET Radar, Sonar & Navigation, Asian Journal Control, International Journal of Control, International Journal of Systems Science, Nonlinear Dynamics, IEEE Access, ...

Conferences: IEEE Conference on Decision and Control (CDC), IEEE American Control Conference (ACC), IEEE European Control Conference (ECC), several conferences sponsored by International Federation of Automatic Control (IFAC), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE International Conf. on Automation Science and Engineering (CASE), IEEE International Conf. on Intelligent Transportation Systems, Asian Control Conference (ASCC), ...

12. OTHERS

12.1 Mentorship

Carleton University Design League (CUDL) Mech/Aero Design Challenge	**2022**

12.2 Community Extracurricular Activities

High school outreach work for TRU engineering programs (workshops & promotional events), BC, CA	**Sep.2019-Dec.2021**
Coaching and supporting TRU Student Union Engineering Club (TRUSU-EC), TRU, BC, CA	**Sep.2019-Dec.2021**
Vice-president (Social) of Graduate Engineering Society (GES), UWO, ON, CA	**Sep.2018- Aug.2019**
GES representative at the faculty council, UWO, ON, CA	**Sep.2018- Aug.2019**
Coaching and supporting 4th year students in the Canadian CubeSat Project, UWO, ON, CA	**Sep.2018- Apr.2019**
Moderator with International and Exchange Student Centre (ISEC), UWO, ON, CA	**Sep.2018- Apr.2019**
Organizer (Weekly Global Cafe event) and Transition Assistant with ISEC, UWO, ON, CA	**Sep.2018- Apr.2019**
Organizer of multiple international orientation sessions, UWO, ON, CA	**Sep.2018- Apr.2019**
Council member at the Society of Graduate Students (campus wide), UWO, ON, CA	**Sep.2016- Sep.2017**

---------- **End of Curriculum Vitae** ----------

Fateme Rajabiyazdi
Carleton University
Faculty of Engineering and Design
Department of Systems and Computer Engineering
Email: fateme.rajabiyazdi@carleton.ca
Website: https://healthvisfutures.sce.carleton.ca/

Work Experience

Assistant Professor - Carleton University, Canada Jan 2021–present
Department of Systems and Computer Engineering
Cross-Appointed School of Information Technology

Affiliate Investigator - Bruyère, Canada Jun 2023–present
Bruyère Research Institute

Postdoctoral Fellow - McGill University, Canada Jan 2019–Dec 2020
Supervisor: Dr. Julio Fiore
Project Leaders: Dr. Liane Feldman and Dr. Nancy Mayo

Data Visualization Researcher - Alberta Innovates - W21C, Canada Sep 2015–Oct 2018
Project Leader: Dr. William Ghali

Education

PhD of Computer Science - Information Visualization - University of Calgary 2014–2018
Thesis: Exploring the Design of Visualizations to Facilitate Patient-Provider Communication
**Thesis Awards:* Nominated for Bill Buxton Dissertation Award and the IEEE VGTC VPG Doctoral Dissertation Award
Supervisors: Dr. Sheelagh Carpendale and Dr. Lora Oehlberg

Master of Computing - HCI - Australian National University 2010–2012
Thesis: Design and Development of Interfaces for Different Tablet Sizes
Supervisors: Dr. Tom Gedeon and Dr. Duncan Stevenson

Bachelor of Software Engineering - University of Tehran 2006–2010

Grants

G11. **Canada Foundation for Innovation - John R. Evans Leaders Fund (CFI-JELF)** 2023-2025
Clinical Decision-Making on Large High-Resolution Displays (LHRDs)
Role: Principal Investigator, Granted: $217,302 CAD

G10. **Collaborate 2 Commercialize (C2C) - Ontario Centre of Innovation (OCI)** 2023-2024
Intelligent Insights – Patient Transfers
Role: Principal Investigator, Granted: $300,000 CAD

G9. **Multidisciplinary Research Catalyst Fund (MRCF)** 2022-2024
Canadian Futuristic Health Data Visualization Center
Role: Principal Investigator, Granted: $50,000 CAD

G8. **National Research Council (NRC) Aging in Place Challenge** 2022-2025
Evaluation and Adaptation of Assistive Technologies for Older Adults
Role: Principal Investigator (Academic), NRC PI: Dr. Hélène Fournier, Granted: $90,000 CAD

G7. **Natural Sciences and Engineering Research Council of Canada (NSERC) Alliance - Ontario Centre of Innovation (OCI) Voucher for Innovation and Productivity (VIP)** 2022-2023
Qualitative Data Visualization Dashboard
Industry Partner: NovaceneAI
Role: Principal Investigator, Granted: $60,000 CAD

G6. **Carleton University Experiential Learning Fund** 2022-2023
EXPeriential-learning for ANalyzing Data (EXPAND) Program
Role: Principal-Investigator, Granted: $6,000 CAD

G5. **Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant** 2021-2026
Exploring the Design and Development of Patient Data Visualizations on Shared Displays
Role: Principal Investigator, Granted: $132,500 CAD

G4. **Carleton Faculty of Engineering and Design** 2021
Multitaction table display
Role: Principal Investigator, Granted: $50,000 CAD

G3. **Scholarship of Teaching and Learning (SoTL)** 2021-2022
Critical Reflections on Teaching Data Visualizations to Students with Engineering Backgrounds
Role: Principal Investigator, Granted: $5,000 CAD

G2. **Carleton University I-CUREUS Grant** 2021-2024
Fall 2023, Fall 2022, Winter 2022, Fall 2021, Summer 2021
Role: Principal Investigator, Granted: $11,250 CAD

G1. **Career Ready Technation Canada** 2021
Design and Development of a Wearable Pain Tracker
Role: Principal Investigator, Granted: $5,900 CAD

Co-PI

Bruyere Foundation 2023
Electronic Memory Support System: An Innovative Digital Calendar for Older Adults with Mild cognitive impairment
Role: Co-PI with Dr. Neil Thomas (PI, Bruyere Research) Granted: $19,288 CAD

Carleton University Research Development Grants NSERC Early Career Researcher 2023
Data-Physicalization for Youth Mental Health: A Human-Centered Approach
Role: Co-PI with Dr. Juan Garcia (Carleton University, School of Industrial Design) Granted: $10,000 CAD

SIGCHI Development Fund 2023
Graphics Interface (GI'23) Early Career Researcher Mentorship and Panel
Role: Co-PI with Dr. Sowmya Somanath (University of Victoria) Granted: $3,500 USD

Multidisciplinary Research Catalyst Fund (MRCF) 2022
Socially-inclusive Extended Reality (XR) Systems for Multi-User Collaboration and Communication
Role: Co-PI with Dr. Robert Teather (Carleton University) Granted: $50,000 CAD

Canadian Institutes of Health Research (CIHR) Project Grant - Fall 2021 and Spring 2022 2022
The OPERa Study: A Multicenter Observational Prospective Cohort Study to Evaluate Determinants of Long-Term Quality of Life following Restorative Proctectomy for Rectal Cancer Treatment
Role: Co-PI with Dr. Marylise Boutros (McGill University - Jewish General Hospital) Granted: $558,450 CAD

American Society of Colorectal Surgeons 2022
Consensus Development on the Definition, Grading and Reporting of Colorectal Anastomotic Leak
Role: Co-PI, PI: Dr. Patricia Sylla (Icahn School of Medicine at Mount Sinai) Granted: $67,500 USD

Collaborator

Canadian Institutes of Health Research (CIHR) Planning and Dissemination Grant 2019
Transforming Post-Fracture Acute Pain Management in Older Men/Women through mHealth Application
Role: Collaborator, PI: Dr. Suzanne Morin (McGill University Health Center)

Canadian Institutes of Health Research (CIHR) Project Grant - Fall 2019 2019
Opioid versus Opioid-Free Analgesia After Surgical Discharge: A Systematic Review and Meta-Analysis
Role: Collaborator, PI: Dr. Julio Fiore (McGill University Health Center)

Awards and Scholarships

Early Career Researcher Award, Canadian Medical and Biological Engineering Society (CMBES) 2023

Outstanding Publication Committee Award, IEEE Ottawa Section 2022

Individual Service Excellence Award Nomination, Carleton University 2022

Co-op Employer of the Year Nomination, Carleton University 2021

Postdoctoral Scholarship, Fonds de Recherche du Québec – Santé (FRQS), $45,000 CAD 2020-2021

W21C Health Services Research Scholarship, Alberta Health Services, $60,000 CAD 2015-2017

Computer Science Department Research Award, University of Calgary, $8,000 CAD 2016-2017

Computer Science Department Research Award, University of Calgary, $10,000 CAD 2014-2016

Publications

* indicates HQP under my direct supervision.

Book Chapters (B)

B1. Julio F Fiore Jr., **Fateme Rajabiyazdi**, and Liane S Feldman. (2022). Developing Patient-Centered Outcomes Metrics for Abdominal Surgery. *The SAGES Manual of Quality, Outcomes and Patient Safety*, 259-276, https://doi.org/10.1007/978-3-030-94610-4-14.

Peer Reviewed Journal Publications (J)

J15. Benjamin Bach, Mandy Keck, **Fateme Rajabiyazdi**, Tatiana Losev, Isabel Meirelles, Jason Dykes, Robert S. Laramee, Mashael AlKadi, Christina Stoiber, Samuel Huron, Charles Perin, Luiz Morais, Wolfgang Aigner, Doris Kosminsky, Magdalena Boucher, Søren Knudsen, Areti Manataki, Jan Aerts, Uta Hinrichs, Jonathan C Roberts, Sheelagh Carpendale. Challenges and Opportunities in Data Visualization Education: A Call to Action. (2023). *IEEE Transactions on Visualization and Computer Graphics*. 30, 649-660, https://doi.org/10.1109/TVCG.2023.332737

J14. Olivia Monton, Allister Smith, Jeongyoon Moon, Marie Demian, Richard Garfinkle, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2023) An Online Educational and Supportive Care Application for Rectal Cancer Survivors with Low Anterior Resection Syndrome: A Mixed Methods Pilot Study. *Colorectal Disease* 00: 1–9. https://doi.org/10.1111/codi.16665

J13. Makena Pook, Tahereh Najafi, Maxime Lapointe-Gagner, Philip Nguyen-Powanda, Hiba Elhaj, **Fateme Rajabiyazdi**, Pepa Kaneva, Lawrence Lee, Liane S. Feldman. (2023) Patients' Experiences Undergoing Cancer Surgery During the COVID-19 Pandemic: A Qualitative Study. *Support Care Cancer* 31, 400. https://doi.org/10.1007/s00520-023-07861-w

J12. Natasha Caminsky, Jeongyoon Moon, et al, **Fateme Rajabiyazdi**, and Marylise Boutros. (2023) Patient and surgeon preferences for early ileostomy closure following restorative proctectomy for rectal cancer – why aren't we doing it? *Surgical Endoscopy*, 37, 669–682, https://doi.org/10.1007/s00464-022-09580-5.

J11. Kevin Tran-Nguyen*, Caroline Berger*, Roxanne Bennett, Michelle Wall, Suzanne Morin, and **Fateme Rajabiyazdi**. (2022). Mobile App Prototype in Older Adults for Postfracture Acute Pain Management: User-Centered Design Approach. *Journal of Medical Internet Research Aging*, 5(4):e37772, https://doi.org/10.2196/37772.

J10. Maryam Mozafarinia, **Fateme Rajabiyazdi**, Marie-Josée Brouillette, et al. (2022). Effectiveness of a Personalized Health Profile on Specificity of Self-Management Goals Among People Living with HIV in Canada Findings from a Blinded Pragmatic Randomized Controlled Trial. *Quality of Life Research*, https://doi.org/10.1007/s11136-022-03245-5.

J9. Uyen Do, Makena Pook, Tahereh Najafi, **Fateme Rajabiyazdi**, et al. (2022). Opioid-free analgesia after outpatient general surgery: A qualitative study focused on the perspectives of patients and clinicians involved in a pilot trial. *Surgical Endoscopy*, 1-12, https://doi.org/10.1007/s00464-022-09472-8.

J8. Uyen Do, Charbel El-Kefraoui, et al., **Fateme Rajabiyazdi**, Nadia Safa, Nawar Touma, Francine Tremblay. (2022). Feasibility of Prospectively Comparing Opioid Analgesia With Opioid-Free Analgesia After Outpatient General Surgery: A Pilot Randomized Clinical Trial. JAMA Netw Open, 5(7):e2221430, https://doi.org/10.1001/jamanetworkopen.2022.21430.

J7. Julio F Fiore Jr., Charbel El-Kefraoui, Marc-Aurele Chay, Philip Nguyen-Powanda, Uyen Do, Ghadeer Olleik, **Fateme Rajabiyazdi**, et al. (2022). Opioid versus opioid-free analgesia after surgical discharge: A systematic review and meta-analysis of randomised controlled trials. *The Lancet* 399(10343), 2280-2293, https://doi.org/10.1016/S0140-6736(22)00582-7.

J6. **Fateme Rajabiyazdi**, Charles Perin, Lora Oehlberg, and Sheelagh Carpendale.(2021) Designing Patient Data Visualization:A Wicked Problem.*Computer Graphics & Applications*, 41(6):179-186, https://doi.org/10.1109/MCG.2021.3112845.

J5. Charbel El-Kefraoui, **Fateme Rajabiyazdi**, Nicolò Pecorelli, Franco Carli, Lawrence Lee, Liane S Feldman, and Julio F Fiore. (2021). Prognostic value of the Duke Activity Status Index (DASI) in patients undergoing colorectal surgery. *World Journal of Surgery*, 45, 3677–3685, https://doi.org/10.1007/s00268-021-06256-4.

J4. **Fateme Rajabiyazdi**, Roshni Alam, Aditya Pal*, Joel Montanez, Susan Law, et al. (2021). What does 'recovery' mean to patients undergoing abdominal surgery? An international qualitative study. *JAMA Surgery*, 156(8): 758–765, https://doi.org/10.1001/jamasurg.2021.1557.

J3. Maryam Mozafarinia, **Fateme Rajabiyazdi**, Marie-Josée Brouillette, Lesley K. Fellows, and Nancy E. Mayo. (2020). Development and Usability of a Feedback Tool, "My Personal Brain Health Dashboard", to Improve Setting of Self-Management Goals Among People Living with HIV in Canada, 30(11):3199-3211, *Quality of Life Research Journal*, https://doi.org/10.1007/s11136-020-02555-w.

J2. Maryam Mozafarinia, **Fateme Rajabiyazdi**, Marie-Josée Brouillette, Lesley Fellows, Bärbel Knäuper, and Nancy E. Mayo. (2020). Effectiveness of a Personalized Health Profile on Specificity of Self-Management Goals Among People Living with HIV in Canada: A Protocol for a Blinded Pragmatic Randomized Controlled Trial. *MNI Open Res*, 4:1, https://doi.org/10.12688/mniopenres.12846.1.

J1. Charbel El-Kefraoui, Ghadeer Olleik, Marc-Aurele Chay, Araz Kouyoumdjian, Philip Nguyen-Powanda, **Fateme Rajabiyazdi**, et al. (2020). Opioid Versus Opioid-free Analgesia after Surgical Discharge: Protocol for a Systematic Review and Meta-analysis. *BMJ Open*, 10:e035443. https://doi.org/10.1136/bmjopen-2019-035443.

Peer Reviewed Conference Publications (C)

C12. Shri Harini Ramesh*, Alicia Ouskine*, Elahe Khorassani*, Mona Ebrahimipour, Hillel Finestone, Adrian D.C. Chan, and **Fateme Rajabiyazdi**. (2024). A Data Visualization Tool to Facilitate Patient-Healthcare Provider Communication During Inpatient Stroke Rehabilitation. *Graphic Interface*. (Accepted).

C11. Mahsa Sinaei Hamed*, Laura Reid*, Alice Olorunnife*, David Casciano*, and **Fateme Rajabiyazdi**. (2023). Designing and Developing a Mobile Application for Monitoring & Visualizing Blood Pressure Data. In *Proceedings of IEEE Sensor Applications Symposium*, 1-6, doi: 10.1109/SAS58821.2023.10253972

C10. Connor Haberl*, Graham Cook, Andrew Crean, Calum Redpath, **Fateme Rajabiyazdi**, and Robert DeKemp. (2023). A 4D Visualization Tool for Treatment Planning of Non-Invasive Radioablation in Patients with Ventricular Tachycardia. In *Proceedings of SPIE Medical Imaging*. https://doi.org/10.1117/12.2654482

C9. Irina Kondratova, Helene Fournier, and **Fateme Rajabiyazdi**. Aging in Place Virtual Care Technology from the User Experience Perspective. Human Aspects of IT for the Aged Population. Human-Computer Interaction International (2023). Lecture Notes in Computer Science, 14043, 131-144, Springer, https://doi.org/10.1007/978-3-031-34917-1-10

C8. **Fateme Rajabiyazdi**, Charles Perin, Lora Oehlberg, and Sheelagh Carpendale. (2020). Exploring the Design of Patient-Generated Data Visualizations. In *Proceedings of the 46th Graphics Interface Conference*, 362-373, https://doi.org/10.20380/GI2020.36.

C7. **Fateme Rajabiyazdi**, Charles Perin, Jo Vermeulen, Diane Gromala, and Sheelagh Carpendale. (2017). Differences That Matter: In-Clinic Communication Challenges. In *Proceedings of Pervasive Computing Technologies for Healthcare*, 251-260, http://doi.acm.org/10.1145/3154862.3154885.

C6. **Fateme Rajabiyazdi**, Charles Perin, Lora Oehlberg, and Sheelagh Carpendale. (2017). The Challenges of Individuality to Technology Approaches to Personally Collected Health Data. In *Proceedings of Pervasive Computing Technologies for Healthcare*, 448-451, https://doi.org/10.1145/3154862.3154923.

C5. **Fateme Rajabiyazdi**. (2016). Designing and Developing Technologies to Facilitate Clinician-Patient Communication. In *Proceedings of the International Conference on Interactive Surfaces and Spaces*, 19-24, https://doi.org/10.1145/3009939.3009943.

C4. Alice Thudt, Jagoda Walny, Charles Perin, **Fateme Rajabiyazdi**, Lindsay MacDonald, Riane Vardeleon, Saul Greenberg, and Sheelagh Carpendale. (2016). Assessing the Readability of Stacked Graphs. In *Proceedings of the 42nd Graphics Interface Conference*, 167–174, https://dx.doi.org/10.20380/GI2016.21.

C3. **Fateme Rajabiyazdi**, Jagoda Walny, Carrie Mah, John Brosz, and Sheelagh Carpendale. (2015). Understanding Researchers' Use of a Large, High-Resolution Display Across Disciplines. In *Proceedings of the International Conference on Interactive Tabletops & Surfaces*, 107–116, http://doi.acm.org/10.1145/2817721.2817735.

C2. **Fateme Rajabiyazdi** and Tom Gedeon. (2012). Hand Grip Strength on a Large PDA: Holding While Reading Is Different from a Functional Task. In *Proceedings of the Sixth International Conference on Complex, Intelligent, and Software Intensive Systems*, 475–480,https://doi.org/10.1109/CISIS.2012.110.

C1. **Fateme Rajabiyazdi** and Tom Gedeon. (2012). Comparing User Performance on an iPad to a 17-inch BackPad. In *Proceedings of the Sixth International Conference on Complex, Intelligent, and Software Intensive Systems*, 469–474, https://doi.org/10.1109/CISIS.2012.215.

Abstracts and Posters (AP)

AP25. Abagael Hudak, Laura Ault, Julien Lariviere-Chartier, Bruce Wallace, Frank Knoefel, Rafik Goubran, **Fateme Rajabiyazdi**, Neil W. Thomas. (2023). Developing a user interface to provide sensor information on the daily activities of care partners of people living with cognitive impairment. *Canadian Conference on Dementia.* (Poster)

AP24. Olivia Monton, Allister Smith, **Fateme Rajabiyazdi**, and Marylise Boutros. (2023). Understanding surgeon and nurse perspectives on the use of patient-generated data in the management of low anterior resection syndrome. *American Society of Colon and Rectal Surgeons 2023 Annual Scientific Meeting*. (Poster)

AP23. Jenny Moon, et al. **Fateme Rajabiyazdi**, and Marylise Boutros. (2023). Current Rectal Cancer Survivorship Care: Unmet Patient Needs and Fragmented Specialist and Family Physician Care. *American Society of Colon and Rectal Surgeons 2023 Annual Scientific Meeting*. (Podium)

AP22. Neil W. Thomas, Laura Ault, Julien Larivière-Chartier, Padraig Greene*, Mihaela Petriu, **Fateme Rajabiyazdi**, Bruce Wallace, Frank Knoefel, Jeffrey Kaye, and Rafik Goubran. (2022). Smart Home Tech: an interface to provide feedback to caregivers of persons living with cognitive impairment. *AAIC Conference*. (Poster)

AP21. Neil W. Thomas, Laura Ault, Julien Larivière-Chartier, Padraig Greene*, Mihaela Petriu, **Fateme Rajabiyazdi**, et al. (2022). Home Sensor Platform Feedback Application: Building a Sensor Feedback System to Support Care Partners of those with Cognitive Impairment. *AGE-WELL Conference*. (Poster)

AP20. Kevin Tran-Nguyen*, Caroline Berger*, Roxanne Bennett, Michelle Wall, Suzanne Morin, and **Fateme Rajabiyazdi**. (2022). A Mobile Application for Post-fracture Acute Pain Management in Older Adults: an Iterative Development Study. *American Society for Bone and Mineral Research*. (Poster)

AP19. Khiran Arumugam, Katayoun Khorramak, Julio Flavio Fiore Junior, Amal Bessissow, **Fateme Rajabiyazdi**, and Suzanne Morin. (2022). The Role of The Community Pharmacists in The Management of Acute Pain in Adults: A Scoping Review. *American Society for Bone and Mineral Research*. (Poster)

AP18. Beck Langstone* and **Fateme Rajabiyazdi**. (2022). Co-Designing Unstructured Text Data Visualization Systems. *Graphics Interface*. (Poster)

AP17. Alicia Ouskine*, Adrian D.C. Chan, and **Fateme Rajabiyazdi**. (2022). Designing interactive data visualizations representing recovery progress for patients after stroke. *Graphics Interface*. (Poster)

AP16. Arsh Saleem*, Beck Langstone*, Alicia Ouskine*, and **Fateme Rajabiyazdi**. (2022). Design and Development of PainBit: Portable Device for Supporting Patients with Chronic Pain to Log their Pain. *Graphics Interface*. (Poster)

AP15. Maryam Mozafarinia, **Fateme Rajabiyazdi**, Marie-Josee Brouillette, Lesley K Fellows, Barbel Knauper, and Nancy E Mayo. (2021). Effectiveness of a personalized health profile on specificity of self-management goals among people living with HIV in Canada: findings from a blinded pragmatic randomized controlled trial. *Quality of Life Research*, 30(1) Springer. (Poster)

AP14. Olivia Monton, Allister Smith, Jeongyoon Moon, Marie Demian, Richard Garfinkle, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2021). An Online Educational App for Rectal Cancer Survivors with Low Anterior Resection Syndrome: A Mixed Methods Pilot Study. *Canadian Journal of Surgery*. 64, S130-S130. (Abstract)

AP13. Vincent Brissette, Nasra Al Busaidi, Marie Demian, Carol-Ann Vasilevsky, Nancy Morin, **Fateme Rajabiyazdi**, Marylise Boutros. (2021). Sexuality and rectal cancer treatment: a qualitative study exploring patients' information needs and expectations on sexual dysfunction after rectal cancer treatment.*Canadian Journal of Surgery*, 64, S128. (Abstract)

AP12. Rachel Szwimer, Jeongyoon Moon, Marie Demian, A Pang, Nancy Morin, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2021). A qualitative study to explore the optimal timing and approach for the LARS discussion. *Canadian Journal of Surgery*, 64, S137. (Abstract)

AP11. Yossef Levin, Nasra Al Busaidi, Marie Demian, Nancy Morin, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2021). Financial and Occupational Impact of Low Anterior Resection Syndrome: A Qualitative Study. *American Society of Colon and Rectal Surgeons*. (Poster).

AP10. Rachel Szwimer, Jeongyoon Moon, Marie Demian, Nancy Morin, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2021). Qualitative Study to Explore the Optimal Timing and Approach for the LARS discussion. *Canadian Surgery Forum*. (Poster).

AP9. Vincent Brissette, Nasra Al Busaidi, Marie Demian, Nancy Morin, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2021). "Let's talk about sex?" A Qualitative Study Exploring Patients' Needs and Expectations for Information on Sexual Dysfunction After Rectal Cancer Surgery. (*Canadian Surgery Forum*. (Poster)

AP8. Olivia Monton, Allister Smith, Jeongyoon Moon, Marie Demian, Richard Garfinkle, Carol-Ann Vasilevsky, **Fateme Rajabiyazdi**, and Marylise Boutros. (2021). An Online Educational App for Rectal Cancer Survivors with Low Anterior Resection Syndrome: A Pilot Study. *Canadian Surgery Forum*. (Podium)

AP7. **Fateme Rajabiyazdi**, Roshni Alam, Haley Montgomery, Charbel El Kefraoui, Lawrence Lee, Nancy Mayo, Liane Feldman, and Julio Fiore Jr. (2020). Item generation and cognitive interviewing for a patient-reported outcome measure of recovery after abdominal surgery. *International Society for Quality of Life Research*, S84-S85, Springer. (Poster)

AP6. Maryam Mozafarinia, **Fateme Rajabiyazdi**, Amanda Austin-Keiller, Marie-Josee Brouillette, Lesley Fellows, and Nancy E Mayo. (2020). Goal quality, education, and cognition: preliminary analysis of self-management goals formulated by people living with HIV. *International Society for Quality of Life Research*, S106-S106, Springer. (Poster)

AP5. **Fateme Rajabiyazdi**, Aditya Pal, et al. (2020). What Does 'Recovery' Mean To Patients Undergoing Abdominal Surgery?An International Qualitative Study. *The Society of American Gastrointestinal and Endoscopic Surgeons*. (Poster)

AP4. Charbel El-Kefraoui, Ghadeer Olleik, Marc-Aurele Chay, Araz Kouyoumdjian, Philip Nguyen-Powanda, **Fateme Rajabiyazdi**, et al. (2019). Opioid Versus Opioid-free Analgesia after Surgical Discharge: a Systematic Review and Meta-analysis. *Experimental Surgery Research Day*. (Poster)

AP3. Seyedeh Maryam Mozafarinia, **Fateme Rajabiyazdi**, and Nancy Mayo. (2019). Measuring quality of health outcome goals using text mining techniques. *International Society for Quality of Life Research*, S126, Springer. (Poster)

AP2. **Fateme Rajabiyazdi**, Charles Perin, Lora Oehlberg, and Sheelagh Carpendale. (2018). Personal Patient-Generated Data Visualizations for Diabetes Patients. (Poster)

AP1. **Fateme Rajabiyazdi**, Charles Perin, and Sheelagh Carpendale. (2015). WESt: Visualizing non-Emergency Surgery Waiting Times. IEEE Information Visualization Conference, https://hal.inria.fr/hal-01587925/ (Poster)

Peer Reviewed Workshop Papers (W)

W5. Jonathan C. Roberts, Benjamin Bach, Magdalena Boucher, Fanny Chevalier, Alexandra Diehl, Uta Hinrichs, Samuel Huron, Andy Kirk, Søren Knudsen, Isabel Meirelles, Rebecca Noonan, Laura Pelchmann, **Fateme Rajabiyazdi**, and Christina Stoiber. (2022). Reflections and Considerations on Running Creative Visualization Learning Activities. *4th IEEE Workshop on Visualization Guidelines in Research, Design, and Education at IEEE VIS*, https://doi.org/10.48550/arXiv.2209.09807, (author ordered alphabetically).

W4. Jan Aerts, Wolfgang Aigner, Benjamin Bach, Fearn Bishop, Magdalena Boucher, Peter C.-H. Cheng, Alexandra Diehl, Jason Dykes, Sarah Hayes, Uta Hinrichs, Samuel Huron, Christoph Kinkeldey, Andy Kirk, Søren Knudsen, Doris Kosminsky, Tatiana Losev, Areti Manataki, Andrew Manches, Isabel Meirelles, Luiz Morais, Till Nagel, Rebecca Noonan, Georgia Panagiotidou, Laura Pelchmann, **Fateme Rajabiyazdi**, et al. (2022). Me-ifestos for Visualization Empowerment in Teaching (and Learning?). *IEEE Alt.Vis 2022*, https://openreview.net/forum?id=FpkLUpGAgvv, (author ordered alphabetically).

W3. **Fateme Rajabiyazdi**, Charles Perin, Julie Babione, Joseph Tropiano, Maria Santana, Jaime Kaufman, William Ghali, Peter Sargious, and Sheelagh Carpendale. Challenges Involving Patients in their Care Plan from Clinicians' Perspectives. (2016). In *Proceedings of the CHI Workshop on Interactive Systems in Healthcare (WISH'16)*.

W2. Xin Tong, Diane Gromala, Lyn Bartram, **Fateme Rajabiyazdi**, and Sheelagh Carpendale. (2015). Evaluating the Effectiveness of Three Physical Activity Visualizations - How People Perform vs. Perceive. In *eProceedings of the IEEE Information Visualization Conference*.

W1. Tamara Flemisch, **Fateme Rajabiyazdi**, Mona Hosseinkhani, and Sheelagh Carpendale. (2015). NeckLan: Language as Jeweller. In *eProceedings of the IEEE Information Visualization Conference*.

Media Appearance

CTV News Ottawa September 2023
Title: Utilizing Technology to Close the Doctor-Patient Gap
Full Interview: https://ottawa.ctvnews.ca/video?clipId=2775511

Invited Talks

Biomedical Engineering Seminar Series - University of Ottawa October 2023
Title: Empowering Patients in their Care using Data Visualization

Faculty of Health Sciences - University of Ottawa April 2023
Title: Empowering Patients in their Care using Data Science

Ingenious Talks Lecture Series - Carleton University November 2022
Title: Enhancing Patient Collaboration in Healthcare using Interactive Data Visualization

Policy Horizons Canada, Government of Canada October 2022
Title: Innovative Text Data Visualization

Privy Council Office - Security Centre of Excellence Speakers Series September 2022
Title: AI, ML, NLP, Unstructured Text Data Visualization
Office of the Prime Minister, Ottawa, Canada

Dagstuhl - Visualization Empowerment: How to Teach/Learn Data Visualization June 2022
Title: Teaching Data Visualization Free From
Schloss Dagstuhl, Wadern, Germany

Advancing New Canadian Women in Technology - uOttawa/Carleton University January 2022
Title: Data Visualization for Health

Nuclear Medicine Research Rounds - Ottawa Hospital September 2021
Title: Multi-person Interactions with Medical Data on Large Displays

Carleton University Institute for Data Science - Seminar Series April 2021
Title: Exploring the Design and Development of Patient Health Data Visualizations

IEEE Ottawa Section: Engineering in Medicine and Biology Society February 2021
Title: Information Visualization to Support Patients' Medical Care Management

Department of Computer Science, Toronto Metropolitan University July 2020
Title: Designing interactive Data Visualization Systems to Enhance Patient Health

Department of Computer Science & Software Engineering, Concordia University April 2020
Title: Designing and Developing Information Visualization Tools to Support Patients with their Medical Care

Minimally Invasive Surgery Research Day, McGill University Health Center October 2019
Title: What does 'recovery' Mean to Patients Undergoing Abdominal Surgery?
Montreal General Hospital, Montreal, Canada

Human Factors Interest Group, University of Toronto April 2018
Title: Designing and Developing Tools to Enhance Patient-Physician Communication
Toronto University, Toronto, Canada

Knowledge and Technology Transfer

Quebec Health Surgical Outcome Tracker - under development 2023 - present
This data visualization system enables surgical units across Quebec to track and analyze the quality of care offered to patients. Hospitals can view a summary of patient demographics, complication rates, readmission rates, etc.

PainApp - under development 2020 - present
PainApp is the first mobile application that was developed with a user-center design approach to support older adults in managing their pain after a fracture. I am the co-principal investigator in the project, leading the design team.

MyCareCompass 2018 - 2020
MyCareCompass is the first platform designed for patients with chronic conditions in Alberta to manage their care. My PhD research and data visualization designs were incorporated into this platform.

Supervision and Mentoring HQP

Postdoctoral (1)

Dr. Elahe Khorasani
Postdoctoral Fellow, McGill University Health Center Spring 2021 - Winter 2024
Primary Supervisor: Dr. Julio Fiore (McGill University)
Project: Developing a Patient-Reported Outcome Measure to Assess Recovery after Abdominal Surgery

PhD Students (3)

Connor Harbel
PhD-SCE, Biomedical Engineering, Carleton University Winter 2024 - present

Co-Supervisor: Dr. Robert DeKemp
Thesis: Evaluating Cardiac Image Registration Software

Shri Harini Ramesh
PhD-SCE, Biomedical Engineering, Carleton University — Fall 2023 - present
Thesis: Designing Data Visualization System for Analyzing the Virtual Cardiac Rehabilitation (VCR)

Mahsa Sinaee
PhD-SCE, Software Engineering, Carleton University — Fall 2022 - present
Thesis: Designing and Developing Patient-Clinician Communication Technology for Older Adults with Chronic Conditions

Master Students (6)

Faisal Zaki
MEng Project Supervision, Electrical and Computer Engineering, Carleton University — Winter 2024 - present
Project: Visualizing Hospital Bed Patient Transfer Data

Abhishek Ahuja
MEng Project Supervision, Electrical and Computer Engineering, Carleton University — Winter 2023 - Summer 2023
Project: Visualizing Quality Indicators in Surgical Units in Hospitals across Quebec

Mariana Perez Rodriguez
MDes, Industrial Design, Carleton University — Fall 2022 - present
Primary Supervisor: Dr. Juan Garcia
Thesis: Designing an Interface on Tabletop to Support Patients and Clinicians with Health Decision-Making

Beck Langstone
MASc-HCI, Carleton University — Fall 2021 - Fall 2023
Thesis: Designing and Developing Patient Data Collection via Virtual Assistant AI Technology

Alicia Ouskine
MASc-HCI, Carleton University — Fall 2021 - Fall 2023
Co-Supervisor: Adrian Chan
Thesis: Designing and Developing Data Visualization for Patients in Rehabilitation Centers

Connor Harbel
MASc, Biomedical Engineering, Carleton University — Fall 2021 - Fall 2023
Co-Supervisor: Dr. Robert DeKemp
Thesis: Cardiac Image Registration

Undergraduate Students (6)

Darwin Jull
Bachelor Biomedical Computing
I-CUREUS, Carleton University — Fall 2023 - Present
An Interview Study with Cardiac Rehabilitation Team

Erin Lui-Hing
Bachelor Biomedical Computing
I-CUREUS, Carleton University — Fall 2022
Developing and Evaluating a Pain Tracker

Ala'A Alsatari
Bachelor of Neuroscience
I-CUREUS, Carleton University — Fall 2022
Usability and Practical Utility Factors of VCR for Cardiac Rehabilitation

Padraig Greene
Bachelor Biomedical Computing
USRA, Queen's University — Summer 2022
Designing an Interactive Visualization System for Dementia

Arsh Saleem
Bachelor of Engineering Biomedical and Electrical
Co-op Program, I-CUREUS, Carleton University — Summer 2021 - Winter 2022
Designing and Developing an Accessible Pain Tracker

Rahel Gunaratne
Bachelor Software Engineering
I-CUREUS, Undergraduate Student Researcher, Carleton University — Summer 2021 - Winter 2022
Designing an Interactive Visualization System to Enhance Student Awareness on EDI

Research Assistant (2)

Abhishek Mayurbhai Patel
MEng, Electrical and Computer Engineering, Carleton University — Fall 2022 - Summer 2023
Developing a Web Platform for Collecting Large Datasets

Daniil Kulik
Master of Computer ScienceCarleton University — Summer 2022 - Fall 2023
Developing Text Data Visualization Systems

Fourth-Year Undergraduate Engineering Projects (17)

Darwin Jull, Nikita Yovchev, Maven Uyttewaal — Fall 2023 - present
Application for Monitoring SID for parents

Khusmeet Ahluwalia, Momin Mushtaha, Gineydi Orozco, Priya Tailor — Fall 2022 - Winter 2023
Connecting Health Data from iPad to a Large Display

Nafe Ahmed, Aayush Mallya, Ishanov Sahni, Monishkumar Sivakumar — Fall 2022 - Winter 2023
Connecting Health Data from iPad to a Large Display

Laura Reid, David Casciano, Alice Olorunnife — Fall 2021- Winter 2022
Visualizing Blood Pressure Data

Jack Hendry, Justice Ayela, Haoyu Xu — Fall 2021 - Winter 2022
Connecting Health Data from iPad to a Large Display

Advisee - Committee Member (1)

Mohamed Gazarin
PhD, Department of Health Sciences Carleton University — 2021 - present
Development of an Automated Vision-based Incident Analysis System for Indoor Falls

Mentee (7)

Kevin Tran
Research Associate, McGill University — 2021-2022
Supervisor: Dr. Suzanne Morin
Project: Developing a Mobile app to Support Patients Manage Pain after a Bone Fracture

Caroline Berger
Research Associate, McGill University — 2020-2021
Supervisor: Dr. Suzanne Morin
Project: Designing a Mobile app to Support Patients Manage Pain after a Bone Fracture

Olivia Monton
Medical Student, McGill University — 2020-2021
Supervisor: Dr. Marylise Boutros
Project: eLARS Online Educational App Pilot Study

Vincent Brissette
Medical Student, McGill University — 2020-2021
Supervisor: Dr. Marylise Boutros
Project: Sexual Dysfunction in Patients with LARS: A Qualitative Study

Rachel Szwimer
Medical Student, McGill University — 2020-2021
Supervisor: Dr. Marylise Boutros
Project: Exploring the Optimal Timing for detailed LARS discussions

Aditya Pal
Medical Student, McGill University — 2019-2020
Supervisor: Dr. Julio Fiore
Project: Understanding Patients' Perspectives who are Recovering from Abdominal Surgery

Tharaniya Vallipuram
Medical Student, McGill University 2019 - 2020
Supervisor: Dr. Julio Fiore
Project: Visualizing Cancer Patient Pathway

Established National and International Collaborations

Canadian Government and Healthcare Organizations

National Research Council Canada (NRC), Canada 2021 - present
Dr. Hélène Fournier, Research Officer Human-Computer Interaction Department, NRC
Outcomes: Co-awarded a grant, published a paper, supervised 2 HQP

Bruyère Research Institute, Ottawa, Canada 2021 - present
Dr. Neil Thomas, Assistant Professor, Division of Neurology, Department of Medicine, University of Ottawa
Outcomes: Co-published 2 posters, supervised 1 HQP, developing a user interface for patient home monitoring system

Winchester District Memorial Hospital, Winchester, Canada 2021 - present
Dr. Mohamed Gazarin, Chief Research Officer
Outcomes: Collaborating on a research project

Montreal General Hospital, Montreal, Canada 2020 - present
Dr. Liane Feldman, Surgeon-in-chief, McGill University Health Centre
Outcomes: Collaborating on a quality improvement project at Montreal General Hospital

Jewish General Hospital, Montreal, Canada 2020 - present
Dr. Marylise Boutros, Program Director for the Colorectal Surgery Residency Program
Outcomes: Co-awarded 2 grants, co-published 1 journal and 9 posters

Canadian Industry

Able Innovations, Ottawa, Canada 2023 - present
Intelligent Insights – Patient Transfers
Outcomes: Awarded 1 grant, supervising 1 MEng student project

Novacene AI, Ottawa, Canada 2021 - present
Marcelo Bursztein, Company's founder and CEO Novacene AI Corporation
Outcomes: Awarded 1 grant, supervised 1 MASc student, co-submitted 1 paper publication

International Research Collaborations

University of Edinburgh, City University London, UK; University of Applied Sciences Upper Austria, Austria; University of Victoria, Canada 2023-present
Dr. Benjamin Bach, Associate Professor, the University of Edinburgh, UK; Dr. Jason Dykes, Professor, City University London, UK; Dr. Mandy Keck, Assistant Professor, University of Applied Sciences Upper Austria; Dr. Charles Perin, University of Victoria, Canada.
Outcomes: co-published 1 journal paper, 2 workshop papers, co-organized a workshop session at the IEEE VIS'23, the premier conference of Information Visualization.

University of Massachusetts Amherst, United States 2022-present
Dr. Ali Sarvghad Assistant Professor, Manning College of Information & Computer Sciences
Outcomes: Collaborating on a research project to develop an AI-assisted technology for older adults.

University of Cincinnati, United States 2022-present
Dr. Jillian Aurisano Assistant Professor, University of Cincinnati Electrical Engineering & Computer Science
Outcomes: Collaborating on a research project to develop technologies for large interactive displays.

Oxford Brooks University, United Kingdom 2019-2020
Centre for Movement, Occupational and Rehabilitation Science with Dr. Mansoubi and Dr. Shelly Coe.
Outcomes: Collaborated on a research project to use text mining techniques in a systematic review study.

Academic Service

Tri-Agency Grant Review

Review Panel, NSERC Research Tools and Instruments (RTI) 2023-2024
Computer, Mathematical, and Statistical Sciences Committee, 31 applications
Reviewer, Canada Foundation for Innovation (CFI) 2022
John R. Evans Leaders Fund (JELF), 1 application

Conference Program Committees and Chairing

International Program Committee, EuroVis 2024
Session Chair, IEEE VIS EduVis Workshop 2023
Session Chair, Graphics Interface Conference 2023
Tutorial Chair, IEEE SAS 2023
Program Committee, CHI Late-Breaking Work (LBW) 2022, 2023
Strategy Planning Committee, Graphics Interface Conference 2020-2022
Poster Chair, Graphics Interface Conference 2022
Publicity Chair, ACM Interactive Surfaces and Spaces (ISS) Conference 2022
Poster Chair, ACM Interactive Surfaces and Spaces (ISS) Conference 2021
Program Committee, IEEE Information Visualization (InfoVis) Conference Short Papers 2020, 2021, 2023
Posters Chair, McGill University Health Center Injury, Repair, Recovery Annual Research Day 2020
Video Preview Chair, ACM Interactive Surfaces and Spaces (ISS) Conference 2019
Best Poster Award Committee, McGill University Experimental Surgery Research Day 2019
Program Committee, ACM Intelligent User Interfaces (IUI) Conference Posters and Papers 2015, 2019 - 2021
Mobile App Chair, ACM Interactive Surfaces and Spaces (ISS) Conference 2016

Conference/Journal Paper Reviewer

CHI 2016-2024, EduVis 2023, EuroVis 2023, VIS 2020-2023, UIST 2021, GI 2021-2023, AMIA 2017-2021, DIS 2018-2019, TEI 2017& 2021, IUI 2016-2022, IMWUT 2019

Department and University Services

EDI Council Member, Carleton University - Faculty of Engineering and Design 2022-present
EDI committee Member, Carleton University - Department of Systems and Computer Engineering 2021-present
Student Awards Committee, Carleton University - Department of Systems and Computer Engineering 2022-2023
sWall Coordinator Carleton University - Department of Systems and Computer Engineering 2021-2023

Community Outreach

Faculty Representative, Carleton University Faculty of Engineering and Design - Student Recruitment February 2024
Faculty Representative, Carleton University Faculty of Engineering and Design - Showcase Demo November 2023
Student Competition Judge, Advancing New Canadian Women in Technology February 2022
Podcast guest, Carleton University Women in Science and Engineering Words Podcast November 2021
Speaker, Carleton University SCE: Transition to Faculty Position December 2021
Speaker, Carleton University SCETalk: What is Data Visualization October 2021
Speaker, Carleton University, Passionate Minds Unit 101 Summer Webinar August 2021
Panelist, Carleton University-WISE National Engineering Month Event Information March 2021

Professional Development

Certificate of Course Design Fundamentals
Teaching and Learning Services, Carleton University August 2023
Kinàmàgawin Indigenous Learning Certificate
Centre for Indigenous Support and Community Engagement, Carleton University August 2022
Certificate of University Teaching
Teaching and Learning Services, Carleton University April 2022

Professional Membership

Member, Canadian Medical and Biological Engineering Society (CMBES) 2022-present
Member, Institute of Electrical and Electronics Engineers (IEEE) 2021-present

Sreeraman Rajan

CONTACT INFORMATION

ME 4480, Systems and Computer Eng.
1125 Colonel By Dr., Ottawa, Ontario
K1S 5B6
e-mail: sreeramanr@sce.carleton.ca

Office: 613-520-2600x4169
Fax: 613-520-5727
Citizenship: Canadian
*web:*www.sce.carleton.ca/faculty/srajan

EDUCATION

Ph.D., Electrical and Computer Engineering, *2004*
University of New Brunswick, Fredericton, New Brunswick, Canada

M.Sc., Electrical Engineering, *1992*
Tulane University, New Orleans, Louisiana, U.S.A

Orientation Training, Nuclear Science and Engineering, *1987*
Training School, Bhabha Atomic Research Center, Mumbai, Maharashtra, India

B.E, Electronics and Communication Engineering, *1986*
Bharathiyar University, Coimbatore, TamilNadu, India

ACADEMIC EMPLOYMENT

Professor, Tier 2 Canada Research Chair *July 2021 – Present*
Department of Systems and Computer Engineering,
Carleton University, Ottawa, Ontario, Canada

- Digital Signal Processing teaching and research in the areas of contact/noncontact sensor signal processing, data analytics, compressive sensing, and machine learning

Associate Professor, Tier 2 Canada Research Chair *July 2015 – Present*
Department of Systems and Computer Engineering,
Carleton University, Ottawa, Ontario, Canada

- Digital Signal Processing teaching and research in the areas of contact/noncontact sensor signal processing, data analytics, compressive sensing, and machine learning

Adjunct Assistant Professor *April 2015 – present*
Department of Electrical Engineering and Computer Engineering,
The Royal Military College, Kingston, Ontario, Canada

- Research in various aspects of signal processing for electronic warfare and electronic warfare systems

Adjunct Professor *April 2010 – 2018*
School of Electrical Engineering and Computer Science,
University of Ottawa, Ottawa, Ontario, Canada

- Research in the area of physiological signal processing, design of instrumentation and signal processing for non-invasive medical devices, stand-off detection

Research Assistant *Sept. 1995 to Aug. 1999*
Department of Electrical and Computer Engineering,
University of New Brunswick, Fredericton, New Brunswick, Canada

- Conducted research and analysis in the areas of signal processing, pattern classification and neural networks

Research Assistant *Sept. 1992 to Aug. 1995*
Department of Electrical and Computer Engineering,
University of Colorado at Denver, Denver, Colorado, U.S.A.

- Conducted research and analysis on adaptive filtering and two-dimensional signal processing

Research Assistant *Sept. 1990 to May 1992*
Department of Electrical Engineering,
Tulane University, New Orleans, Louisiana, U.S.A

- Conducted research and analysis on adaptive filtering

Industry Experience

Defence Scientist *December 2004 – June 2015*
Defence Research & Development Canada, Ottawa, Ontario, Canada

- Research in areas of Communication and Radar Electronic Warfare.

Signal Processing Specialist *August 2003 – December 2004*
Biopeak Corporation, Ottawa, Ontario, Canada

- Research and development in non-invasive medical devices for physiological signal monitoring

DSP Algorithm Specialist/Optics Engineer *September 2000 – May 2003*
Ceyba Corp, Ottawa, Ontario, Canada

- Research and development in ultra long haul and long haul fiber optical communication systems

Module Algorithm Specialist *September 1999 – August 2000*
JDS Uniphase, Ottawa, Ontario, Canada

- Research and development of algorithms for modules and testing of optical switches

Visiting Research Associate *August 1997 to April 1998*
Siemens Corporate Research, Princeton, New Jersey, U.S.A

- Member of the "Tricorder Project" team. Researched and developed a heart murmur detection system using electronic stethoscope

Scientific Officer *August 1987 – August 1990*
Reactor Control Division,
Bhabha Atomic Research Center, Mumbai, Maharashtra, India

- Researched and designed computer based systems for control, protection, and regulation systems for nuclear research and power reactors.

Teaching Experience

Associate Professor/Professor *July 2015 - Present*
Department of System and Computer Engineering,
Carleton University, Ottawa, Ontario, Canada

- SYSC 4405 Digital Signal Processing (6 offerings as Instructor) Winter 2016, Winter 2017, Fall 2016, Fall 2017, Fall 2019, Fall 2020
- SYSC 5602 Digital Signal Processing (6 offerings as Instructor) Fall 2017, Fall 2018, Winter 2020, Winter 2021, Winter 2022, Winter 2024
- SYSC 3203 Bioelectrical Systems (1 offering as Instructor) Fall 2018
- SYSC 3501 Signals and Systems (1 offering as Instructor) Fall 2023

- SYSC 5906, Directed Study: *Computational Modelling Technique to Study of Electrical Characteristics of Soil*, Fall 2018
- SYSC 5906, Directed Study: *Inverse Problems and Regularization*, Winter 2019
- SYSC 5906, Directed Study: *Human Activity Monitoring*, Winter 2018
- SYSC 5906, Directed Study: *Deep Learning*, Fall 2018
- SYSC 5906, Directed Study: *Analysis of 5G characteristics using high-speed optical telemetry and architecture*, Winter 2019
- BIOM 5800, Biomedical Seminar Series (for M.Eng and M.A.Sc) Fall 2020, Winter 2021, Fall 2021, Winter 2022
- BIOM 6800, Biomedical Seminar Series (for Ph.D.) Fall 2020, Winter 2021, Fall 2021, Winter 2022

Instructor *May 2017*
Carleton Mini Enrichment Program,
Carleton University, Ottawa, Ontario, Canada

- Fast Math for High School Students

Instructor – Vedic Mathematics *Fall 2010, Spring 2011*
Ottawa Chapter of Association of Bright Children of Ontario, Ottawa,Ontario, Canada

- Instructed elementary and high school students in Vedic Mathematics.
- Developed course material for Vedic Mathematics

TEACHING EXPERIENCE (CONT.)

Teaching Assistant – Electrical and Computer Engineering *1995–1998*
University of New Brunswick, Fredericton, New Brunswick, Canada

- Teaching assistant for two senior-level undergraduate electrical engineering courses: *ECE 4531 Digital Signal Processing I* and *ECE 4542 Digital Signal Processing II.*
- Co-delivered the graduate-level course: *EE 6513 Introduction to Random variables and Stochastic Processes* with Prof. R. Doraiswami in Fall 1997
- Supervised weekly two lab sessions for EE 3511 Signals Lab in Fall 1996, 1997
- Supervised weekly two lab sessions for ECE 1817 Electricity and Magnetism Lab in Fall 1995, 1996).
- Responsible for grading the quizzes, midterm, and lab reports.
- Responsible for guiding undergraduate students in their thesis projects.

Facilitator *1993 – 1994*
Center for Women and Hispanic Students Welfare, **University of Colorado at Denver**, Denver, Colorado, U.S.A

- Instructor for remedial courses given by Electrical Engineering Faculty.
- Courses taught include:
  - ◇ *EE 3316 Linear Systems Theory* *Fall 1993*
  - ◇ *EE 3225 Electronics II* *Winter 1994*
  - ◇ *EE 3215 Electronics I* *Fall 1994*

Instructor – Electrical and Computer Engineering *1992–1995*
University of Colorado at Denver, Denver, Colorado, U.S.A

- EE 4467 Communications Laboratory *Summer 1994*
- EE 3215 Electronics Lab I *Winter 1993, 1994*
- EE 3325 Electronics Lab II *Fall 1992, 1993*

Teaching Assistant – Electrical Engineering *1990-1992*
Department of Electrical Engineering, Tulane University, New Orleans, Louisiana, U.S.A.

- ELEN 303 Electronics Lab *Fall 1990*
- ELEN 377 Elements of Electrical Eng. (Machines Lab for Mechanical Engineers) *Fall 1990*
- ELEN 201 Electric circuits I (Lab) *Fall 1991*
- ELEN 202 Electric circuits II (Lab and Marking) *Winter 1991*

Grants

- 2023-2027 IDEAS Micronet grant, "Microwave Quantum Radar," $525,000, *Co-Investigator*, Lead: Prof. C. Wilson, University of Waterloo
- 2023-2027 IDEAS Micronet grant, "Quantum Enhanced Instrumentation for Superior Situational Awareness QEISSA ," $400,000, *Co-Investigator*, Lead: Prof. A. Helmy, University of Toronto
- 2023-2027 NSERC Alliance grant, "Development of a Cyber-Physical Simulator for Ultrasound-guided Percutaneous Nephrolithotomy," $286,000, *Co-investigator*
- 2023-2027 NSERC Discovery Grant, "Intelligent Noncontact Sensing and Advanced Signal Processing for Human Health and Safety Monitoring," $250,000, *Principal Investigator*
- 2023-2024 National Research Council Contract 1009534, "Single and multiple drone detection experiments in an indoor / outdoor environment with software-defined radar-based systems," $30,000, *Principal Investigator*
- 2022-2023 National Research Council Contract 995513,"Single and Multiple Drone Detection Experiments with Advanced Software Defined AI-Radar," $35,000, *Principal Investigator*
- 2022-2024 Mathematics of Information Technology and Complex Systems (MITACS), "Quantum Machine Learning for Doppler Radar Signal Processing in Clutter," $75,000, *Principal Investigator*
- 2022-2023 Natural Resources Canada, "Multi-sensor Application to Address Critical Electricity Infrastructure Vulnerabilities," $56,250, *Co-investigator*
- 2021-2022 Natural Resources Canada Contract NRCan-3000741164, "Creating a Multi-modal Sensor Data Resource of Canadian Critical Electrical Infrastructure," $38,500, *Principal co-investigator*
- 2022 Natural Resources Canada Contract NRCan-3000741169, "Segmentation Algorithms for Multimodal Monitoring of Critical Electrical Infrastructure," $35,000, *Co-investigator*
- 2022-2025 National Research Council Grant AiP-004-2, "Printed electronics (PE)-based sensors for fall prevention and detection: RF-based sensing", $120,000, *Principal Investigator*
- 2022-2023 National Research Council Contract 984973, "Single and multiple drone detection experiments with software defined radar-based systems," $30,000, *Principal Investigator*

- 2020-2021 Natural Resources Canada Contract NRCan-3000721188, "Monitoring Critical Infrastructure using 3D LiDAR," $19,583.33, *Co-Investigator*
- 2021 Carleton Research Grant for Directors of Joint Institute: $5,000, *Principal Investigator*
- 2019-2020 National Research Council Contract 942206, "Parsing and Performance of Commercial Radars and Lidars for Drone Detection," $24,000, *Principal Investigator*
- 2020 Carleton Research Grant for Directors of Joint Institute: $5,000, *Principal Investigator*
- 2020-2021 Carleton FED support for the second term of Canada Research Chair: $10,000, *Principal Investigator*
- 2020-2021 Carleton VPRI support for second term of CRC: $10,000, *Principal Investigator*
- 2020-2025 Canada Research Chair (Tier II) Advanced Sensor Systems and Signal Processing: $500,000, *Principal Investigator*
- 2020 Carleton COVID Rapid Response Research Grant: $12,000, *Co-investigator*
- 2020 Carleton University Faculty Research Award: $10,000, *Principal Investigator*
- 2020-2024 NSERC Collaborative Research and Development: $498,000, (NSERC part $249,000) *Principal Investigator*
- 2020 NRC Research Contract: $24,000, *Principal Investigator*
- 2019 IDEAS Micronet Grant: $1,500,000, *Co-applicant*
- 2019 Carleton University Multidisciplinary Research Catalyst Fund, $20,000, *Co-applicant*
- 2019 Carleton University Multidisciplinary Research Catalyst Fund: $100,000 (2 grants $50, 000 each) *Co-applicant*
- 2019 Field's Institute CQAM-IMSRV Grant: $ 60,000 *Principal Investigator*
- 2019 Carleton University Research Impact Endeavour (CURIE) fund: $750, *Principal Investigator*
- 2018-2020 CRC Annual Research Stipend: $45,000 *Prinicipal Investigator*
- 2017 JELF CFI Grant: $150,000, *Principal Investigator*
- 2017 ORF Grant (part of CFI): $150,000, *Principal Investigator*
- 2017 NSERC Engage Grant: $25,000, *Principal Investigator*
- 2017 IEEE Foundation Grant, US $25,000 *Co-applicant*
- 2016 IEEE Canada Foundation Grant: Virtual Histories of Assistive Technologies $2,500 *Co-applicant*
- 2016-2017 NSERC I2I Grant: $135,533, *Co-applicant*
- 2016-2021 NSERC Discovery Grant: $216,000 *Principal Investigator*
- 2015-2020 Research Expense Grant: $50,000 *Principal Investigator*
- 2015 Startup Grant $30,000 *Principal Investigator*
- 2015-2020 Carleton FED support for the first term of Canada Research Chair: $50,000 *Principal Investigator*
- 2015-2020 Carleton VPRI support for first term of Canada Research Chair: $50,000 *Principal Investigator*
- 2015-2019 Canada Research Chair (Tier II) Sensor Systems: $500,000, *Principal Investigator*
- 2012-2015 DRDC Technology Investment Fund: $500,000, *Principal Investigator*
- 2013-2015 Royal Canadian Air Force: $50,000, *Principal Investigator*
- 2014-2017 Correctional Services Canada: $98,850, *Co-applicant*
- 2014-2016 Correctional Service Canada: $49,800, *Co-applicant*

Awards and Recognition

Awards and Recognition

- Tier 2 Canada Research Chair (Term 2), NSERC, Canada *2020-2025*

- Carleton University Faculty Research Award *2020*
- Outstanding Engineering Educator Award, IEEE Ottawa Section *2019*
- 2018-2019 CUSA Teaching Excellence Award, Carleton University *2019*
- Outstanding Engineer Award, IEEE Ottawa Section *2018*
- Faculty Graduate Mentoring Award (FGMA), Carleton University *2018*
- Raving Raven for Teaching Excellence, Office of the Associate Vice-President (Teaching & Learning), Carleton University *2017*
- IEEE Wally S. Read Outstanding Service Award *2016*
- Tier 2 Canada Research Chair (first term), NSERC, Canada *2015*
- Outstanding Contribution Award, Defence Research and Development Canada, Ottawa *2013*
- IEEE MGA Achievement Award *2012*
- Queen Elizabeth II Diamond Jubilee Medal *2012*
- Outstanding Volunteer Award, IEEE Ottawa Section *2012*
- Competent Leader, Toastmasters Inc. *2012*
- IEEE MGA Best Large Section Award *2011*
- IEEE Engineering in Medicine and Biology Society Best Chapter Award *2011*
- Competent Communicator, Toastmasters Inc. *2011*
- IEEE Canada Best Large Section Award *2011*
- IEEE Ottawa Best Chapter Award for IEEE Ottawa Engineering in Medicine and Biology Society Chapter *2010*
- IEEE Ottawa Best Chapter Award for IEEE Ottawa Engineering in Medicine and Biology Society Chapter *2008*
- Wally Reed GOLD Best Paper Award *2008*
- Recognition Award for successful DRDC Workshop in IEEE CCECE *2006*
- Best Mentor Award, Dalhousie University Co-op Program *2002*
- Tuition Scholarship, University of Colorado at Denver *1992-1995*
- Tuition Scholarship, Tulane University *1990-1992*
- Second Rank, Bharathiyar University *1987*
- Government of India Merit Scholarship *1982-1986*

Professional Affiliations

- Feb 2023-Present: Professional Engineer, Professional Engineers Ontario
- 2006-Present: Senior Member, Institute of Electrical and Electronics Engineer
- 2021 IEEE Consumer Technology: Member
- 2019: IEEE Aerospace and Electronic Systems: Member
- 1990-2010,2018-Present: IEEE Signal Processing Society: Member
- 2006-Present: IEEE Engineering and Medicine Society: Member
- 2013-Present: IEEE Instrumentation and Measurement Society: Member
- 2007-2016: IEEE Communication Society: Member
- 2004-2006: Member, Institute of Electrical and Electronics Engineer
- 08/1990-2004: Institute of Electrical and Electronics Engineers (IEEE) Student Member

Graduate Supervision

Master Thesis Completed

- K. Tran (2023), Thesis:" *Classification of Motion-Mode Ultrasound Images Obtained Using Wearable Ultrasonic Sensor for Automated Lung Monitoring*," Co-Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada. Awarded University Senate Medal for best Master's thesis work.

- Ms. P. F. Shahmirzadi (2021), Thesis: *Computationally Efficient and Secure Kronecker-*

based Compressive Sensing, Co-Supervisor: Prof. I. Lambadaris, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada.

- Mr. S. Steinberg (2021), Thesis: *Continuous Artery Monitoring based on Decomposition of Ultrasound Radiofrequency Signals*, Co-supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada.
- Ms. A. Young (2021), Thesis: "*Machine Learning Algorithms for the Parametric Characterisation of Low Signal-to-noise Ratio Pulse Compression Radars*", Co-Supervisor: Dr. B. Balaji, Defence Research and Development Canada
- Mr. A. Huang (2021) Thesis: "*Drone Characterization using HElicopter Rotation Modulation (HERM) line signatures*," Co-supervisor: Dr. B Balaji, Defence Research and Development Canada
- Mr. S. Bakshi (2021), Thesis: "*Investigation of Few-Shot Learning for Fall Detection*", Sole Supervision
- Mr. S. Venugopal, (2019), Thesis: "*Automatic Arterial Wall Detection and Diameter Tracking Using M-mode Ultrasound*," Co-Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Canada.
- Mr. D. Mitra, (2019), Thesis: "*Investigation of Kronecker-based Compressive Sensing*," Sole Supervision, **Nominated for University Senate Medal.**
- Mr. A. Khedr, (2018), Thesis: "*Signal Processing for Raman Spectroscopy*," Sole Supervision.
- Mr. N. Pradhan (2017), Thesis: "*Evaluation of the Signal Quality of Wrist-Based Photoplethysmography*," Co-Supervisor: Prof. A. Adler, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada.
- Mr. Z. Baird, (2017) (NSERC OGS), Thesis: "*Human Activity and Posture Classification Using Single Non-Contact Radar Sensor*," Sole Supervision.
- Mr. G. Singh, (2017) Thesis:"*Techniques for Enhancing the Computational Speed of Multiple Object Tracking*," Co-Supervisor: Prof. S. Majumdar, Department of Systems and Computer Engineering, Carleton University, Canada. **University Senate Medal**
- Capt. S. Henault, (2008), Thesis: "*Analysis and Optimization of a Compact Array of Wire Elements for Wideband Direction Finding in Tactical Electronic Warfare*," Co-Supervisor: Prof. Y. M. M. Antar, Royal Military College, Canada. **Nominated for University Medal**

Master Thesis in Progress

- Y. Zhou, Thesis: "*TBD*," (Part-Time) Co-Supervisor: Prof. R. Dansereau, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada.
- O. Imran, Thesis: "*TBD*," Co-Supervisor: Prof. S. Majumdar, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada.
- D. Sharma, Thesis: "*TBD*," Co-Supervisor: Prof. M. Attia, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada.
- R. Akhand, Thesis: "*TBD*," Co-Supervisor: Prof. R. Thornhill, Department of Systems and Computer Engineering, Carleton University, Ottawa.

- S. Lovett, Thesis:"*TBD*," Co-Supervisor, Prof. C. Rossa, Department of Systems and Computer Engineering, Carleton University, Ottawa.
- M. Agarwal, Thesis: "*TBD*," (Part-Time) Sole Supervisor.

Doctoral Thesis Completed

- Mr. D. Luong, (2023), *"Quantum Radar Signal Processing"*, Co-Supervisor: Dr. B. Balaji, Defence Research and Development Canada, Ottawa. **Vanier Scholar**, **Governor General Award, University Medal, Robert. T. Hill Best Dissertation Award from IEEE Aeronautics and Electronic Systems Society**
- Mr. M. Abdelazez, (2022), Dissertation: "*Analysis of Compressively Sensed Electrocardiograms for Detection of Atrial Fibrillation*", Co-Supervisor: Prof. A. D. C. Chan, Department of Systems and Computer Engineering, Carleton University, Canada. **Vanier Scholar**, **University Senate Medal**
- H. Chahrour (2021), Dissertation: "*Signal Processing Methods in Riemannian Geometry with Application to Drone Detection*", Co-Supervisor: Prof. R. Dansereau, Department of Systems and Computer Engineering, Carleton University, Canada.
- Ms. F. F. Firouzeh, (2021), Dissertation: "*Dimensionality Reduction in Signal Processing using Maximum Feasible Subsystems*", Co-Supervisor: Prof. J.W. Chinneck, Department of Systems and Computer Engineering, Carleton University, Canada.
- Dr. M. Mabrouk, (2014), Dissertation: "*Signal Processing of UWB Radar Return Signals For Human Detection Behind Walls"*, Co-Supervisor: Prof. M. Bolic, School of Electrical Engineering and Computer Science, University of Ottawa, Canada.

Doctoral Thesis in Progress

- Mr. Z. Baird, Thesis: "*Convolutional Neural Network Based Target Detectors for Maritime Wide Area Surveillance Non-Coherent Radar*", Sole Supervision
- Ms. H. Nematallah, Thesis: "*TBD*," Sole Supervision.
- Mr. M. Rashid, Thesis: "*TBD*," (Part-Time) Sole Supervision.
- Mr. Z. Sharifisoraki, Thesis: "*TBD*," Co-Supervisor, Prof. M. Amini, School of Information Technology, Carleton University, Canada.
- Ms. A. Dey, Thesis: "*Towards Unsupervised Learning for Remote Monitoring Using Active and Passive Sensors*," Sole Supervision.
- Mr. E. Ali, Thesis: "*TBD*", Sole Supervision.
- Mr. S. Steinberg, Thesis: "*TBD*," Co-Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Canada.
- Mr. F. Alizadeh, Thesis:"*TBD*," Co-Supervisor: Prof. R. Thornhill, Department of Systems and Computer Engineering, Carleton University, Canada.
- Mr. Y. Al-Sanaani, Thesis: " *TBD*," Co-Supervisor: Prof. R. Thornhill, Department of Systems and Computer Engineering, Carleton University, Canada.

PDF, Visiting Professor, and Visiting Student Supervision

PostDoctoral Fellow Supervision

- Dr. D. Luong, "*Quantum Radar Signal Processing*", Sole Supervision, *2023-Present*
- Dr. Y. Cabanes, "*Geometric Signal Processing and Quantum Machine Learning*," Sole Supervision. *May 2022-Present*
- Dr. S. Selladurai, "*Ultrasound Imaging*," Co-Supervisor: Prof. C. Rossa. *Oct 2023-Present*
- Dr. F. Su, "*Learning Techniques for Controlling Meta Material Surfaces*," Sole Supervision. *Feb 2021 - Jan 2022*
- Dr. I. L. Wheng-Kit, "*Noise Radar Signal Processing*," Sole Supervison. *Dec 2020 - Mar 2023*
- Dr. J. Hosseinkhani, "*Advanced Signal and Image Processing Techniques for Active and Passive Sensors*", Sole Supervision. *Sept 2020 - Jan 2022*
- Dr. R. C. C. Wang, "*Anamoly Detection and Rare Event detection*", Sole Supervision. *April 2019-March 2020*
- Dr. H. Sadreazami, "*Fall Detection using Ultra Wideband Radar*", Co-supervisor: Prof. M. Bolic, School of Electrical Eng. and Computer Science, University of Ottawa, Canada *Nov 2017-Dec 2018*
- Dr. I. Nejadgholi, "*Classification of Activities using Doppler-based Radar*", Co-supervisor: Prof. M. Bolic, School of Electrical Eng. and Computer Science, University of Ottawa, Canada *July 2015-Dec 2016*
- Dr. M. Forouzanfar, "*Heart and Breathing Rate Estimation using Doppler-based Radar*", Co-supervisor: Prof. M. Bolic, School of Electrical Eng. and Computer Science, University of Ottawa, Canada. *May 2014-Jan 2015*
- Dr. S. Salari, "*Compressive Sensing for Electronic Warfare Receivers*", Co-supervisors: Prof. I-M. Kim, Department of Electrical and Computer Engineering, Queens University, Canada and Prof. F. Chan, Department of Electrical and Computer Engineering, The Royal Military College, Canada. *May 2013-June 2015*
- Dr. M. Niu, "*Compressive Sensing for Electronic Warfare Receivers*", Co-supervisors: Prof. I-M. Kim, Department of Electrical and Computer Engineering, Queens University, Canada and Prof. F. Chan, Department of Electrical and Computer Engineering, The Royal Military College, Canada. *May 2013-June 2015*
- Dr. S. Lee, "*Uncertainty in Blood Pressure Measurements*", Co-supervisors: Prof. H. R. Dajani, Prof. M Bolic, Prof. V. Z. Groza, School of Electrical Eng. and Computer Science, University of Ottawa, Canada. *Jan 2010-May 2012*
- Dr. S. Ahmad,"*Pulse Rate Variability*", Co-supervisors: Prof. H. R. Dajani, Prof. M Bolic, Prof. V. Z. Groza, School of Electrical Eng. and Computer Science, University of Ottawa, Canada. *2009*

Visiting Professor Supervision

- Dr. P. Xu, Assistant Professor, Jiyang College of Zhejiang A & F University, P. R. China. *September 2019 - April 2021*
- Dr. G. Sarabishiei, Assistant Professor, Sadjad University of Technology, Mashhad, Iran. *June 2017 - July 2017*

Visting Student Supervision

- Mr. E. Picariello, Ph.D. Candidate, Signal Processing and Information Laboratory, Department of Engineering, University of Sannio, Italy, *May 2022-October 2022*
- Mr. R. Crispino, Ph.D. Candidate, Department of Electrical, Electronics and Information Engineering, University of Catania, Italy. *January 2020 - February 2020*

Contribution to Graduate Supervision

Active contributor to Supervision

- Contributed actively to the co-supervision of the following students:
  - Mr. M. Forouzanfar (PhD), Thesis : *Computational Intelligence Algorithms for Blood Pressure Monitoring* (Supervisors: Prof. V. Z. Groza and Prof. H. R. Dajani), *2009-2014.*
  - Mr. S. Chen (M.A.Sc.), Thesis: *Robust Blood Pressure Measurement*, (Supervisors: Prof. V. Z. Groza and Prof. M. Bolic), *2008-2010.*
  - Mr. M. Mafi (M.A.Sc.), Thesis: *Blood Pressure Estimation Using Oscillometric Pulse Morphology* (Supervisors: Prof. M. Bolic and Prof. V. Z. Groza), *2010-2012.*
  - Mr. D. A. Abolarin (M.A.Sc.), Thesis: *Non-invasive Estimation of Blood Pressure using Harmonic Components of Oscillometric Pulses* (Supervisor: Prof. V. Z. Groza), *2013-2016.*

Undergraduate Supervision

Current Undergraduate Supervision

Current Sole Supervision

- Irene Macaulay, Thesis: *Thermography-based Breast Abnormality Detection Using Color Clustering* *2023-2024*

Current Co-Supervision

- Liam Tripp, Aaron Yee, Hamsa Zafar, Thesis: *Tissue Detection and Classification in Lung Ultrasound Images using Machine Learning*, Co-Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Ottawa *2023-2024*

Sole Supervised the following students

- Omar Imran and Santhosh Bradley Pradepan, Thesis: *Deep Learning on Trajectory Images* *2021-2022*
- Xander May and Mattias Lightstone, Thesis: *Remote Expert* *2020-2021*
- Joshua Dooley, Eimhin Mcdonald and Benjamin Melone, Thesis: *Deep Learning on Trajectory Images* *2020-2021*
- Chris Farah, OmKrishan Rajey, Adam Rocco, Kavichandran Dharmarajan, Thesis: *Dose Prediction Using Optical Techniques* *2019-2020*

- Benjamin Kukhta, Matt Wiles, Mohamed Osman, Hashim Hussen, Umar Sheikh-Omar, Thesis: *Am I Engaged or Am I Disengaged* *2019-2020*
- Kukai Hamada Beaudry, Joseph Lycano, Jason Wang, Thesis: *Augmented Reality Application Development* *2019-2020*
- Abubakar Sadiq Shehu, Seun Lawal, Musab Hassan, David Nzidee, Cedric Kamgang, Thesis: *Machine Learning for Heart Sound Classification* *2019-2020*
- Paul Grant, Geoffrey Nguyen and Abdul-Halim Ratmono, Thesis: *Smart sensor-based Sleep Therapy Using Biofeedback* *2018-2019*
- Kouvner Dhillon, Stefan Murga and Ian Malonda, Thesis: *Smart Phone-based Phono-cardiography* *2018-2019*
- Salma Hassan, Yehia Hosny and Andi Huang, Thesis: *Respiratory Effort Estimation using Empatica Watch* *2017-2018*
- Francois Campbell and Madelaine George, Thesis: *Estimating Respiratory Efforts with Empatica Wristband*, *2016-2017*
- Sadman Kabir, Anshuman Srivastava, Kalvin Alexander and Kevin Alexander, Thesis: *Android Application for Computing Heart Rate from PPG Signal obtained from Empatica E4 Wristband*, *2016-2017.*
- Mohamed Alhamwi, Arslan Haq, Idaf Joudeh and Xiaoke Lu, Thesis: *Monitoring of Arduino-based PPG and GSR Signals through an Android Device*, *2015-2016.*
- Yolina Petkova, Kavindi Ranasinghe, Shabiba Siddiq and Kevin Valade, Thesis: *Personal Multi-sensor Display*, *2015-2016.*

Co-supervised the following students

- Belal ElKhaledy, Josh Downing and Taylor Courtland, Thesis: *Brain Tumor Classification using Machine Learning*, Co-Supervisor: Prof. Y. Ono, Department of Systems and Conputer Engineering, Carleton University, Ottawa *2021-2022*
- Haiqa Haroon, Linpu Liu and Samy Abumohamed, Thesis: *Personal Telematics Device for Monitoring COVID-19 Measures*, Co-Supervisor: Prof. M. Atia, Department of Systems and Computer Engineering, Carleton University, Ottawa *2021-2022*
- Greg Hamilton. Ahmad Shahbaz, Thomas Tran and Khoa Tran, Thesis: *Artery wall motion tracking by ultrasound using machine learning*, Co-Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Ottawa *2020-2021*
- Olivia Arscott, Luke Stys, Kush Shah, Thesis: *Classifying EEG signals to Monitor User's Mental Alertness*, Co-Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University, Ottawa *2020-2021*
- Diego Politis, Joshua Poole, Juan Delgado Torres, Thesis: *Compressed Sensing and Recovery of ECG*, Co-Supervisor: Prof. P. Garcia, Department of Systems and Computer Engineering, Carleton University, Ottawa *2019-2020*
- Jacob Martin, Dillon Claremont, Amr Mazen, Mustafa Abdulmajeed, Thomas Bryk, Thesis: *Hey Drone, Can you talk?*, Co-Supervisor: Y. Labiche, Department of Systems and Computer Engineering, Carleton University, Ottawa *2019-2020*
- Anthony Calcicuri and Julia St-Jean, Thesis: *Characterization of Drones Using Radar*, Co-Supervisor: Dr. B. Balaji, DRDC, Ottawa *2018-2019*
- Jacob Podhraski, Connor Mckeen and Richard Finney, Thesis: *Machine Learning for Ship Detection and Classification*, Co-Supervisor: Dr. B. Balaji, DRDC, Ottawa *2018-2019*
- Adam Batson, Maxwell Demelo and Richard Carson, Thesis: *Gesture Based Text Input System - Writing in the Air*, Co-Supervisor: Prof. E. Ukwatta, Department of Systems and Computer Engineering, Carleton University, Ottawa, Canada. *2016-2017*
- Kevin Rosengren, Nikola Neskovic and Ian Wong, Thesis: *Google Glass for Chemical Invertory Tracking*, Co-supervisor: Prof. J. R. Green, Department of Systems and

Computer Engineering, Carleton University, Ottawa, Canada. *2015-2016*

- Landon Entwistle, Noel Lawan, Phil Grant and Yuxuan Zhao, Thesis: *iOS/Android Application for E4 wristband*, Co-Supervisor: Prof. M. Bolic, School of Electrical Engineering and Computer Science, University of Ottawa, Ottawa, Canada. *2015-2016*
- Daanish Khan and Dragan Trifkovic, Thesis: *Biological Signal Processing using an FPGA*, **Honorable Mention in Innovate Canada 2008 Alterra Design Competition for "FPGA-based Heart Rate Estimator"**, Co-Supervisor: Prof. A. D. C. Chan, Systems and Computer Engineering, Carleton University, Ottawa, Canada *2007-2008.*
- Wen-Yi Que, Ahmer Gulzar, Gurtej Sandhu and Denis Kutman, Thesis: *FPGA-based Implementation of Efficient Four-Quadrant Arctangent Functions*, Co-Supevisor: Prof. A. D. C. Chan, Systems and Computer Engineering, Carleton University, Ottawa, Canada. *2006-2007*

Undergraduate Student Research Supervision

- Mr. K. Tran, NSERC USRA *Summer 2021*
  Research Topic: *Continuous Estimation of Arterial Diameter Waveforms using M-mode Ultrasound Images*
- Mr. B. Balaji, NSERC USRA *Summer 2021*
  Research Topic:*Machine Learning for Biomedical Applications*
- Mr. O. Imran, I-CUREUS student internship *2020-2021*
  Research Topic: *Machine Learning for Pulse-by-Pulse Classification of Radar Signals*
- Ms. H. Sheik, I-CUREUS student internship *2020-2021*
  Research Topic *Wavelet-based processing for removing motion artifacts in vital sign monitoring using video amplification techniques.*
- Mr. O. Imran, I-CUREUS student internship *2019-2020*
  Research Topic *Detection and Tracking of Multiple Drones*
- Mr. O. Imran, Systems and Computer Engineering 1st year Summer Undergraduate Internship *Summer 2019*
  Research Topic: *Stone Soup*
- Mr. J. Gao, Systems and Computer Engineering 1st year Summer Undergraduate Internship *Summer 2019*
  Research Topic: *Stone Soup*
- Mr. S. Liu, Systems and Computer Engineering 1st year Summer Undergraduate Internship *Summer 2018*
  Research Topic: *Fall Detection using non-contact sensors*
- Mr. Z. Fuller, Systems and Computer Engineering 1st year Summer Undergraduate Internship *Summer 2018*
  Research Topic: *Fall Detection using non-contact sensors*
- Mr. X. May, Carleton University Research Opportunity (CUROP) *Summer 2017*
  Research Topic: *Non-contact Sensor Signal Processing*
- Ms. M. Kaka, Institutional Undergraduate Student Research Assistant *Summer 2016*
  Research Topic: *Brain Computer Interface for Biofeedback Rehabilitation*

JOURNAL ARTICLES

1. E. A. Nehary and **S. Rajan**, "Phonocardiogram Classification by Learning from Positive and Unlabeled Examples," accepted in *IEEE Transactions on Instrumentation and Measurement.*

2. Ganesha, H. S., R. Gupta, S. H. Gupta, **S. Rajan**, "Few-shot Transfer Learning for Wearable IMU-based Human Activity Recognition," accepted for publication in *Neural Computing and Applications.*

3. A. Dey, **S. Rajan**, G. Xiao and J. Lu, "Radar-based Human Activity Recognition using Multi-Domain Multi-Level Fused Patch-based Learning," accepted in *IEEE Transactions on Instrumentation and Measurement.*

4. B. Andò, S. Baglio, V. Marletta, M. Marrella, **S. Rajan**, V. Dibilio, G. Mostile, M, Zappia, "A Neuro-Fuzzy-Based Sensing Approach for the Classification of Emulated Postural Instability," *IEEE Sensors Journal*, vol. 23, no. 19, pp. 23866-23874, 1 Oct.1, 2023

5. A.Al-Najjar, M. Amini, **S. Rajan**, and J.R. Green, "Identifying Areas of High-risk Vegetation Encroachment on Electrical Powerlines using Mobile and Airborne Laser Scanned Point Clouds," accepted in *IEEE Sensors Journal*

6. P. Xu, J. Hosseinkhani, **S. Rajan**, H. Wang, J. Yang, and J. Chen, "Spectral estimation from non-raw color images with nonlinearity correction," *Color Research and Application*, vol. 48, no.4, pp. 393-407, 2023.

7. A. Dey, **S. Rajan**, G. Xiao and J. Lu, "Radar-Based Fall Event Detection Using Histogram of Oriented Gradients of Binary-Encoded Radar Signatures," *IEEE Sensors Letters*, vol. 7, no. 11, pp. 1-4, 2023.

8. A. Dey and **S. Rajan**, "Hue-Preserved Quantile-Based Global Contrast Enhancement of Breast Thermograms for Abnormality Detection," IEEE Sensors Letters, vol. 7, no. 9, pp. 1-4, Sept. 2023.

9. D. Luong, B. Balaji, and **S. Rajan**, "Quantum Radar: Challenges and Outlook," *IEEE Microwave Magazine*, vol. 24, no. 9, pp. 61-67, 2023.

10. A. Dey, E. Ali and **S. Rajan**, "Bilateral Symmetry-Based Abnormality Detection in Breast Thermograms Using Textural Features of Hot-Regions," *IEEE Open Journal of Instrumentation and Measurement*, doi: 10.1109/OJIM.2023.3302908.

11. A. Dey, **S. Rajan**, G. Xiao, and J. Lu, "One-Class Classification for Radar-Based Human Fall Event Detection," *IEEE Sensors Letters*, vol. 7, no. 7, pp. 1-4, 2023.

12. A. Dey, **S. Rajan**, G. Xiao, and J. Lu, "Measurement Methodology: Radar-Based Human Activity Recognition: Is it Ready for Aging in Place?," *IEEE Instrumentation and Measurement Magazine*, vol. 26, no. 7, pp. 12-19, 2023.

13. Z. Sharifisoraki, A. Dey, R. Selzler, M. Amini, J. R. Greeen, **S. Rajan**, and F. Kwamena, "Monitoring Critical Infrastructure Using 3D LiDAR Point Clouds," accepted in *IEEE ACCESS*

14. M. Abdelazez, **S. Rajan**, and A. D. C. Chan, "Detection of Atrial Fibrillation in Compressively Sensed Electrocardiogram for Remote Monitoring," accepted in *Frontiers in Electronics.*

15. D. Luong, B. Balaji, and **S. Rajan**, "Structured Covariance Matrix Estimation for Noise-Type Radars," accepted in *IEEE Transactions in Geoscience and Remote Sensing.*

16. M. Abdelazez, **S. Rajan**, and A. D. C. Chan, "Signal Quality Assessment of Compressively Sensed Electrocardiogram," accepted in *IEEE Transactions on Biomedical Engineering*

17. H.Zanddizari, **S. Rajan**, H. Rabah, and H. Zarrabi, "Privacy-Assured Outsourcing of Compressive Sensing Recovery Service in Cloud for ECG Signal," accepted in *IEEE Access*.

18. D. Luong, B. Balaji, and **S. Rajan**, "A Likelihood Ratio Detector for QTMS Radar and Noise Radar," accepted in *IEEE Transactions on Aerospace and Electronic Systems*.

19. D. Luong, B. Balaji, and **S. Rajan**, "Performance Prediction for Coherent Noise Radars Using the Correlation Coefficient," *IEEE ACCESS*, Vol. 10, 2022, pp. 8627-8633

20. S. Steinberg, A. Huang, Y. Ono, and **S. Rajan**, "Continuous Artery Monitoring using a Flexible and Wearable Single-Element Ultrasonic Sensor," accepted in *IEEE Instrumentation and Measurement Magazine*

21. F F. Firouzeh, J. W. Chinneck, and **S. Rajan**, "Faster Maximum Feasible Subsystem Solutions for Dense Constraint Matrices," accepted in *Computers and Operations Research*, 2021.

22. C. Ciobanu, K. J. I. Ember, B. J. Nyíri, **S. Rajan**, V. Chauhan, F. Leblond and S. Murugkar, "Potential of Raman spectroscopy for blood-based biopsy," accepted in *IEEE Instrumentation and Measurement Magazine*

23. H. Chahrour, R. Dansereau, **S. Rajan**, and B. Balaji, "Target detection through Riemannian Geometric Approach," *IEEE ACCESS*, Vol 9, 2021, pp. 123950-123963.

24. S. Behbehani, H. Ahmadieh, and **S. Rajan**, " Feature Extraction Methods in Electroretinogram Signal Analysis: A Review," *IEEE ACCESS*, Vol. 9, 2021, pp. 116879-116897.

25. S.Bakshi, and **S. Rajan**, "Few Shot Learning Using Siamese Network for Fall Detection,"*IEEE Sensors Letters*, Vol 5, No. 8, pp. 1-4, August 2021.

26. H. Sadreazami, M. Bolic, and **S. Rajan**, "Contactless Fall Detection Using Time-Frequency Analysis and Deep Neural Network," *IEEE Transactions on Industrial Electronics*, Vol 17, issue 10, October 2021, pp. 6842-6851.

27. M. Abdelazez, **S. Rajan**,and A. D. C. Chan,"Automated Biosignal Quality Analysis of Electrocardiograms," *IEEE Instrumentation and Measurement Magazine*, Vol. 24, No. 2, pp. 37-44, April 2021.

28. M. Abdelazez, **S. Rajan**, and A. D. C. Chan, "Detection of Atrial Fibrillation in Compressively Sensed Electrocardiogram Measurements," *IEEE Transactions in Instrumentation and Measurement*, Vol 70, pp. 1-9, 2020, Art no. 2502209.

29. D. Luong, **S. Rajan**, and B. Balaji, "Quantum Monopulse Radar," Applied Computational Electromagnetics Society Journal, Vol. 35, Nov. 2020, pp. 1430 -1432.

30. P. Klaer, A. Huang, P. Sevigny, **S. Rajan**, S. Pant, P. Patnaik, and B. Balaji, "An Investigation of Rotary Drone HERM Line Spectrum under Manoeuvering Conditions," *Sensors*, Vol. 20, 2020, pp. 5940.

31. D. Luong, **S. Rajan**, and B. Balaji, "Quantum Two-Mode Squeezing Radar and Noise Radar: Correlation Coefficient and Integration Time," *IEEE Access*, Vol. 8, 2020, pp. 185544-185547.

32. Z. Baird, M. K. McDonald, **S. Rajan**, and S. Lee, "A CNN-LSTM Network for Augmenting Target Detection in Real Maritime Wide Area Surveillance Radar Data," *IEEE ACCESS*, Vol 8, 2020, pp. 179281-179294.

33. F. Zabihollahy, **S. Rajan**, and E. Ukwatta, "Machine Learning-based Segmentation of Left Ventricular Myocardial Fibrosis from Magnetic Resonance Imaging," in *Current Cardiology Report*, Vol. 22, Article 65, 2020.

34. B. F. Firouzeh, J. W. Chinneck, and **S. Rajan**, "Maximum Feasible Subsystem Algorithms for Recovery of Compressively Sensed Speech," *IEEE Access*, Vol. 8, Issue 1, December 2020, pp. 82539-82550.

35. S. Lee, H. Dajani, **S. Rajan**, G. Lee, and V. Z. Groza, "Uncertainty in Blood Pressure Measurement Estimated using Ensemble-based Recursive Methodology," *Sensors*, Vol. 20, Issue 7, April 2020, pp. 1-15.

36. D. Mitra, H. Zanddizari, and **S. Rajan**, "Investigation of Kronecker-based Recovery of Compressed ECG Signal," *IEEE Transactions in Instrumentation and Measurement*, Vol. 69, Issue 6, June 2020, pp. 3642-3653.

37. D. Luong, **S. Rajan**, and B. Balaji, "Quantum Two-Mode Squeezing Radar and Noise Radar: Correlation Coefficients for Target Detection," *IEEE Sensors Journal*, Vol. 20, Issue 10, May 2020, pp. 5221-5228.

38. D. Luong, **S. Rajan**, and B. Balaji, "Entanglement-based Quantum Radar: From Myth to Reality," *IEEE Aerospace and Electronic Systems Magazine*, Vol. 23, No. 4, April 2020, pp. 22-35.

39. H. Sadreazami, M. Bolic, **S. Rajan**, "Fall Detection Using Standoff Radar-based Sensing and Deep Convolutional Network," *IEEE Transactions on Circuits and Systems -II: Express Briefs*, Vol. 67, No. 1, January 2020, pp. 197-201.

40. N. Pradhan, **S. Rajan**, A. Adler, "Evaluation of Signal Quality of Wrist-Based Photoplethysmography", *Physiological Measurements*, Vol. 40, No. 6, July 2019, pp. 065008

41. H. Sadreazami, M. Bolic, **S. Rajan**, "CapsFall: Fall Detection using Ultra Wideband Radar and Capsule Network", *IEEE Access*, Vol. 7, 2019, pp. 55336-55343.

42. I. Nejadgholi, H. Sadreazami, **S. Rajan**, M. Bolic, "Classification of Doppler Radar Reflections as Preprocessing for Breathing Rate Monitoring," *IET Signal Processing*, Vol. 13, Issue. 1, February 2019, pp. 21-28.

43. I. Nejadgholi, H. Sadreazami, Z. Baird, **S. Rajan**, M. Bolic, "Estimation of Breathing Rate with Confidence Interval Using Single-Channel CW Radar", *Journal of Healthcare Engineering*, vol. 2019 (article ID 2658675).

44. H. Zanddizari, **S. Rajan** and H. Zarrabi, "Increasing the Quality of Reconstructed Signal in Compressive Sensing Utilizing Kronecker Technique," *Springer- Biomedical Engineering Letters*, vol 8, issue 2, 2018, pp. 239-247.

45. G. Singh, **S. Rajan**, S. Majumdar "A Fast Iterative Data Association Technique for Multiple Object Tracking," *Special issue of the International Journal of Semantic Computing (IJSC)*, Vol. 12, No. 02, 2018, pp. 261-285.

46. B. Li, L. Zhang, T. Kirubarajan and **S. Rajan**, "Projection Matrix Design Method for MSE Reduction in Adaptive Compressive Sensing," *Signal Processing*, Vol. 141, December 2017, pp. 16-27.

47. S. Salari, I-M. Kim, F. Chan, **S. Rajan**, "Blind Compressive-Sensing Based Electronic Warfare Receiver," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 53, No. 4, August 2017, pp. 2014-2030.

48. S. Lee, **S. Rajan**, G. Jeon, J-H. Chang, H. R. Dajani and V. Z. Groza, "Oscillometric blood pressure estimation by combining nonparametric bootstrap with Gaussian mixture model," *Computers in Medicine and Biology*, Vol. 85, June 2017, pp. 112-124.

49. B. Li, L. Zhang, T. Kirubarajan, **S. Rajan**, "Projection Matrix Design Using Prior Information in Compressive Sensing," *Signal Processing*, Vol. 135, June 2017, pp. 36-47.

50. M. Forouzanfar, M. Mabrouk, **S. Rajan**, M. Bolic, H. R. Dajani and V. Z. Groza, "Event Recognition for Contactless Activity Monitoring Using Phase-Modulated Continuous Wave Radar," *IEEE Transactions in Biomedical Engineering*, Vol 64, Issue 2, February 2017, pp. 474-491.

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52. Y. Guo, R. Tharmarasa, **S. Rajan**, T. L. Song, T. Kirubarajan, "Passive Tracking in Heavy Clutter With Sensor Location Uncertainty," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 52, No. 4, 2016, pp. 1536-1554.

53. M. Forounzanfar, H. R. Dajani, V. Z. Groza, M. Bolic, **S. Rajan** and I. Batkin, "Bayesian Fusion Algorithm for Improved Oscillometric Blood Pressure Estimation" *Medical Engineering and Physics*, Vol. 38, Issue. 11, Aug 16, 2016, pp. 1300-1304.

54. M. Mabrouk, **S. Rajan**, M. Bolic, M. Forounzanfar, H. R. Dajani and I. Batin, "Human breathing rate estimation from radar returns using harmonically related filters," *Journal of Sensors*, Vol. 2016 (2016) (article ID 9891852).

55. X. Jiang, W-J. Zeng, H. C. So, **S. Rajan** and T. Kirubarajan, "Robust Matched Filtering in l_p Space," *IEEE Transactions on Signal Processing*, Vol.63, No.23, December 2015, pp.6184-6199.

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57. M. Forouzanfar, H.R. Dajani, V. Z. Groza, M. Bolic, **S. Rajan** and I. Batkin, "Oscillometric Blood Pressure Estimation: Past, Present, and Future," *IEEE Reviews in Biomedical Engineering*, Vol. 8, 2015, pp. 44-63.

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61. M. Forouzanfar, H. Dajani, V. Z. Groza, M. Bolic, **S. Rajan** and I. Batkin, "Ratio-Independent Blood Pressure Estimation by Modeling the Oscillometric Waveform Envelope," *IEEE Transactions on Instrumentation and Measurement*, Vol. 63, Issue 10, October 2014, pp. 2501-2503.

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65. O. A. Dobre, M. Oner, **S. Rajan** and R. Inkol, "Cyclostationarity-based Algorithms for QAM Signal Identification," *IEEE Communication Letters*, Vol. 16, No. 1, January 2012, pp. 12-14.

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21. S. Wang, R. Inkol, **S. Rajan**, F. Patenaude, "Theory of the FFT Filter Bank-based Majority and Median CFAR Detectors," *DRDC Ottawa Technical Report TR 2007-088*. (Unclassified)

22. R. Doraiswami and **S. Rajan**, "Detection and Classification of Phonocardiogram Signals," Unclassified, Technical report submitted to Siemens Corporate Research, Princeton, U.S.A., February 1998.

23. T. Bose and **S. Rajan**, "Enhancement of Sinusoid using Adaptive Notch Filters," Unclassified, Technical report submitted to Micro Motion Inc, U.S.A., 1994.

PATENTS

1. Y. Ono, M. Yoshida, A. Huang, and **S. Rajan**, "Method and Apparatus for Ultrasonic Continuous Measurement of Blood Vessel Diameter", U.S. Patent Application-US 62/685344 Filed June 15, 2018.

2. M. Mabrouk, I. Batkin, **S. Rajan**, M. Bolic, H. Dajani and V. Groza, "Remote Sensing of Human Breathing at a Distance", U.S. Patent 10401479 Granted on Sep 3, 2019.

3. S. Henault, Y. M. M. Antar, **S. Rajan**, R. Inkol and S. Wang, "The Multiple Antenna Induced EMF Method (MAIEM)," DRDC File 1416-08/010CA, Report of Invention, July 2008.

4. R. Inkol, **S. Rajan**, S. Wang and F. Patenaude and M. Dufour, "Robust Signal Detection and Direction Finding Technique," DRDC File 1416-07/21 (DBDO 6), Report of Invention, 31 May 2007.

5. R. L. Watrous, N. Reichek, **S. Rajan** and D. Nikovski, WO 01/22883 A1, "Multi-Modal Cardiac Diagnostic Decision Support System and Method," Pub. Date 5th April 2001.

6. H. V. Derby, T. Bose, and **S. Rajan**, U.S. Patent number 5,555,190: "Method and Apparatus for Adaptive Line Enhancement in Coriolis Effect Mass Flow Meter Measurement," 1996 (also shows up as WO9703339 (A1); EP0838020 (A1); US5555190 (A1); EP0838020 (A0); EP0838020 (B1); RU2155325 (C2); AU704345B (B2), CN 2208452)

Invited Presentations

1. A. Dey and **S. Rajan**, "Signal Processing for Detection and Classification of Human Activity Monitoring through Privacy-Preserving Remote Measurements," accepted for tutorial presentation in *IEEE International Conference on Instrumentation and Measurement (I2MTC)*, Glasgow, Scotland, United Kingdom, 2024.

2. **S. Rajan**, 'Advanced Sensing and Signal Processing in Monitoring Applications". *IEEE Canadian Conference on Electrical and Computer Engineering*, Halifax, Canada, Oct 2022.

3. **S. Rajan**, "Applied Machine Learning for Wearable and Remote Sensors," **Keynote Speaker**, 2nd IEEE Instrumentation and Measurement Workshop, IEEE Spain and Portugal Instrumentation and Measurement Chapters, April 2021.

4. **S. Rajan**, "Sensing in the connected world: A curse or a boon?," IEEE Ottawa Chapter of Engineering in Medicine and Biology Society, October 2020.

5. B. F. Firouzeh, **S. Rajan** M. Abdelazez, "From Compression to Recovery: An Overview of Compressive Sensing," **Tutorial Speaker**, *IEEE International Instrumentation and Measurement Conference*, May 2020.

6. **S. Rajan**, "Sensing in the IoT Era", **Keynote Speaker**, *Second IEEE International Symposium on Sensing and Instrumentation in IoT Era*, August 2019.

7. M. Abdelazez, **S. Rajan**, "Signal Quality: From Wearables to Hospitals", **Tutorial Speaker**, *IEEE International Instrumentation and Measurement Conference*, May 2019.

8. **S. Rajan**, "Artificial Intelligence and Machine Learning," **Panelist**, *Data Day 5.0*, Carleton University, March, 2018.

9. **S. Rajan**, "When All Knowns Are Unknowns", **Keynote Speaker**, *Carleton University TA Training Day*, January. 2018.

10. **S. Rajan**, "Remote Vital Sign Monitoring", *Ingenious Talks Series*, December 2017.

11. **S.Rajan** and M. Bolic, "NonContact Life Sign Monitoring for Inmates", *Use of Technology for Correctional Services Conference*, 2017.

12. M. Tarar, **S. Rajan** and M. Bolic, "Radar and 3D Motion Sensor System for Contactless Monitoring of Seniors", Champlain Fall Prevention Steering Committee, Regional Geriatric Program of Eastern Ontario, August 2017.

13. **S. Rajan**, "Sensor Systems and Data Analytics", Manitoba Advanced Sensors Centre of Excellence-MASCoE workshop on Sensors, NRC Ottawa, August 2016.

14. **S. Rajan**, "Treasure Trove: Signal Processing Intelligently," Department of Systems and Computer Engineering, Carleton University, May 2014.
15. **S. Rajan**, "An Overview of Electronic Protection and Electronic Support Measures," (Unclassified), Canadian Systems Electronic Course, April 2014.
16. **S. Rajan**, "General EP/ES Overview," (Unclassified), Canadian Systems Electronic Course, April 2013.
17. **S. Rajan**, "IEEE Pulse Waveform Standard," (Unclassified), Conductive Weapons Strategy Initiative Workshop, October 2011.
18. **S. Rajan**, "STEP-UP to Rise," Poster Presentation, IEEE Sections Congress, August 2011.
19. **S. Rajan**, S. Wang, R. Inkol and F. Patenaude, "On Detection of Signals," (Unclassified), Oral Presentation at the Workshop on SMART ARM 2009, November 2009.
20. **S. Rajan**, F. Dilkes, H-J Du, "Report on Action Item on Long Range Geolocation, Task 13 on TP4," (Classified Secret), Presentation to the Task 13 Group on TTCP EWS TP4 at AFRL, Dayton, Ohio, October 2009.
21. **S. Rajan**, "Update on Kaizen," (Classified Secret), Presentation to the TTCP EWS Joint TP2-TP4 at AFRL, Dayton, Ohio, October 2009.
22. **S. Rajan**, S. Wang, R. Inkol and F. Patenaude, "Angle Averaging Strategies," (Unclassified), Presentation to the TTCP EWS TP4 at DRDC Ottawa, May 2009.
23. **S. Rajan**, "Detection, Demodulation and Automatic Modulation Recognition," (Unclassified) Part of Canadian National Brief at TTCP EWS TP2, Australia, 2009. (Presented on behalf by Mr. A. Mudry)
24. **S.Rajan**, "Communication Electronic Warfare," Course for Canadian Electronic Warfare Officers, 2008.
25. R. Inkol, S. Wang and **S. Rajan**, "FFT filter bank-based CFAR Detection Schemes," (Unclassified), Poster in DRDC Ottawa CNEW Open House, October 2007.
26. S. Wang, R. Inkol and **S. Rajan**, "FFT Filter Bank-based CFAR Detectors," (Unclassified), Presentation to the TTCP-EWS-TP2, Ottawa, February 2007.
27. O.A. Dobre, **S. Rajan**, R. Inkol and S. Wang, "Automatic Modulation Recognition," (Unclassified), Presentation to TTCP-EWS-TP2, Ottawa, February 2007.

Non-refereed Presentations and Posters

1. B. F. Firouzeh, J. Chinneck, and **S. Rajan**, "A Maximum Feasible Subset Approach for Compression of Speech Signals", Carleton RADS Poster Fair, Oct. 2018.
2. M. Abdelazez, S. Sreeraman, and A. D. C. Chan, **S. Rajan**, "Application of Signal Quality in ECG Biometrics", Medical Devices Innovation Institute and NSERC CREATE Poster Fair, Sep. 2017.
3. G. Singh, **S. Rajan**, and S. Majumdar, "Fast and Scalable Techniques for Multiple Object Tracking", Poster, Carleton University Data Day 4.0, 2017. **Second Prize with cash Award $ 500**

4. G. Singh, **S. Rajan**, and S. Majumdar, "An Offline Multi-stage Tracking-by-detection approach for tracking multiple pedestrians", Oral Presentation, Canadian Tracking and Fusion Workshop, 2016.

SERVICES

Services to Profession

- 2023-Present Member, Steering Committee, IEEE Sensors Applications Symposium
- 2024 Special Sessions Chair, IEEE Sensors Applications Symposium
- 2023- Present Member-at-Large, Board of Governors, IEEE Consumer Technology Society
- 2023 Executive Chair, IEEE International Conference on Consumer Electronics
- 2023 General Co-Chair, IEEE Sensors Applications Symposium
- 2023 Session Chair, IEEE Sensors Applications Symposium
- 2022-Present Associate Editor, IEEE Transactions on Consumer Technology
- 2022 Tutorial Chair, 2022 IEEE Instrumentation and Measurement Technology Conference
- 2021-Present Representative of IEEE Consumer Technology Society in IEEE Biometric Council
- 2021 - Present Member, Awards Committee, IEEE Consumer Technology Society
- 2021 - Present Member, Board of Governors, IEEE Consumer Technology Society
- 2021 - Present Director, North America Region, IEEE Consumer Technology Society
- 2021 Chair, Plenary Session, 2021 IEEE Second International Conference on Control, Measurement and Instrumentation (CMI)
- 2020 Technical Program Committee Member, 2021 IEEE Second International Conference on Control, Measurement and Instrumentation (CMI)
- 2020 Session Chair, IEEE Measurements in Medical Applications (MeMeA)
- 2019 Member, Organization Committee, Ottawa AI Alliance Workshop
- 2019-Present Chair, IEEE Ottawa Aerospace, and Electronics Systems Chapter
- 2019 General Co-Chair, IEEE Global Conference on Signal and Information Processing
- 2019 Academic Co-Chair, Canadian Medical and Biological Engineering Conference
- 2019 Workshop Chair, IEEE International Conference on Wireless for Space and Extreme Environments (WiSEE 2019)
- 2019 Session Co-chair, IEEE Sensors Application Symposium
- 2018 Session Co-Chair, IEEE International Symposium on Medical Measurements and Applications
- 2017-8/2018 External Relations Group Chair, IEEE Canada
- 2017-2018 Section Vitality Chair, IEEE Canada

- 2016 Member, Steering Committee, First International Workshop on Research Advancements in Future Networking Technologies (RAFNET 2016)
- 2016 Co-Chair, Technical Program Committee, Electrical Power and Energy Conference (EPEC)
- 2015 Member, Technical Program Committee, IEEE International Symposium on Innovations in Intelligent Systems and Applications (INISTA)
- 2015 Member, Technical Program Committee, Second International Symposium on Signal Processing and Intelligent Recognition Systems (SIRS2015)
- 2015 Member, IEEE MGA Strategic Development and Environmental Assessment Committee
- 2015-2017 Member, IEEE MGA Admissions and Advancement Committee
- 2015 Co-Chair, Patronage Committee, IEEE Integrated Management (IM 2015)
- 2015 Co-Chair, Student Travel Grants, IEEE Integrated Management (IM 2015)
- 2015 Co-Chair, Sponsorship and Industry Liaison, Canadian Workshop on Information Theory
- 2015 Member, Advisory Board, IEEE International Humanitarian Technology Conference (IHTC 2015)
- 2015 Member, Finance Committee, IEEE International Humanitarian Technology Conference (IHTC 2015)
- 2014-2015, Organizing Committee Member, Canadian Tracking and Fusion Workshop
- 2015 Co-Chair, Industry/Government Liaison and Sponsorships, IEEE Canadian Workshop on Information Theory
- 2013-2019 Associate Editor, IEEE Canadian Journal of Electrical and Computer Engineering
- 2013-2015 Chair, IEEE Canada Eastern Area
- 2013-2014 Member, IEEE Canada Nomination Committee
- 2013-2014 Chair, IEEE Ottawa Section Nomination Committee
- 2015 Member, IEEE Ottawa Section Nomination Committee
- 2012, Member, Technical Program Committee, IEEE Vehicular Technology Conference
- 2017-8/2018 Member, IEEE Canada Executive Committee
- 2011-8/2018 Member, IEEE Canada Board
- 2011-2012 Chair, IEEE Ottawa Section
- 2009-2010 Chair, IEEE Ottawa Section AGM
- 2009-2010 Vice Chair, IEEE Ottawa Section
- 2007-2008 Treasurer, IEEE Ottawa Section
- 2007-2016 Member, IEEE Ottawa Section Awards Committee

- 2007-present Chair, IEEE Ottawa Chapter of Engineering in Medicine and Biology Society
- 2009-present Chair, IEEE Ottawa Section Senior Member Committee
- 2009-present Steering Committee Member, IEEE Midwest Symposium on Circuits and Systems
- 2005-2006 Vice Chair, IEEE Ottawa Chapter of Engineering in Medicine and Biology Society
- 2014, Industry and Sponsorship Liaison Chair, IEEE Queen's Biennial Symposium
- 2013 Associate General Chair, IEEE Radar Conference
- 2013 Member, Technical Program Committee, Canadian Engineering in Medicine and Biology Society Conference
- 2013 Co-Chair, Partnership Program, IEEE Radar Conference
- 2013 Technical Program Committee Member, International Conference on Computational Intelligence and Virtual Environment for Measurement Systems and Applications
- 2012 Track Chair, IEEE International Workshop on High-Performance Chips, Package and Systems
- 2012 Co-Chair, Local Arrangements, IEEE International Conference on Communications
- 2012 Member, Executive Committee, IEEE International Conference on Communications
- 2012 Co-Chair, Bioengineering circuits and systems, IEEE Midwest Symposium on Circuits and Systems
- 2011 Member, Technical Program Committee, IEEE International Conference on Communications
- 2010 Member, Steering Committee, IEEE Symposium on Medical Measurements and Applications
- 2010 Co-ordinator, Biomed/Optoelectronics Technical Streams of IEEE Newfoundland Electrical and Computer Engineering Conference
- 2010 Member, Technical Program Committee, IEEE Global Communications Conference
- 2010 Co-Chair, Local Arrangements, IEEE Vehicular Technology Conference-Fall
- 2010 Member, Technical Program Committee, IEEE Vehicular Technology Conference-Spring
- 2009 Co-Chair, Signal and Multi-media Processing Symposium, IEEE Canadian Conference on Electrical and Computer Engineering
- 2009 Member, Program Committee, IEEE Conference on Computational Intelligence for Security and Defense Applications
- 2008-2010 Member, Steering Committee, Technical Organizing Committee, IEEE Workshop on Adverse Response to Monitoring

- 2008, 2007 Judge, IEEE Eastern Ontario Student Oral Paper Competition
- 2008 Session Chair, 24th IEEE Biennial Queen's Symposium on Communications
- 2008 Session Chair for Standards and Medical Applications II, IEEE Symposium on Medical Measurements and Applications
- 2008 Member, Steering Committee, IEEE Symposium on Medical Measurements and Applications
- 2008 Co-Chair, Signal and Multi-media Processing Symposium, IEEE Canadian Conference on Electrical and Computer Engineering
- 2007 Co-Chair, DSP Track-III, IEEE MidWest Symposium on Circuits and Systems
- 2007 Member, Organizing Committee, IEEE Workshop on Blood Pressure Measurements and Standardization Seminar
- 2007 Member, Organizing Committee, IEEE FPGA Workshop, Ottawa
- 2007 Member, Review Panel Committee for DSP track, IEEE MidWest Symposium on Circuits and Systems
- 2006 Member, Organizing Committee, IEEE Canadian Conference on Electrical and Computer Engineering
- 2006 Track Chair and Organizer, DRDC Workshop, IEEE Canadian Conference on Electrical and Computer Engineering
- 2006 Sessions Chair, DSP Track-III, IEEE Canadian Conference on Electrical and Computer Engineering

Journal Reviewer

- Reviewer for Annals of Biomedical Engineering, IEEE Transactions on Circuits and Systems-II, IEEE Transactions on Aerospace and Electronics, IEEE Transactions on Instrumentation and Measurements, IEEE Transactions on Wireless Communication, IEEE Transactions on Biomedical Engineering, IEEE Reviews on Biomedical Engineering, IEEE Signal Processing Magazine, EURASIP Journal on Wireless Communications, Digital Signal Processing, Canadian Journal of Electrical and Computer Engineering, Journal of System Architecture, IET Signal Processing, IET Microwave, Antennas and Propagation, IEEE Instrumentation and Measurement Magazine.
- Associate Editor, *Canadian Journal of Electrical and Computer Engineering 2013-present*

Conference Reviewer

- Regular Reviewer for IEEE GlobeCom, IEEE ICC, IEEE VTC (Fall and Spring), IEEE WCNC, IEEE LISA, IEEE CCECE, IEEE ISCAS, IEEE MWSCAS, International Conf on Sig. Processing and Communications, IEEE MeMeA, Itherm Conference, IEEE NECEC and WCSP

Grants and Proposals Assessor

- Reviewer for Canada Research Chair
- Reviewer for NSERC: Industrial Research Chair for Colleges, Strategic Projects Proposals, CREATE Proposals and DISCOVERY grants

- Strategic Review Panel Member of Ontario Research Funds for Large Infrastructure Grants
- Reviewer for MITACS Proposals
- Reviewer for Reviewer for Applied Research Proposals for Royal Military College, Kingston, Ontario, Canada
- Reviewer for Internal University Grant proposals of University of Western Ontario, London, Ontario, Canada
- Reviewer for Atlantic Canada Opportunities Agencies

SERVICES TO THE UNIVERSITY

External University Examiner for PhD

- Ms. Mira Vrbaski *Aug 2023*
  Dissertation title: *Cost-Effective Large-Scale Digital Twins Notification System with Uncertainty and Prioritization Consideration*, School of Electrical Engineering and Computer Science, University of Ottawa (with the Ottawa Carleton Institute for Electrical and Computer Engineering)
- Mr. Ramin Babaee *July 2023*
  Dissertation title: *DSP and Optimization for System-Level and Component-Level Improvements in Coherent Optical Communications*, School of Electrical Engineering and Computer Science, University of Ottawa (with the Ottawa Carleton Institute for Electrical and Computer Engineering)
- Mr. Ran Zhang *Nov 2022*
  Dissertation title: *Spotting Shipping Container Codes with Deep Learning Methods*, Department of Electrical Engineering, Univeristy of British Columbia, Okanagan, Canada
- Mr. S. Kumar *Aug 2022*
  Dissertation title: *Joint Compressed Sensing-based Multi-Channel ECG Data Compression*, Department of Electronics and Communication Engineering, School of Engineering, Tezpur University, Tezpur, India
- Ms. Meenakshi *May 2022*
  Dissertation title: *Sensing Matrix Optimization and Feature Extraction for Image Processing*, Department of Electrical Engineering, Indian Institute of Technology, Delhi, India
- Mr. K. C. Howell *Jan 2022*
  Dissertation title: *Deep Reinforcement Learning as Guidance for Aerospace Robotics*, Department of Mechanical Engineering and Aerospace, Carleton University, Canada
- Mr. R. Chen *Aug 2021*
  Dissertation title: *Consensus-enabled and Value-oriented Collaboration in IOT Systems: Mechanisms, Design, and Implementation*, Department of Electrical and Computer Engineering, Western University, Canada
- Mr. Yousef Ali *Dec 2019*
  Dissertation title: *Objective Estimation of Tracheoesophageal Speech Quality*, Department of Electrical and Computer University, Western University, Canada
- Mr. Hershel Caytak *Nov 2018*
  Proposal Title: *Bioimpedance spectroscopy methods for analysis and control of neurostimulation dose*, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering)

External University Examiner for M.A.Sc

- Farzaneh Bannazadeh *Dec 2023 Model Predictive Control for Dissolved Oxygen and Temperature to Study Adeno-Associated Virus (AAV) Production in Bioreactor*
  Thesis Supervisor: Prof. M. Bolic, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute of Biomedical Engineering).

- Ms. J. Rusrus *Apr 2023*
  Thesis title: *Moving Sound Sources Direction of Arrival Estimation using Different Deep Learning Schemes*
  Thesis Supervisors: Prof. S. Shirmohammadi and Prof. M. Bouchard, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. Z. Han *May 2021*
  Thesis title: *Respiratory Patterns Classification using UWB radar*
  Thesis Supervisor: Prof. M. Bolic, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- S. Hong *May 2020*
  Thesis title: *Active Sensing for Collaborative Localization in Swarm Robotics*
  Thesis Supervisor: Prof. P. Payeur, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. S. He *Dec 2018*
  Thesis title: *Time-interval based Blood Pressure Measurement Technique and System*
  Thesis Supervisor: Prof. M. Bolic, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. F. F. T. Kemdjo *Aug. 2018*
  Thesis title: *Recognition and Classification of Aggressive Motion using Smartwatches*
  Thesis Supervisors: Prof. N. Baddour and Prof. E. Lemaire, Department of Mechanical Engineering, University of Ottawa (within the Ottawa Carleton Institute for Biomedical Engineering).

- Mr. N. Primeau *Oct. 2017*
  Thesis title: *Risk-Aware Decision Support for Critical Infrastructure Protection using Multi-Objective Optimization*
  Thesis Supervisors: Prof. E Peitru and Prof. R. Abeilmona, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. A. Plachkov *Oct. 2016*
  Thesis title: *Soft Data-Augmented Risk Assessment and Automated Course of Action Generation for Maritime Situational Awareness*
  Thesis Supervisors: Profs. V. Groza, R. Abielmona, Emil Peitru and Diana Inkpen, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. G. W Somers *July 2016*
  Thesis title: *Acceleration of Block-Aware Matrix Factorization on Heterogeneous Platforms*

Thesis Supervisors: Prof. E. Gad and Prof. M. Bolic, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. E. Poliakov *Apr. 2012*
  Thesis title: *Virtual Receiving Array Method for Direction of Arrival Estimation Using Direct Data Domain Techniques and Signal Cyclostationarity*
  Thesis Supervisors: Prof. Y. M. Antar and Dr. Chen Wu, Department of Electrical Engineering, Royal Military College, Kingston, Ontario, Canada.

Chairman for Internal PhD Examinations

- E. Nakhostin, "Performance of corrugated steel culverts buried in shallow cover depth and subjected to environmental deteriorations", Department of Civil Engineering, Carleton University, Dec 2021.

External Departmental Examiner for M.A.Sc

- Mr. Jake W. J. Staples, *Nov 2023*
  Thesis title: *A Portable, Rapid Isothermal Nucleic Acid Amplification System with Integrated Microfluidics for Pandemic Surveillance*
  Thesis Supervisor: Prof. R. Prakash, Department of Electronics, Carleton University

- Mr. D. Bascelli, *June 2022*
  Thesis title: *Novel Scalable Metasurface Control System*
  Thesis Supervisors: Prof. J. Wight and Prof. S. Gupta, Department of Electronics, Carleton University

- Mr.T. Bimenyimana *Aug 2020*
  Thesis title: *Using Machine Learning and Deep Learning for Load disaggregation and Recognition of Activities in Household*
  Thesis Supervisor: Prof. O. Shafiq, School of Information Technology, Carleton University

- Ms. A. Mazurkiewicz *May 2020*
  Thesis title: *Effects of brain gyrification on impact-induced strain measurements with a preliminary study on viable ex-vivo porcine brain*
  Thesis Supervisor: Prof. O. E. Petel, Prof. H. Frei, Department of Mechanical and Aerospace Engineering, Carleton University (within the Ottawa Carleton Institute for Electrical and Computer Engineering)

- Mr. E. F. A. Calzadillas *Oct 2019*
  Thesis title: *Sparse Video Visual Odometry With Local Non-Linear Least Squares Optimization for Navigation of Autonomous Vehicles*
  Thesis Supervisor: Prof. J. Sasiadek, Department of Mechanical and Aerospace Engineering, Carleton University (within the Ottawa-Carleton Institute for Electrical and Computer Engineering

- Mr. S. Abujoub *Sept 2019*
  Thesis title: *Development of a Landing Period Indicator and the use of Signal Prediction to Improve Landing Methodologies of Autonomous Unmanned Aerial Vehicles on Maritime Vessels*
  Thesis Supervisor: Prof. R. Irani, Department of Mechanical and Aerospace Engineering, Carleton University (within the Ottawa-Carleton Institute for Electrical and Computer Engineering

- Mr. M. K. Emara *April 2018*
  Thesis title: *Dispersion Engineered Radiative and Guided Wave Electromagnetic*

Structure for Efficient Wave Control
Thesis Supervisors: Prof. S. Gupta and Prof. J Wight, Department of Electronics, Carleton University (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Capt. G. Dufour *Sept. 2017*
Thesis title: *Self Stabilizing Switched Beam Offset Reflector (3SBOR) Antenna*
Thesis Supervisor: Prof. J. Wight, Department of Electronics, Carleton University (within the Ottawa Carleton Institute for Electrical and Computer Engineering).

- Mr. A. Nagy *Jan. 2017*
Thesis title: *Multilateration and Kalman Filtering Techniques for Stealth Intelligence Surveillance and Reconnaissance using Multistatic Radar*
Thesis Supervisor: Prof. J Wight, Department of Electronics, Carleton University (within the Ottawa-Carleton Institute for Electrical and Computer Engineering).

- Mr. O. Marsh *Sept. 2016*
Thesis title: *Silicon-on-Insulator Biosensor using microring resonators and ring-assisted mach-zhender interferometers*
Thesis Supervisor: Prof. W. Yee, Department of Electronics, Carleton University (within the Ottawa-Carleton Institute for Electrical and Computer Engineering).

- Mr. A. R. M. Haidari *Sept. 2016*
Thesis title: *Retrospective Dosimetric Monte Carlo Study for Permanent Implant Prostate Brachytherapy at the Ottawa Hospital Cancer Centre*
Thesis Supervisors: Prof. R. Thomson and Prof. J Cygler, Department of Physics, Carleton University (within the Ottawa-Carleton Institute for Biomedical Engineering).

External Departmental Examiner for PhD Proposal

- Mr. S. He *Jan 2023*
Proposal Title:*A Study of Cuffless Blood Pressure Estimation* School of Electrical Engineering and Computer Science, University of Ottawa (with the Ottawa-Carleton Institute for Electrical and Computer Engineering).

- Mr. R. Babaee *Sept 2022*
Proposal Title: *DSP and Optimization for System- Level and Component-Level Improvements in Coherent Optical Communications*, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa-Carleton Institute for Electrical and Computer Engineering.

- Ms. M. Vrbaski *June 2021*
Proposal Title: *Cost-effective Large-scale Digital Twins Notification System With Uncertainty and Prioritization Consideration*, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa-Carleton Institute for Electrical and Computer Engineering.

- Ms. C. Sun *July 2020*
Proposal Title *Single-view 3D Hair Strands Reconstruction-based on Deep Learning*, School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa-Carleton Institute for Electrical and Computer Engineering.

- Mr. Hershel Caytak *May 2017*
Proposal Title *Optimization of Transcranial Direct Current Stimulation: Investigation of the Relationships Between Relative Head Tissue Sensitivity Distribution and Multi-frequency Impedance Signal Characteristics* , School of Electrical Engineering and Computer Science, University of Ottawa (within the Ottawa-Carleton Institute

for Electrical and Computer Engineering).

External Examiner for PhD Written/Oral Comprehensive Exam

- F. Daudbab, University of Ottawa *Aug 2022*
- Ms. H. Yazdizadeh, School of Information Tech., Carleton University *Dec 2021*
- Mr. M. Sadhegi, University of Ottawa *May 2019*
- Ms. S. S. Gilakjani, University of Ottawa *April 2019*
- Mr. S. Alfattani, University of Ottawa *April 2018*
- Mr. M. Mabrouk, University of Ottawa *Sept 2013*

Service to the Department: Examination Committee Member

Member of Dissertation Examination Committee

- Mr. Y. Youhao *May 2023*
  Dissertation title: *Reconstruction of Compressive Sensed Images with Deep Equilibrium Model (DEQ) Based on Iterative Shrinkage-Thresholding Algorithm*
  Thesis Supervisor: Prof. R. Dansereau
- Ms. N. Haghighatpanah *Apr 2023*
  Proposal title: *Compressed sensing of block sparse signals with known and unknown block borders*
  Supervisor: Prof. R. Gohary
- Ms. T. L. Mahyari *Apr 2021*
  Dissertation title: *Image Separation using Multi-layer Image Segmentation for Translucent Partially Overlapped Objects*
  Thesis Supervisor: Prof. R. Dansereau
- Ms. F. Zabihollahy *April 2020*
  Dissertation title: *Deep Learning Methods For Abnormality Detection and Segmentation in Computer Tomography and Magnetic Resonance Images*
  Thesis Supervisors: Profs. E. Ukwatta, J. R. Green
- Mr. H. Harvey *May 2019*
  Dissertation title: *Biometric Quality and its Impact on Template Ageing in Longitudinal Fingerprint Study*
  Thesis Supervisors: Prof. A. Adler, Dr. J. Campbell
- Mr. A. M. Assem *Aug. 2017*
  Thesis title: *Low Latency Compressive Sensing using Multi-resolution Analysis in Radar Signal Processing*
  Thesis Supervisor: Prof. R. Dansereau
- Ms. H. Dehghan *May 2016*
  Thesis title: *Convolutive Blind Sparse Source Separation with Application to EMG Decomposition*
  Thesis Supervisors: Prof. R. Dansereau and Prof. A. D. C. Chan
- Ms. Z. Zeinelkhani *Sept. 2015*
  Thesis title: *Compressive Sensing of Block Sparse Signals with Applications to Wideband Sensing*
  Thesis Supervisor: Prof. A. Banihashemi

Member of Proposal Defence Examination Committee

- Ms. N. Haghighatpanah *Aug 2022*
  Proposal title: *Compressed sensing of block sparse signals with known and unknown block borders*
- Ms. E. Farago *June 2022*
  Proposal title: *Detection and Quantification of Signal Quality in Electromyography (EMG) Signals*
- Mr. Y. Youhao *April 2022*
  Proposal title: *Reconstruction of Compressive Sensed Images with Deep Equilibrium Model (DEQ) Based on Iterative Shrinkage-Thresholding Algorithm*
- Ms. T. L. Mahyari *Apr 2020*
  Proposal title: *Image Separation using Multi-layer Image Segmentation for Translucent Partially Overlapped Objects*
- Ms. R. Gbadeyan *Feb 2020*
  Proposal title: *Object Layer Based Hybrid Video Compression*
- Mr. C. C. Lu *Sep 2019*
  Proposal title: *Real-time Identification of Sub-cortical Structures During Deep Brain Stimulation Surgery*
- Mr. I. AlMohimeed *Aug 2019*
  Proposal title: *Design and Construction of Wearable and Flexible Ultrasonic Sensor Using Double-Layer PVDF Films for Continuous Monitoring and Quantitative Analysis of Muscle Contraction*
- R. Miner III *June 2018*
  Proposal title: *Quantitative PET imaging of the Left Atrium for the Investigation of Physiological Processes in Atrial Fibrillation*
- Mr. A. M. Assem *Aug. 2017*
  Proposal title: *Compressive Sensing in Radar Signal Processing*
- Ms. H. Dehghan *May 2016*
  Proposal title: *Convolutive Blind Sparse Source Separation with Application to EMG Decomposition*

Chairman of Proposal Defence Examinations

- Mr. B. Karimi *May 2020*
  Proposal title: *Construction of QC-LDPC Codes with Low Error Floor by Efficient Systematic Search and Elimination of Trapping Sets*
- Mr. H. Sokun *Apr. 2017*
  Proposal title: *Enhancing Energy and Spectral Efficiencies in Cellular and Heterogeneous Networks*
- Mr. J. Harvey *Nov. 2016*
  Proposal title: *Evaluation of quality metrics in a large-scale longitudinal fingerprint study*
- Mr. A. Biswas *Apr. 2016*
  Proposal title: *Auto-scaling Techniques for Cloud Environments with Service Level Agreements*

- Mr. T. Beitelmal *Apr. 2016*
  Proposal title: *Cell Switch off Approach for Energy Saving in Cellular Networks*

Chairman of PhD Written Comprehensive Examination

- Ms. K. Beange *May 2020*
- Ms. A. Gal *May 2019*
- Ms. M. C. McFarlane *Nov 2018*
- Mr. S Stowe *Sept 2018*

Chairman of PhD Oral Comprehensive Examination

- Mr. R. Mohamed *June 2020*
- Mr. M. Abdelazez *May 2017*
- Mr. B. Karimi *May 2017*
- Ms. S. Naseri *May 2016*
- Mr. M. Haggag *June 2016*

Member of Oral Comprehensive Examination

- Ms. E Farago *May 2019*
- Mr. I. Showalter *June 2018*
- Ms. F. F. Firouzeh *June 2017*
- Ms. O. Mohammed *June 2017*
- Mr. S. Salsabili *June 2017*
- Ms. M. A. Bahramabadi *May 2016*
- Mr. A. N. Aghdam *May 2016*

Chairman of M.A.Sc Defence Committee

- Mr. Tuheen Ahmmed *Dec 2023*
  Thesis title: *Passive Intermodulation Effects in Modern Radio Communication System*
  Thesis Supervisor: Prof. H. Yanikomeroglu, Department of Systems and Computer Engineering, Carleton University
- Mr. Rinkesh Joshi *Sept 2023*
  Thesis title: *Reinforcement Learning for GitHub Pull Request Predictions: Analyzing Development Dynamics*
  Thesis Supervisor: Prof. Nafiseh Kahani, Department of Systems and Computer Engineering, Carleton University
- Mr. Martin Klamrowski *Aug 2023*
  Thesis title: *Derivation and Validation of a Machine Learning Model for the Prevention of Unplanned Dialysis*
  Thesis Supervisor: Prof. James. R. Green, Co-Supervisors: Dr. Ayub Akbari, Department of Medicine, University of Ottawa, Dr. Gregory Hundemer, Department of Medicine, University of Ottawa, Dr. Ran Klein, Department of Systems and Computer Engineering, Carleton University

- Mr. Wesley Araujo *May 2023*
  Thesis title: *Optimal Computational Task Offloading to an Edge Server with Firm Deadlines*
  Thesis Supervisor, Prof. I. Lambadaris, Department of Systems and Computer Engineering, Carleton University

- Mr. J. Daigneault *Sept. 2020*
  Thesis title: *Model and Algorithm for Real-Time Resource Allocation in Fog Computing Networks*
  Thesis Supervisor: Prof. M. St. Hilaire, Department of Systems and Computer Engineering, Carleton University

- Mr. E. Reveron *Aug 2019*
  Thesis title: *A Framework for Traffic Collision Prediction Using Historical Accident Information and Real-Time Sensor Data: A Case Study for the City of Ottawa*
  Thesis Supervisor: Prof. A-M. Cretu, Department of Systems and Computer Engineering, Carleton University

- Mr. N. Echegini *Sept 2018*
  Thesis title: *A DHT-based Routing Solution for Hierarchical MANETS*
  Thesis Supervisor: Prof. T. Kunz, Department of Systems and Computer Engineering, Carleton University

- Mr. J. Singh *July 2018*
  Thesis title: *An Adaptive System to Allocate VM in Cloud for Secure Remote Access using AutoRegression*
  Thesis Supervisors: Prof. M. St. Hilaire and Prof. S. Majumdar, Department of Systems and Computer Engineering, Carleton University.

- Mr. P. Balogun *Jan 2016*
  Thesis title: *Multilevel Polar Codes for Grassmanian Signalling*
  Thesis Supervisors: Prof. I. Marsland and Prof. H. Yanikomeroglu, Department of Systems and Computer Engineering, Carleton University

Member of M.A.Sc Defence Committee

- Ms. J. Lee *Sept. 2018*
  Thesis title: *Development of a Method for Registering Surface of Left Atrium Determined by LGE-MRI to ElectroAnatomical Maps*
  Thesis Supervisors: Prof. E. Ukwatta and Dr. R. Thornhill, Department of Systems and Computer Engineering, Carleton University

- Ms. F. Zabihollahy *Aug. 2016*
  Thesis title: *Continuous Monitoring of Mechanical Properties of Plantar Soft Tissue Using Wearable Ultrasonic and Force Sensors for Diabetic Patients*
  Thesis Supervisor: Prof. Y. Ono, Department of Systems and Computer Engineering, Carleton University.

- Mr. J. Wong *Jan. 2016*
  Thesis title: *Evaluation of an Interactive Video Tracking System using Face Recognition*
  Thesis Supervisor: Prof. A. Adler, Department of Systems and Computer Engineering, Carleton University.

- Mr. P. Tworzydlo *Jan. 2016*
  Thesis title: *Monitoring Breathing using a Doppler Radar*
  Thesis Supervisor: Prof. A. D. C. Chan, Department of Systems and Computer Engineering, Carleton University.

- Mr. M. Rashid *Dec. 2015*
  Thesis title: *Cramer-Rao Lower Bound Derivation and Performance Analysis for Space-based SAR*
  Thesis Supervisor: Prof. R. Dansereau, Department of Systems and Computer Engineering, Carleton University.

- Mr. J. Wagenaar *Sept. 2015*
  Thesis title: *Electrical Impedance Tomography in 3D: Characterization and Evaluation*
  Thesis Supervisor: Prof. A. Adler, Department of Systems and Computer Engineering, Carleton University.

Administrative Duties

Adhoc Mathematics Committee Member, Faculty of Engineering and Design

Administrative Duties

Jan 2023 – Present
Director, Ottawa-Carleton Institute for Biomedical Engineering (OCIBME)
July 2020 – present

- Chair the bi-annual Board of Management meetings of the Institute
- Approve and maintain the membership intake of the Institute
- Manage the graduate course offering across both the Universities
- Manage the graduate student intake into the graduate programs including Clinical Engineering
- Lead the Cyclical review process whenever needed

Associate Director, Ottawa-Carleton Institute for Biomedical Engineering (OCIBME) *July 2016 – June 2020*

- Co-ordinate bi-annual Board of Management meetings of the Institute
- Co-ordinate the graduate courses offered across the Universities with the Director of the Institute
- Manage and approve the membership intake of the Institute
- Manage the intake of M.Eng and M. Clinical Eng. students of the Biomedical Engineering Graduate Program

Program Co-ordinator, Communication Engineering Program July 2020 – June 2021

- **Attend DAPC meetings and manage the Communication Engineering curriculum**

Member, Autonomous Systems Institute Initiative *2018 – Present*

- **Develop strategy and provide directions for Carleton's Autonomous Systems Institute Initiative**

Member, University NSERC Scholarship Selection Committee *2019 – Present*

- **Review and rank applications across the University for NSERC Scholarships**

Member (Non-Voting), Graduate Faculty Board ***2018 – Present***

- **Represent OCIBME in Graduate Faculty Board**

Member, Adhoc Committee for Graduate Recruitment ***2018 – Present***

- **Develop strategies to attract domestic undergraduate and graduate students students to the Department**

Chairman, Hiring Committee for Biomedical Faculty Position ***2019***

- Co-ordinate the hiring process

Member, Hiring Committee for Mechanical/Systems shared Canada Research Chair Position *2019*

- Actively participate in the hiring process

Mentor, Internal Departmental Student Clubs *2018-2019*

- Guide the student clubs within the department

Carlos Rossa | PhD, P.Eng

Associate Professor
Department of Systems and Computer Engineering
Carleton University
Ottawa, ON, Canada

rossa@sce.carleton.ca
(613) 520 2600 x 4219
www.biomechatronics.ca
Google scholar, Research Gate

1. PERSONAL INFORMATION

Contact information

Department of Systems and Computer Engineering
Office: Canal Building 5201
Lab: Canal Building 6110
Carleton University, 1125 Colonel By Dr. Ottawa, K1S 5B6
Email: rossa@sce.carleton.ca
Lab website: www.biomechatronics.ca

Languages

	read	write	speak	understand	peer review
French	yes	yes	yes	yes	yes
English	yes	yes	yes	yes	yes
Portuguese	yes	yes	yes	yes	yes

Certifications

Professional Engineer (P.Eng) with the Assoc. of Prof. Engineers and Geoscientists of Alberta.

2. EDUCATION

University of Alberta, Canada 2014 - 2017
» Postdoctoral fellow - Dep. of Electrical and Computer Engineering.

Université Pierre et Marie Curie (Sorbonne Université), France 2010 - 2013
» Doctor of Philosophy, Mechatronics and Robotics.

Ecole Nationale d'Ingénieurs de Metz, France 2009 - 2010
» Mastère II - Mechatronics/Mechanical Engineering.

Ecole Nationale d'Ingénieurs de Metz, France 2008 - 2010
» Diplôme d'Ingénieur - Mechanical Engineering.

Pontifical Catholic University of Rio Grande do Sul, Brazil 2005 - 2008
» Bachelor of Engineering - Mechatronics.

3. RECOGNITIONS/AWARDS

Carleton University Teaching Achievement Award	2024
Ontario Ministry of Colleges & Universities Early Researcher Award	2023
Carleton University Research Achievement Award	2023
Ontario Tech Deborah Saucier Early Researcher Award	2018
Enhanced Eurotalents Research Fellowship (declined)	2016
PhD degree with “Mention très honorable”	2013
Master degree with “Mention bien”	2010
Ecole Nationale d’Ingénierus de Metz’s scholarship	2009
BRAFITEC excellence scholarship	2008

4. RESEARCH PROFILE

Medical robotics: Image-guided percutaneous surgery, human-robot collaborative surgery

Instrumentation: Biomedical instrumentation, sensors, signal processing

Medical imaging: Ultrasound and multi-modal imaging, image generation and simulation

Human-machine interfaces: Haptic devices, surgical simulation, hybrid actuation

I have unique expertise in medical robotics, instrumentation, and image-guided percutaneous surgery, as well as human-machine interfaces, which I developed during his BEng and MASc degrees in Mechanical Engineering from the Ecole Nationale d’Ingénieurs de Metz, and my PhD in Mechatronics and Robotics at the Sorbonne Université (UPMC) and under the auspices of the Commissariat à l’Energie Atomique with first class honours (mention très honorable). As a postdoctoral fellow, I honed my skills in image-guided surgery. As an independent researcher, I obtained over $2M in research funds since 2018, published 84 peer-reviewed papers, of which 33 were issued in the last 4 years from my own research program. I have active funded collaborations with companies, hospitals, and knowledge users. Most notably, I am the recipient of the 2023 Ontario Ministry of Colleges and Universities Early Researcher Award, the 2023 Carleton University Early Researcher Award, the 2018 Ontario Tech Early Researcher Award, the 2019 New Frontiers in Research Fund, which supports high-risk, high-reward research (success rate of 8% at the time of award), the 2022 Cancer Research Society operating grant, and several research grants from NSERC.

I have established a world-class research laboratory at Carleton University with state-of-the-art equipment. This infrastructure provides an unique training environment for highly qualified personnel. All the graduate students that completed their theses under my supervision were nominated for best thesis award, one of them received the 2020 Ontario Tech’s Outstanding thesis award, and another student received the best student paper award at IEEE I2MTC. My research has also resulted in a student-run start-up company incorporated in Ontario, which is currently generating revenue.

5. EMPLOYMENT HISTORY

Associate professor (early promotion) 2021 - present
» Systems and Computer Engineering, Carleton University, Canada

Adjunct professor 2021 - 2024
» Faculty of Engineering and Applied Science, Ontario Tech University, Canada

Assistant professor 2017 - 2021
» Faculty of Engineering and Applied Science, Ontario Tech University, Canada

Postdoctoral fellow 2014 - 2017
» Dep. of Electrical and Computer Engineering, University of Alberta, Canada

Sessional lecturer 2016
» Dep. of Electrical and Computer Engineering. University of Alberta, Canada

Research assistant 2010 - 2013
» Commissariat à l'Energie Atomique (CEA), France

Research assistant 2010
» Technische Universität Kaiserslautern, Germany

Undergraduate industrial internship 2008 - 2009
» Kolbenschmidt Pierburg, France

Undergraduate research assistant 2006 - 2008
» Pontifical Catholic University of Rio Grande do Sul, Brazil

6. RESEARCH FUNDING

▸ **As principal Investigator:** Total funding since 2018: $**2,042,835**

17. **Acoustoelectric imaging of prostate cancer**
☆ *Ontario Ministry of Colleges & Universities - Early Researcher Award*
» Total award: $**190,000**
» Portion of funds received: $150,000 ($40,000 Carleton U. overhead costs)
» Duration: 2023-2028
» Application success rate: 15% at the time of award

16. **Development of a cyber-physical training simulator for ultrasound-guided percutaneous nephrolithotomy**
» *Natural Sciences and Engineering Research Council of Canada (NSERC) - Alliance Grant*
» Total award: $**306,000**
» Duration: 2023-2027
» Industry partner: Marion Surgical.

15. **Development of a pediatric laparoscopic surgery simulator**
☆ *Carleton University Research Achievement Award*
» Total award: $**15,000**
» Duration: 2023

14. **Design and control of a haptic device with hybrid actuation**
    - » *Natural Sciences and Engineering Research Council of Canada (NSERC) - Alliance Grant*
    - » Total award: $**156,000**
    - » Duration: 2022-2026
    - » Industry partner: Haply Robotics.
13. **Sensorized needles for prostate cancer localization in multiparametric magnetic resonance imaging/ultrasound targeted biopsy**
    - » *Cancer Research Society, Operating Grants*, and
    - » *The Canadian Institutes of Health Research*
    - » Total award: $**120,000**
    - » Duration: 2022-2024
12. **Infrastructure for ultrasound-guided percutaneous robotic surgery**
    - » *Canada Foundation for Innovation (CFI), John R. Evans Leaders Fund*, and
    - » *Ontario Research Fund - Research Infrastructure*
    - » Total award: $**270,926**
    - » Duration: 2022
11. **Collaboration with the Ottawa Hospital on instrumentation for prostate cancer biopsy**
    - » *Carleton Faculty of Engineering and VIP Research seed grant*
    - » Total award: $**50,000**
    - » Duration: 2022
10. **Research on instrumentation, medical imaging, and surgical robotics**
    - » *Carleton University Faculty of Engineering start-up grant*
    - » Total award: $**105,000**
    - » Duration: 2021
9. **FireNav: Navigation and mapping for structural firefighters**
    - » *Ontario Tech Brilliant Catalyst small start up grant*
    - » Total award: $**3,000**
    - » Duration: 2021
8. **Sonographic diagnosis and monitoring of COVID-19**
    - » *Natural Sciences and Engineering Research Council of Canada (NSERC) - Alliance Grant*
    - » Total award: $**50,000**
    - » Duration: 2020-2021
    - » Industry partner: Marion Surgical
7. **Research and development platform for acoustoelectric impedance tomography in internal radiation therapy**
    - » *Natural Sciences and Engineering Research Council of Canada (NSERC) - Research Tools and Instruments (RTI)*
    - » Total award: $**150,000**
    - » Duration: 2020-2021
    - » Application success rate: 19% at the time of award.
6. **Steerable tumour-sensing needles for real-time biopsy and brachytherapy of breast, prostate, and gynaecological cancers**
    - » *NSERC/CIHR/SSHRC New Frontiers in Research Fund - Exploration*
    - » Total award: $**273,309**
    - » Portion of funds received: $218,647 ($54,661 Ontario Tech overhead costs)
    - » Duration: 2019-2023

» Application success rate: 8% at the time of award.

5. **From virtual reality simulation to collaborative robotic surgery: Enabling data-driven teleoperated percutaneous nephrolithotomy**
   » *Natural Sciences and Engineering Research Council of Canada (NSERC) - Engage Grant*
   » Total award: $**25,000**
   » Duration: 2019
   » Industry partner: Marion Surgival
4. **Tactile navigation system for structural firefighters using SLAM**
   » *City of Oshawa, Teaching City program*
   » Total award: $**25,000**
   » Duration: 2019-2020
3. **Smart needles with micro impedance sensors for glandular cancer screening**
   ☆ *Ontario Tech Deborah Saucier Early Researcher Award*
   » Total award: $**25,000**
   » Duration: 2018-2019
   » Application success rate: 14% at the time of award.
2. **Towards collaborative and autonomous robotic minimally invasive surgery**
   » *NSERC Discovery grant*
   » Total award: $**209,600**
   » Duration: 2018-2024
   » Includes $12,500 early career researcher supplement
   » Includes a 1-year funded extension due to covid-19
1. **Research on medical robotics and haptics**
   » *Ontario Tech Faculty of Engineering start-up grant*
   » Total award: $**70,000**
   » Duration: 2018-2021

▸ As Co-investigator

1. **Evaluation of a pediatric laparoscopic simulator**
   » *Children's Hospital of Eastern Ontario - CHAMO Innovation Fund Competition*
   » Co-investigator. PI: Ahmed Nasr
   » Total award: $**140,000**
   » Portion of funds received: $**50,000**
   » Duration: 2024-2026

7. ACTIVITIES

7.1. Student Supervision (current)

10. **Sathiyamoorthy Selladurai**, Postdoctoral fellow — 2023 - present
    » Ultrasound image reconstruction for surgical training in virtual reality
9. **Afshin Alaghehband**, Ph.D — 2024
    » Ultrasound guided percutaneous robotic surgery
8. **Theekshana Wijewardhanav**, Ph.D — 2024
    » Optimal control of hybrid active/passive haptic devices

7. **Hoorieh Mazdarani**, Ph.D 2022 - present
   » Collaborative human-robot percutaneous nephrolithotomy under US image guidance
6. **Hossein Asilian**, Ph.D 2022 - present
   » High-frequency dielectric spectroscopy for real-time prostate cancer biopsy
5. **Samuel Lovett**, MASc 2022 - present
   » Sensor fusion for wearable simultaneous localization and mapping
   » Vanier Canada Graduate Scholarship (PhD) nominee for Carleton University (pending)
   ☆ HM Queen Elizabeth II scholarship recipient
4. **Kade Macwilliams**, MASc 2024
   » Instrumentation and signal processing for acoutoeletric imaging
3. **Alex Cotton**, Undergraduate (FED URSA, co-op) 2022 - present
   » Virtual reality training for percutaneous nephrolithotomy
2. **Valerie Xie**, Undergraduate winter 2024
   » High frequency dielectric spectroscopy for tissue classification
1. **Abdlrahman Haboush**, Undergraduate winter 2024
   » Dieletric spectroscopy instrumentation for tissue classification

7.2. Student Supervision (completed)

Post-doctoral fellows

21. **Ben Keeshan**, Postdoctoral fellow 2022 - 2023
    » "Computational methods for acoustoeletric imaging with optimal electrode placement"
    » Current position: Government of Canada

Graduate Students

20. **Conor McDermott**, MASc 2022 - 2023
    » "Electrical impedance spectroscopy with multi-modal tissue discrimination for US-guided targeted biopsy" - Masters of Applied Science in Biomedical Engineering, Carleton University
    » Nominated for the Carleton University's Senate Medal for Outstanding graduate work.
    ☆ Best student paper award recipient at 2023 IEEE I2MTC

19. **Ben DeBoer**, MASc (co-supervisor) 2021 - 2022
    "Design and control of an active ankle-foot orthosis" - Masters of Applied Science in Mechanical Engineering, Ontario Tech University.
    » Current position: PhD student, University of New Brunswick, Fredericton, NS

18. **Olivia Wilz**, MASc 2019 - 2020
    » "Robotic and haptic assistance for kidney access during percutaneous nephrolithotomy" - Masters of Applied Science in Mechatronics Engineering, Ontario Tech University.
    » Nominated for the Ontario Tech Outstanding thesis award.
    » Full text: https://shorturl.at/tDEX5
    » Current position: Project engineer, Irving Shipbuilding, Halifax, NS

17. **Rick Tan**, MASc 2019 - 2020
    » "Electrical impedance tomography for internal radiation therapy" - Masters of Applied Science in Mechatronics Engineering, Ontario Tech University.
    » Nominated for the Ontario Tech Outstanding thesis award.
    » Full text: shorturl.at/nrDG0.
    » Current position: Research engineer at Sunnybrook Res. Institute, Toronto, ON.

16. **Brayden Kent**, MASc 2019 - 2020
» "Tissue classification from electric impedance spectroscopy for haptic feedback in minimally invasive surgery" - Masters of Applied Science in Mechanical Engineering, Ontario Tech University.
» Nominated for the Ontario Tech Outstanding thesis award.
» Full text: https://bit.ly/2Iax8oM
» Current position: Control systems engineer at MDA Ltd, Brampton, ON.

15. **Maciej Lacki**, MASc 2019 - 2020
» "Analysis, development, and control of multi-degree-of-freedom passive haptic devices" - Masters of Applied Science in Mechatronics Engineering, Ontario Tech University.
» Full text: https://bit.ly/32p37HW.
» Current position: Research engineer at Haply Robotics, Montréal, QC.
☆ Ontario Tech 2021 **Outstanding MASc thesis award** recipient.

14. **Brayden DeBoon**, MASc 2018 - 2019
» "Series elastic actuation for human-machine interaction with applications in robot-aided rehabilitation" - Masters of Applied Science in Mechatronics Eng., Ontario Tech University.
» Nominated for the Ontario Tech Outstanding thesis award.
» Full text: http://hdl.handle.net/10155/1113.
» Current position: Research engineer at Mercedes-Benz Formula 1, Brackley, UK

13. **Sridhanussh Srinivasan**, MEng 2022 - 2023
» "Sonographic imaging of the lung using robotic assistance" - Masters of Engineering, Carleton University
» Course-based MEng (non thesis stream)

Undergraduate Students

12. **Larissa Jin** , Undergraduate (NSERC/URSA) S 2023
» Tele-operated robotic surgery
» Current position: MASc student at University of Toronto

11. **Titus Priscu**, Undergraduate 2022 - 2023
» Volumetric ultrasound imaging from 2D arrays
» Current position: MASc student at Carnegie Mellon University

10. **Huda Sheikh**, Undergraduate (co-op) S 2023
» Paediatric laparoscopy simulation training

9. **Elizabeth John**, Undergraduate (i-CUREUS) S 2023
» Biomedical instrumentation for real-time tissue spectroscopy

8. **Logain Ahmed** , Undergraduate W 2023
» Biomedical instrumentation for electrical impedance spectroscopy

7. **Paige Rennison**, Undergraduate S 2022
» Development of lecture demos for SYSC 3600

6. **James Elmgren**, Undergraduate S 2022
» Electromagnetic tracking of surgical needles

5. **Samuel Lovett**, Undergraduate S - F 2020
» Localization and mapping for structural firefighters

4. **Tyler Paquette**, Undergraduate S 2020
   » Localization and mapping for structural firefighters
3. **Angelica Cusipag**, Undergraduate (NSERC/USRA) S 2019
   » Instrumented needles for biopsy using electrical impedance spectroscopy
2. **Karl Kanmaz**, Undergraduate (NSERC/USRA) S 2019
   » Tactile navigation system for structural fire-fighters using SLAM
1. **Amanjot Guilshi**, Undergraduate (NSERC/USRA) S 2018
   » Robotic-aided rehabilitation of musculoskeletal disorders

7.3. Editorial Activities

12. Associate Editor 2024 - present
    Journal of Medical Robotics Research
11. Associate Editor 2022 - present
    Frontiers in Robotics and AI, Section “Robot Design”
10. Technical Program Chair 2024
    International Conference on Smart Multimedia, Los Angeles, USA.
9. Technical Program Chair 2023
   IEEE Sensors Applications Symposium, Ottawa, Canada.
8. Session chair 2023
   IEEE International Conference on Systems, Man, and Cybernetics, Honolulu, USA.
7. Session chair 2023
   IEEE Sensors Applications Symposium, Ottawa, Canada.
6. Guest Editor 2023
   Special issue “Haptic training simulation - Volume III”. *Frontiers in Robotics and AI*.
5. Session chair 2022
   Special session “Haptics”. Inter. Conference on Smart Multimedia, Marseille, France.
4. Guest Editor 2021
   Special issue “Haptic training simulation - Volume II”. *Frontiers in Robotics and AI*.
3. Guest Editor 2020
   Special issue “Haptic training simulation”. *Frontiers in Robotics and AI*.
2. Session chair 2019
   “Haptics and applications”. International conference on smart multimedia, San Diego, USA.
1. Session chair 2016
   “Control issues in mechatronic systems for medicine”. IEEE International Conference on Advanced Mechatronics (AIM), Banff, Canada.

7.4. Committee memberships

15. Selection committee co-chair 2024
    Tri-agency Institutional Programs Secretariat (CIHR, NSERC, SSHRC)
14. Selection committee member 2024
    Tri-agency Institutional Programs Secretariat (CIHR, NSERC, SSHRC)

13. Mechatronics engineering curriculum committee member — 2023 - present
    Carleton University, Faculty of Engineering
12. Selection committee member — 2023
    Tri-agency Institutional Programs Secretariat
11. Scholarship awards committee — 2021 - present
    Carleton University, Department of Systems and Computer Engineering
10. CIHR board of reviewers — 2021 - present
    The Canadian Institutes of Health Research
9. Scholarships & award peer review panel member — 2019 - present
    CIMVHR/ICRSMV
8. Biomedical engineering program coordinator — 2022 - 2023
    Carleton University, Department of Systems and Computer Engineering
7. Hiring committee member for a TTT position in embedded systems — 2023
    Carleton University, SCE
6. Mechatronics engineering curriculum committee member — 2019 - 2021
    Ontario Tech University, Faculty of Engineering
5. Hiring committee member for a TTT position in mechatronics — 2019
    Ontario Tech University, Faculty of Engineering
4. Hiring committee member for a TTT position in mechatronics — 2018
    Ontario Tech University, Faculty of Engineering

Other memberships

3. Senior Member - Institute of Electrical and Electronics Engineers — 2022 - present
2. Ottawa-Carleton Institute for Biomedical Engineering — 2021 - present
1. Canadian Medical and Biological Engineering Society — 2021 - present

8. CONTRIBUTIONS

8.1. Publications

Note: In the list of publications the **last listed author is the principal investigator**. Asterisks (*) indicate supervised students and a start (☆) indicates invited papers or awards. Citations are available on Google scholar.

Peer Reviewed Journal Papers (published)

J.47 M. McDermott*, S. Lovett*, and **C. Rossa** - "Improved bioimpedance spectroscopy tissue classification through data augmentation from generative adversarial networks". Medical & Biological Engineering & Computing. In press, 2024. 10.1007/s11517-023-03006-7

J.46 B. Keeshan*, A. Adler, and **C. Rossa** - "Improved configurations for acoustoelectric tomography with a minimal number of electrodes". IEEE Transactions on Biomedical Engineering, vol. 70, no. 12, pp. 3501-3512, 2023. 10.1109/TBME.2023.3290472

J.45 H. Asilian-Bidgoli*, N. Schieda, and **C. Rossa** - "On the sensitivity of bevelled and conical coaxial needle probes for dielectric spectroscopy". IEEE Transactions on Instrumentation & Measurement, vol. 72, pp. 8002209, 2023. 10.1109/TIM.2023.3265116

J.44 B. DeBoer*, A. Hosseini, and **C. Rossa** - "Model predictive control of an active ankle-foot orthosis with non-linear actuation constraints". Control Engineering Practice, vol. 136, pp. 105538, 2023. 10.1016/j.conengprac.2023.105538

J.43 X. Chen, A. Lelevé, T. McDaniel, and **C. Rossa** - "Research Topic Haptic Training Simulation: from tactile to visual haptic feedback". Frontiers in Robotics and AI, section Haptics, vol. 9, pp. N.A., 2022, 10.3389/frobt.2022.965113
☆ **Invited editorial**

J.42 B. Sainsbury, O. Wilz*, J. Ren, M. Green, M. Fergie, and **C. Rossa** - "Preoperative virtual reality surgical rehearsal of renal access during percutaneous nephrolithotomy: A pilot study". MDPI Electronics, section Computer Science and Engineering, Advances in Tangible and Embodied Interaction for Virtual and Augmented Reality, vol. 11, no 10, p. 1562, 2022. 10.3390/electronics11101562

J.41 B. DeBoer*, A. Hosseini, and **C. Rossa** - "A discrete non-linear series elastic actuator for active ankle-foot orthoses". IEEE Robotics and Automation Letters, vol. 7, no 3, p. 6211-6217, 2022. 10.1109/LRA.2022.3167065

J.40 B. Kent*, and **C. Rossa** - "Development of rapid tissue discrimination electrode embedded surgical needle using vibro-tactile feedback derived from electrical impedance spectroscopy". *In Medical & Biological Engineering & Computing*, vol. 60, no 1, p. 19-31, 2022. 10.1007/s11517-021-02454-3

J.39 O. Wilz*, B. Kent*, B. Sainsbury, and **C. Rossa** - "Multiobjective trajectory tracking of a flexible tool during robotic percutaneous nephrolithotomy". Robotics and Automation Letters, vol. 6, no 4, p. 8110-8117, 2021. 10.1109/LRA.2021.3102946

J.38 B. Kent* and **C. Rossa**, "Electric impedance spectroscopy feature extraction for tissue classification with electrode embedded surgical needles through a modified forward stepwise method". Computers in Biology and Medicine, vol. 135, pp. 104522, 2021. 10.1016/j.compbiomed.2021.104522

J.37 R. Tan*, and **C. Rossa**, "On the feasibility of electrical impedance tomography in internal radiation therapy", in Frontiers in Bioengineering and Biotechnology, vol. 9, pp. 527, 2021. 10.3389/fbioe.2021.698038

J.36 O. Wilz*, B. Sainsbury, and **C. Rossa** - "Constrained haptic-guided shared control for collaborative human-robot percutaneous nephrolithotomy training". *Mechatronics*, vol. 75, pp. 102528, 2021, 10.1016/j.mechatronics.2021.102528.

J.35 B. BeBoon*, S. Nokleby, and **C. Rossa** - "Multiobjective gain optimiser for a multi-input active disturbance rejection controller: Application to series elastic actuators". *Control Engineering Practice*, vol. 109, pp. 104733, 2021. 10.1016/j.conengprac.2021.104733
☆ **Invited paper**: Emerging Leaders in Control Engineering Practice series

J.34 C. McDermott*, M. Lacki*, B. Sainbury, and **C. Rossa** - "Sonographic diagnosis of COVID-19: A review of image processing for lung ultrasound". *Frontiers in Robotics and AI*, vol. 4, pp. 2, 2021. 10.3389/fdata.2021.612561

J.33 B. BeBoon*, R. Foley, S. Nokleby, N. La Delfa, and **C. Rossa** - "Nine degree-of-freedom kinematic modelling of the upper limb complex for constrained workspace evaluation", *ASME Journal of Biomechanics*, vol. 413, no. 2, pp. 021009, 2021. 10.1115/1.4048573

J.32 A. Lelevé, T. McDaniel, and **C. Rossa** - "Haptic Training Simulation". *Frontiers in Robotics and AI, Virtual Environments*. vol. 1, pp. 3, 2020. 10.3389/frvir.2020.00003
☆ **Invited paper**

J.31 M. Lacki*, and **C. Rossa** - "Design and control of a 3 degree-of-freedom parallel passive haptic device". IEEE Transactions on Haptics, vol. 13, no 4, p. 720-732, 2020. 10.1109/TOH.2020.2983037

J.30 M. Lacki*, B. DeBoon*, and **C. Rossa** - Impact of kinematic structure on the force displayability of planar passive haptic devices. IEEE Transactions on Haptics, vol. 13, no. 1, pp. 219-225. 10.1109/TOH.2020.2970906. Selected for presentation at the 2020 IEEE Haptics Symposium.

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J.24 J. Carriere, M. Khadem, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "Event-triggered 3D needle control using a reduced-order computationally efficient model in a constrained optimization framework". *In Journal of Medical Robotics Research*, vol 4, no.1, 1902001, 2018. 10.1142/S2424905X18420047

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J.2 **C. Rossa**, A. Jaegy*, J. Lozada, and A. Micaelli - "Development of a multilayered wide-raged torque magnetorheological brake". *Smart Material and Structures*. vol. 23, no. 2. 025028, 2014. 10.1088/0964-1726/23/2/025028

J.1 **C. Rossa**, L. Eck, A. Micaelli, and J. Lozada - "On a novel torque detection technique for magnetorheological actuators". *IEEE Sensors Journal*. vol. 14, no. 4, pp 1223-1231, 2014. 10.1109/JSEN.2013.2287730

Peer Reviewed Journal Papers (under review)

R.5 S. Lovett*, and **C. Rossa** - "Out-of-plane motion compensation in mmWave EGO-motion recovery". IEEE Robotics and Automation Letters.

R.4 H. Mazdarani*, and **C. Rossa** - "Ultrasound-based visual servoing for 4-DOF tool tracking in robot-aided percutaneous surgeries". IEEE Transactions on Mechatronics.

R.3 H. Asilian-Bidgoli*, N. Schieda, and **C. Rossa** - "A novel Bessel-based formulation of the reflection coefficient of an open-ended coaxial probe in multi-layered media". IEEE Transactions on Microwave Theory and Techniques.

R.2 B. DeBoer*, A. Hosseini, and **C. Rossa** - "Advances in active ankle-foot orthoses: A review". IEEE Transactions on Medical Robotics and Bionics.

R.1 E. Nehary*, S. Rajan, and **C. Rossa** - "Metric-based frame selection and deep learning model with multi-head self attention for classification of ultrasound lung video images". IEEE Transactions on Human-Machine Systems.

Peer Reviewed Conferences (full papers in proceedings)

C.44 H. Mazdarani*, A. Cotton*, and **C. Rossa** - "2D ultrasound-guided visual servoing for in-plane needle tracking in robot-assisted percutaneous nephrolithotomy". IEEE International Conference on Systems, Man, and Cybernetics, Honolulu, USA, Oct 2023, accepted.

C.43 S. Lovett*, T. Paquette*, B. DeBoon*, S Rajan, and **C. Rossa** - "Level Plane SLAM: Out-of-plane motion compensation in a globally stabilized coordinate frame for 2D SLAM". IEEE International Conference on Systems, Man, and Cybernetics, Honolulu, USA, Oct 2023, accepted.

C.42 C. McDermott*, H. Asilian-Bidgoli*, and **C. Rossa** - "Observation of the ultrasonic vibration potential with an instrumented coaxial needle probe". 2023 IEEE Int. Instrumentation and Measurement Technology Conference, Kuala Lumpur. 10.1109/I2MTC53148.2023.10176086
☆ **Best student paper award**.

C.41 C. McDermott*, and **C. Rossa** - "Data augmentation based on inverse transform sampling for improved tissue classification via electrical impedance spectroscopy". IEEE Sensors Applications Symposium (SAS), Ottawa, Canada, 2023 10.1109/SAS58821.2023.10254182.

C.40 E. Nehary, S Rajan, and **C. Rossa** - "Lung ultrasound image classification using deep learning and histogram of oriented gradients features for COVID-19 detection". IEEE Sensors Applications Symposium (SAS), Ottawa, Canada, 2023 10.1109/SAS58821.2023.10254002.

C.39 E. Nehary, S Rajan, and **C. Rossa** - "Comparison of COVID-19 classifications of Imagenet-based and RadImagenet-based transfer learning models with random frame selection". IEEE Sensors Applications Symp. Ottawa, Canada, 2023 10.1109/SAS58821.2023.10254111.

C.38 H. Asilian-Bidgoli*, N. Schieda*, and **C. Rossa** - "Penetration depth quantification of open-ended coaxial probes for dielectric spectroscopy of layered media". IEEE Canadian Conference on Electrical and Computer Engineering, Regina, Canada, 2023, pp. 94-98, 10.1109/CCECE58730.2023.10288987.

C.37 R. Tan*, C. McDermott*, and **C. Rossa** - "A lumped element method for acoustoelectric imaging reconstruction". Inter.l Conference on Systems, Man, and Cybernetics, Prage, Czech Republic, p. 1798-1803, 2022. 10.1109/SMC53654.2022.9945111.

C.36 M. Lacki*, and **C. Rossa** - "Sensorless force approximation control of a 3-DOF passive haptic device". International Conference on Smart Multimidal, Marseille, France, pp. 381-394, 2022. 10.1007/978-3-031-22061-6_28

C.35 B. Keeshan*, A. Adler and **C. Rossa** - "Reduced effective sensitivity of acoustoelectric tomography". International Conference on Bioelectromagnetism, Electrical Bioimpedance, and Electrical Impedance Tomography, Seoul, South Korea, pp. 204-207, 2022. 10.5281/zenodo.6860841

C.34 V. Arora, R. Mulaveesala, S. Rajan, B. Balaji, and **C. Rossa** - "Pulse compression favourable thermal wave imaging approach for estimation of osteoporosis: A numerical study". IEEE International Instrumentation and Measurement Technology Conference, Ottawa, Canada, pp.1-5, 2022. 10.1109/I2MTC48687.2022.9806664

C.33 O. Wilz*, B. Sainsbury, and **C. Rossa** - "Multiobjective path planning for autonomous robotic percutaneous nephrolithotomy via discrete B-spline interpolation". IEEE International Conference on Systems, Man, and Cybernetics, Melbourne, Australia, pp. 72-77 2021. 10.1109/SMC52423.2021.9659210

C.32 B. Kent*, M. Lacki*, and **C. Rossa** - "Building a classifier model for failure modes from robot sensor readings through a modified forward stepwise algorithm". IEEE International Conference on Systems, Man, and Cybernetics, Melbourne, Australia, p. 436-441, 2021. 10.1109/SMC52423.2021.9658748

C.31 B. DeBoer*, A. Hosseini, and **C. Rossa** - "An extended parameter estimation disturbance observer for an active ankle foot orthosis". IEEE International Conference on Systems, Man, and Cybernetics, Melbourne, Australia, pp. 1105-1110, 2021. 10.1109/SMC52423.2021.9659241

C.30 B. DeBoer*, C. McDermott, A. Hosseini, and **C. Rossa** - "Reference point-based particle subswarm optimization". IEEE International Conference on Systems, Man, and Cybernetics, Melbourne, Australia, p. 2906-2911, 2021. 10.1109/SMC52423.2021.9659146

C.29 O. Wilz*, B. Kent*, B. Sainsbury, and **C. Rossa** - "Multiobjective trajectory tracking of a flexible tool during robotic percutaneous nephrolithotomy". IEEE International Conference on Intelligent Robots and Systems, Prague, Czech Republic, 2021, accepted for presentation, published in IEEE Robotics and Automation Letters, vol. 6, no. 4, p. 8110-8117, 2021.

C.28 R. Tan*, and **C. Rossa** - "Electrical impedance tomography using differential evolution integrated with a modified Newton-Raphson algorithm". *IEEE Inter. Conf. on Systems, Man, and Cybernetics*, Toronto, Canada, pp. 2528-2534, 2020. 10.1109/SMC42975.2020.9282957

C.27 B. Kent*, and **C. Rossa** - "Tissue discrimination from impedance spectroscopy as a multi-objective optimisation problem with weighted Naive Bayes classification". *IEEE International Conference on Systems, Man, and Cybernetics*, Toronto, Canada, p. 321-327, 2020. 10.1109/SMC42975.2020.9283266

C.26 M. Lacki*, B. DeBoon*, and **C. Rossa** - "Impact of kinematic structure on the force displayability of planar passive haptic devices". Selected for presentation at the 2020 IEEE Haptics Symposium. Published in Transactions on Haptics, vol. 13, no. 1, pp. 219-225, 2020. 10.1109/TOH.2020.2970906

C.25 B. BeBoon*, S. Nokleby, and **C. Rossa** - "Backlash-compensated active disturbance rejection control of nonlinear multi-input series elastic actuators". *Inter. Conf. on Robotics and Automation (ICRA)*, pp. 6183-6189, Paris, France, 2020. 10.1109/ICRA40945.2020.9196657

C.24 B. Kent*, A. Cusipag*, and **C. Rossa** - "Tissue discrimination through force feedback from impedance spectroscopy in robotic surgery". *International Conference on Smart Multimedia*, pp. 274-285, San Diego, USA, 2019. 10.1007/978-3-030-54407-2_23.

C.23 B. DeBoon*, B. Kent*, M. Lacki*, S. Nokleby, and **C. Rossa** - "Multi-objective gain optimizer for an active disturbance rejection controller". IEEE Global Conference on Signal and Information Processing, Ottawa, Canada, p. 1-5, 2019, 10.1109/GlobalSIP45357.2019.8969275.

C.22 M. Lacki*, and **C. Rossa** - "On the feasibility of multi-degree-of-freedom haptic devices using passive actuators". IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 7282-7287, Macau, 2019, 10.1109/IROS40897.2019.8968164

C.21 B. DeBoon*, S. Nokleby, N. Ladelfa, and **C. Rossa** - "Differentially-clutched series elastic actuator for robot-aided musculoskeletal rehabilitation". IEEE Inter. Conf. on Robotics and Automation (ICRA), pp. 1507-1513, Montréal, Canada, 2019. 10.1109/ICRA.2019.8793586.

C.20 **C. Rossa**, M. Najafi, M. Tavakoli, and K. Adams - "Nonlinear workspace mapping for robotic assistance of upper limb in patients with movement disorders". *IEEE Inter. Conf. on Systems, Man, and Cybernetics, Banff, Canada, pp. 2255-2260, 2017.* 10.1109/SMC.2017.8122956

C.19 M. Khadem, **C. Rossa**, et. al - "Feedback-linearization-based 3D needle steering in a Frenet-Serret frame using a reduced order bicycle model". *American Control Conference (ACC), Seattle, USA, May 2017.* 10.23919/ACC.2017.7963155

C.18 **C. Rossa**, M. Khadem, R. Sloboda, N. Usmani, and M. Tavakoli - "Constrained Optimal Control of Needle Deflection for Semi-Manual Steering". *IEEE International Conference on Advanced Mechatronics (AIM), Banff, Canada, Jul 2016.* 10.1109/AIM.2016.7576933

C.17 M. Waine, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "An Integrator-Backstepping Control Approach for Out-of-Plane Needle Deflection Minimization". *IEEE Int. Conference on Advanced Mechatronics (AIM), Banff, Canada, Jul 2016.* 10.1109/AIM.2016.7576998

C.16 M. Khadem, **C. Rossa**, R. Sloboda, N. Usmani, and M. Tavakoli - "Introducing Notched Flexible Needles with Increased Deflection Curvature in Soft tissue". *IEEE Inter. Conference on Advanced Mechatronics (AIM), Banff, Canada, Jul 2016.* 10.1109/AIM.2016.7576931

C.15 B. Fallahi, **C. Rossa**, et al. - "Partial Estimation of Needle Tip Orientation in Generalized Coordinates in US Image-guided Needle Insertion". *IEEE International Conference on Advanced Mechatronics (AIM), Banff, Canada, Jul 2016.* 110.1109/AIM.2016.7576999

C.14 J. Carriere, **C. Rossa**, R. Sloboda, N. Usmani, and M. Tavakoli - "Real-time Needle Shape Prediction in Soft-Tissue based on Image Segmentation and Particle Filtering". *IEEE Inter. Conf. on Advanced Mechatronics (AIM), Banff, Canada, Jul 2016.* 10.1109/AIM.2016.7576934

C.13 T. Lehmann, **C. Rossa**, R. Sloboda, N. Usmani, and M. Tavakoli - "Needle Path Control During Insertion in Soft Tissue Using a Force-Sensor-Based Deflection Estimator ". *IEEE Inter. Conf. on Advanced Mechatronics (AIM), Banff, Canada, 2016*. 10.1109/AIM.2016.7576929

C.12 **C. Rossa**, J. Fong, R. Sloboda, N. Usmani, and M. Tavakoli - "Multiactuator haptic feedback on the wrist for needle steering guidance in brachytherapy". IEEE Int. Conference on Robotics and Automation (ICRA), Stockholm, Sweden, 2016. 10.1109/LRA.2016.2528295

C.11 B. Fallahi, M. Khadem, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "Extended bicycle model for needle steering in soft tissue". *IEEE/RSJ Inter. Conference on Intelligent Robots and Systems (IROS)*, Hamburg, Germany, 2015. 10.1109/IROS.2015.7353998

C.10 T. Lehmann, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "A virtual sensor for needle deflection estimation during soft-tissue needle insertion". *IEEE Inter. Conference on Robotics and Automation (ICRA)*, Seattle, USA, 2015. 10.1109/ICRA.2015.7139346

C.9 M. Khadem, B. Fallahi, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "A mechanics-based model for simulation and control of flexible needle steering in soft tissue". *IEEE Int. Conf. on Robotics and Automation (ICRA)*, Seattle, USA, 2015. 10.1109/ICRA.2015.7139499

C.8 M. Waine, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "3D shape visualization of curved needles in tissue from 2D ultrasound images using RANSAC". *IEEE Inter. Conference on Robotics and Automation (ICRA)*, Seattle, USA, May 2015. 10.1109/ICRA.2015.7139855

C.7 J. Carriere, **C. Rossa**, N. Usmani, R. Sloboda, and M. Tavakoli - "Needle shape estimation in soft tissue based on partial ultrasound image observation". *IEEE International Conference on Robotics and Automation (ICRA)*, Seattle, USA, May 2015. 10.1109/ICRA.2015.7139501

C.6 **C. Rossa**, A. Anastassova, A. Micaelli, and J. Lozada - "Perceptual evaluation of the passive/active torque asymmetry of a hybrid haptic device". *International Conference Eurohaptics 2014*, LNCS 8618, pp. 55-60. Versailles, France, Jun 2014. 10.1007/978-3-662-44193-0_8

C.5 **C. Rossa**, J. Lozada, and A. Micaelli - "Actionneur hybride pour interface à retour d'effort". *SEEDS/ JCGE*. Saint Nazaire, France, Jun 2013. 10.13140/2.1.3502.0160

C.4 **C. Rossa**, J. Lozada, and A. Micaelli - "Stable haptic interaction using passive and active actuators". *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 2386, 2392. Karlsruhe, Germany, 2013. 10.1109/ICRA.2013.6630901

C.3 **C. Rossa**, J. Lozada, and A. Micaelli - "A new hybrid actuation approach for force-feedback devices". *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 4054-4049. Vila Moura, Portugal, Oct 2012. 10.1109/IROS.2012.6385784

C.2 **C. Rossa**, J. Lozada, and A. Micaelli - "Magnetic flux analysis on magnetorheological actuators can detect external force variation". *IEEE Sensors Conference*. Taipei, Taiwan, Oct 2012. 10.1109/ICSENS.2012.6411116

C.1 **C. Rossa**, J. Lozada, and A. Micaelli - "Interaction power flow based control of a 1-DOF hybrid haptic device". *International Conference Eurohaptics 2012*, pp. 151-156. Tampere, Finland, 2012. 10.1007/978-3-642-31404-9_26

Book Chapters

B.3 **C. Rossa**, J. Carriere, M. Khadem, R. Sloboda, N. Usmani, and M. Tavakoli - "Ultrasound-guided semi-automated seed implantation in prostate brachytherapy". *Brain and Cognitive Intelligence – Control in Robotics*, pp.21-47, 2022.

B.2 M. Lacki*, and **C. Rossa** - "Towards the ideal haptic device: Review of actuation techniques for human-machine interfaces". *Human-robot interaction: control, analysis, and design*, pp. 45-75, 2020.

B.1 **C. Rossa**, M.Keri*, and M. Tavakoli - "Brachytherapy needle steering guidance using image overlay". *Handbook of Research on Biomimetics and Biomedical Robotics*, pp. 191-204, 2018. 10.4018/978-1-5225-2993

Theses

T.2 **C. Rossa**, PhD thesis - "A hybrid actuation system for haptic interfaces". Jan 2014. Université Pierre et Marie Curie (Sorbonne Université).
☆ Awarded with "mention très honorable".
» Full text: http://www.theses.fr/2013PA066700.

T.1 **C. Rossa**, Mastère 2 - "Développement d'une stratégie de commande d'efficience d'énergie à l'aide d'un modèle basé sur un régulateur prédictif de vitesse pour les véhicules routiers". Original title: *Entwicklung einer energieeffizienten Schaltstrategie mit Hilfe eines modellbasierten prädiktiven Geschwindigkeitsreglers für Straßenfahrzeuge*, Ecole Nationale d'Ingénieurs de Metz/ Technische Universität Kaiserslautern, 2010.

Intellectual Property

IP.2 **C. Rossa**, M. Tavakoli, N. Usmani, and R. Sloboda - "Dispositif à main et système mis en oeuvre par ordinateur et méthode de direction assistée d'une aiguille inserée de manière percutanée", Hand-held device and computer-implemented system for assisted steering of a percutaneously inserted needle, 2017. CA 2967482.

IP.1 **C. Rossa**, J. Lozada, and A. Micaelli - "Actionneur à actionnement hybride pour interface à retour de forces". Actuator with hybrid actuation for a force feedback interface, 2013. WO2013189946, US20150301553A1.

8.2. Invited Lectures and Presentations

P.8 Acoustoeletric impedance tomography for robotic surgery — 2022
Queen's University, Kingston, ON

P.7 Le retour haptique pour la chirurgie assistée par ordinateur — 2022
Commissariat à l'Energie Atomique (CEA), Palaiseau, France

P.6 Multimodal instrumentation for robotic surgery — 2021
Data Day 8, Carleton University, Ottawa, ON

P.5 Introduction to surgical robotics — 2021
BIOM5800F Biomedical Engineering Seminar, Ottawa, ON

P.4 Instrumentation and feedback control in surgical robotics — 2021
Carleton University, Ottawa, ON

P.3 Introduction to medical robotics — 2018
Ontario Tech - IEEE mechatronics research night, Oshawa, ON

P.2 Mechatronics systems for improving surgeries and therapies — 2017
Ontario Tech University, Oshawa, ON

P.1 Mechatronics systems for improving surgeries and therapies — 2017
University of Ottawa, Ottawa, ON

9. TEACHING

Carleton University

SYSC 4206 - Surgical robotics (28 students)	winter 2024
SYSC 3600 - Systems and simulation (91 students)	winter 2024
ECOR 1055 - Introd. to biomedical engineering (105 students)	fall 2023
SYSC 3610 - Biomedical systems, modelling, and control (65 students)	fall 2023
Capstone design projects (15 students, 4 groups)	2023-2024
SYSC 4206 - Surgical robotics (28 students)	winter 2023
SYSC 3600 - Systems and simulation (119 students)	winter 2023
SYSC 3610 - Biomedical systems, modelling, and control (59 students)	fall 2022
Capstone design projects (11 students, 3 groups)	2022-2023
SYSC 3600 - Systems and simulation (106 students)	winter 2022
SYSC 3610 - Biomedical systems, modelling, and control (84 students)	fall 2021
Capstone design projects (12 students, 5 groups)	2021-2022

Ontario Tech University

METE 3100 - Actuators and power electronics (85 students)	winter 2021
MECE 3350 - Control systems (291 students, 2 sections)	fall 2020
Capstone design projects (18 students, 4 groups)	2020-2021
METE 3100 - Actuators and power electronics (58 students)	winter 2020
MECE 3350 - Control systems (228 students, 2 sections)	fall 2019
METE 3100 - Actuators and power electronics (39 students)	winter 2019
Capstone design projects (21 students, 4 groups)	2019-2020
MECE 3350 - Control systems (161 students)	fall 2018
MECE 2430 - Dynamics (56 students)	spring 2018
MECE 2230 - Statics (115 students)	fall 2017
Capstone design projects (16 students, 3 groups)	2018-2019

University of Alberta

ECE 210 - Digital logic design (110 students)	fall 2016

- **Total: 1906 students**.

Carleton UNIVERSITY
Canada's Capital University

Department of Mechanical and Aerospace Engineering

3135 Mackenzie Building
1125 Colonel By Drive
Ottawa, ON K1S 5B6 Canada
Tel: (613) 520-5684

Fax: (613) 520-5715

CURRICULUM VITAE

a) NAME:

Jerzy Sasiadek, Full Professor, P.Eng.,Ing.

Web link: http://http-server.carleton.ca/~jsas/

b) DEGREES: designation, institution, department, year

Ph.D. in Control Systems,	Wroclaw University of Science and Technology, Wroclaw, Poland, 1976
MSc in Aerospace Eng,	Wroclaw University of Science and Technology, Wroclaw, Poland, 1973

c) EMPLOYMENT HISTORY: dates, rank/position, department, institution/firm full-time only

1987 – present	Full Professor, Mechanical and Aerospace Engineering, Carleton University, Ottawa, Ontario
1983 - 1987	Associate Professor, Mechanical and Aerospace Engineering, Carleton University, Ottawa, Ontario
1989 – 1991	Director of Space Robotics, Canadian Space Agency, Ottawa, Ontario
1985 - 1987	Technical Director, Alberta Research Council, Calgary, Alberta
1983	Associate Professor. McGill University, Montreal, Quebec
1982	Research Professor, Concordia University, Montreal, Quebec
1980 - 1982	Visiting Professor, University of Alberta, Edmonton, Alberta

CONSULTING and PART-TIME

Government Departments and Government Agencies:

Canadian Space Agency

Atomic Energy of Canada
NASA HQ

NASA Langley Research Centre
NASA Goddard Space Flight Centre
NASA Ames Research Centre
NASA JPL

NASA

European Space Agency
National Research Council
Canadian Federal Government
US Government

Ontario Provincial Government
Quebec Provincial Government
Alberta provincial Government
CNRS

Private Corporations:

Lockheed-Martin, Ltd., Bethesda, Maryland, USA
Boeing Corp, Chicago, Illinois, USA

Bombardier, Ltd., Montreal, Quebec
CAE, Ltd, Montreal, Quebec
Nortel, Ottawa, Ontario

Frontline Robotics, Ltd, Ottawa, Ontario
Alcatel, Paris, France

and 87 other public and private institutions.

d) HONOURS: (F.R.S., F.R.S.C., Governor Generals Award, honorary degree, etc…)

1989	A. Fellow, American Institute of Aeronautics and Astronautics (for contribution in Space Robotics and Guidance, Navigation and Control)
1990	Senior Member, IEEE
2001	AIAA Merit Award
2010	IFAC Service Award

e) SCHOLARLY AND PROFESSIONAL ACTIVITIES: past 7 years only (eg. executive and editorial positions but not memberships in societies)

2008 – 2020	IFAC (International Federation of Automatic Control) Council Member
2001 – present	Director, American Automatic Control Council
1997 – 2006	Chair, IFAC Technical Committee on Robotics
2009 – present	President IFAC Canada
1993 – 2008	Vice president, IFAC Canada
1989 – present	Chair, IEEE Robotics and Automation Society, Ottawa Section
1989 – present	Chair, IEEE Control Systems Society, Ottawa Section
1991 – present	Executive, IEEE Canada
1996 – 2007	AIAA Guidance, Navigation and Control Technical Committee, Member
1993 - present.	Associate Editor, IFAC CONTROL ENGINEERING PRACTICE, Journal,
1990 - 2004	Associate Editor, IFAC AUTOMATICA,
1995 – present	Associate Editor, AIAA Journal of Guidance, Dynamics and Control,
1980 – present	L'Ordre des Ingenieures du Quebec (OIQ), Member
1982 - present	Professional Engineers of Ontario (PEO), Member

f) PUBLICATIONS

I am an author/co-author of 510 referenced journal/conference publications. Also, I authored/coauthored 4 books.

g) GRADUATE STUDENTS SUPERVISION

Completed: 57 MSc, 32 PhD

In progress: 5 MSc, 6 PhD

CURRICULUM VITAE

NAME: **HOWARD M. SCHWARTZ**
Email: schwartz@sce.carleton.ca
Tel: **(613) 520-2600 Ext. 5746**
Web Page: **http://www.sce.carleton.ca/faculty/schwartz/index.html**

EDUCATION

Ph.D.	Robotics and Control Engineering Massachusetts Institute of Technology, Cambridge, Massachusetts, 1987
M.Sc.	Aeronautics and Astronautics Massachusetts Institute of Technology, Cambridge, Massachusetts, 1982
B.Eng.	Civil Engineering McGill University Montreal, Quebec, 1981

EMPLOYMENT EXPERIENCE

Academic

1999-Present	Professor Department of Systems and Computer Engineering Carleton University
2009 – 2013	Department Chair/Head Department of Systems and Computer Engineering Carleton University
1997 – 2001	Associate Chair Graduate Studies Department of Systems and Computer Engineering Carleton University
1992-1999	Associate Professor Department of Systems and Computer Engineering Carleton University, Ottawa
1987-1992	Assistant Professor Department of Systems and Computer Engineering Carleton University, Ottawa

PROFESSIONAL ACTIVITIES

Member, Professional Engineers of Ontario.
Senior Life Member IEEE
Associate Editor, IEEE Transactions on Cybernetics

ACADEMIC AND PROFESSIONAL RESPONSIBILITIES

Teaching (Courses Taught and Year Last 4 years)

2023-2024	SYSC3600A	Systems and Simulation
	SYSC5401	Adaptive and Learning Systems
	SYSC4505A	Automatic Control I
2022-2023	SYSC3600A	Systems and Simulation
	SYSC5401	Adaptive and Learning Systems
	SYSC4505B	Automatic Control I
2021-2022	Sabbatical Year	
2020-2021	SYSC3600B	Systems and Simulation
	SYSC5401	Adaptive and Learning Systems
	SYSC4505	Automatic Control I
2019-2020	SYSC3600B	Systems and Simulation
	SYSC5401	Adaptive and Learning Systems
	SYSC3600D	Systems and Simulation

GRADUATE SUPERVISION (Last 5 Years)

SUMMARY (Last 5 years)			
Masters Students		Doctoral Students	
In Progress	Completed	In Progress	Completed
0	5	4	2

Master's Thesis Research Completed

Ammar Al-Mahbashi, MASc., "A Machine Learning Approach for Aerial Drones Playing the Pursuit-Evasion Game." MASc. Thesis Completed January 2024.

Rachel Haighton, MASc., "Multi-Agent Cooperative Fuzzy Reinforcement Learning" MASc. Thesis Completed September 2023.

Dawei Ni, MASc., "Transfer Learning for Fuzzy Actor-Critic Learning via Fuzzy Rule Transfer." MASc. Thesis Completed September 2020.

Esther Akinwumi, MASc., "Multi-Agent Fuzzy Reinforcement Learning for Autonomous Vehicles." MASc. Thesis Completed Jan. 2020

Tolulope Akinbulire, MASc., "The Evaluation of Multi-Objective Evolutionary Algorithms for a Maritime Domain Awareness Problem." MASc. Thesis completed May 2019.

Doctoral Thesis Research Completed

Ian Showalter, Ph.D., "Evolution of Multiobjective Neuromodulated Neurocontrollers for Multi-Robot Systems." Ph.D. Thesis Completed September 2021.

Amirhossein Asgharnia, Ph.D "Learning of Deception in Adversarial Games with Hierarchical Multiobjective Reinforcement Learning", Ph.D. Thesis Completed May 2023.

Doctoral Thesis Research In Progress

Mahrokh Hezaveh, Ph.D., "Machine Learning for Multi Agent Systems Operating in Complex Environments."

Ash Vahedi Kasbakhi, Ph.D., "Multi Agent, Multi Objective Machine Learning for Cooperation and Competition."

Mohammad Tayefe, Ph.D., "Machine Learning for Drone Control Using Spiking Neural Networks."

Ehsan Rastkhiz, Ph.D., "High Performance Navigation and Control of Drones in a Cluttered Environment."

UNDERGRADUATE SUPERVISION

2020-2021

Angela Byun, Nikhil Kharbanda, Martin Klamrowski, "MIRRAI: A Smart Mirror for Real-Time Clothing Insights and Suggestions".

Emma Maddock, Rafe Osborne, Aldous Rice-Leech , Andrew Vicencio, "Wireless Control of Drones". Co-supervised with Prof. Lambadaris.

Mihailo Krstic, Rosanne De Almeida, "LTE/5G Network for Data Transmission using Software Defined Radios". Co-supervised with Prof. Lambadaris.

2019-2020

Shivanshi Sharma, Adam Labelle, Brian Ranjan Philip, Shaviyo Marasinghe, "Smart Collision Avoiding Robot".

2018-2019

Sid Baden, Roni Peled, Tenaimi Okurude, Emeka Peters , "Class 5 IoT Robot (motorized Robot Assistant)"

SCHOLARLY STUDIES AND RESEARCH

Current Research Interests

Research interests include adaptive control of robotic manipulators, multi robot reinforcement learning, multi robot cooperative control, evolutionary systems, multi-objective optimization, estimation and identification of dynamic systems, adaptive control of nonlinear systems and simulation and modelling of dynamic systems.

PUBLICATIONS (Names in Bold are students working under my supervision, last 5 years)

Papers In Refereed Journals

Ni, D. and Schwartz, H.M., "Enhancing Learning Efficiency in FACL: A Novel Fuzzy Rule Transfer Method for Transfer Learning", *International Journal of Fuzzy Systems*, Accepted for publication November 2023.

Hosseinabadi, P.A., Sotani, A., Schwartz, H. and Mekhilef, S., "Fixed-time Sliding Mode Observer-based Controller for a Class of Uncertain Nonlinear Double Integrator Systems", *Asian Journal of Control* , Vol. 25, No. 5, pp. 3289-4145, September 2023.

Asgharnia, A, Schwartz, H and Atia, M., "Multi-Objective Fuzzy Q-Learning to Solve Continuous State-Action Problems", *Neurocomputing*, Vol. 516, pp. 115-132, 2023.

Hosseinabadi, P.A., Pota, H., Mekhilef, S. and Schwartz, H., "Fixed-time observer-based control of DFIG-based wind energy conversion systems for maximum power extraction", *International Journal of Electrical Power and Energy Systems*, Vol. 146, March 2023.

Asgharnia, A, Schwartz, H and Atia, M., 'Learning Multi-Objective Deception In a Two-Player Differential Game Using Reinforcement Learning and Multi-Objective Genetic Algorithm", *International Journal of Innovative Computing, Information and Control*, Vol. 18, No. 6, pp. 1667-1688, December 2022.

Asgharnia, A, Schwartz, H and Atia, M., "Learning Deception Using Fuzzy Multi-Level Reinforcement Learning in a Multi-Defender One-Invader Differential Game", *International Journal of Fuzzy Systems*, Vol. 24, No. 7, pp. 3015-3038, Oct. 2022.

Showalter, I. and Schwartz, H.M., "Neuromodulated Multiobjective Evolutionary Neurocontrollers Without Speciation", *Evolutionary Intelligence*, Vol. 14, No. 4, pp. 1415-1430, Dec. 2021.

Wang, X., Shi, P., Schwartz, H. and Zhao, Y., "An Algorithm for Pre-Trained Fuzzy Actor-Critic Learning Applied to Fixed-Time Space Differential Games", *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, Vol. 235, No. 14, pp. 2095-2112, Nov. 2021.

Papers Submitted to Refereed Journals

Haighton, R., Schwartz, H., Givigi, S., "Altruism in Fuzzy Reinforcement Learning", Submitted to the IEEE Transactions Computational Social Systems, April, 2023, Revised January 2024.

Haighton, **R.**, **Asgharnia, A.**, Schwartz, H, Givigi, S., "An Adaptable Fuzzy Reinforcement Learning Method for Non-Stationary Environments", Submitted to Neurocomputing Nov. 2023.

Asgharnia, A., Schwartz, H., Learning Deception and agent assignment using hierarchical Reinforcement Learning", Submitted to Applied Soft Computing, December 2024.

Rastkhiz, E., Schwartz, H., Lambadaris, I., "A Fuzzy Approach to Path-planning and Obstacle Avoidance for Autonomous Vehicles", Submitted to the International Journal on Fuzzy System, January 2024.

Ramezanlou, M., Schwartz, H., Lambadaris, I., "Enhancing Cooperative Multi-agent Reinforcement Learning through the Integration of R-STDP and Federated Learning", Submitted to Neurocomputing, Febuary 2024.

Papers In Refereed Conference Proceedings

Rachel Haighton, Amirhossein Asgharnia, Howard Schwartz, Sidney Givigi, "Hierarchical Reinforcement Learning for Non-Stationary Environments", Proceedings of the 2023 IEEE Symposium Series on Computational Intelligence (SSCI 2023), Mexico City, Dec. 5-8, 2023

Mohammad Tayefe Ramezanlou, Howard Schwartz, Ioannis Lambadaris, Michel Barbeau, Syed Naqvi, "Learning a Policy for Pursuit-Evasion Games Using Spiking Neural Networks and the Spike-Timing-Dependent Plasticity Algorithm", Proceedings of 2023 IEEE International Conference on Systems, Man, and Cybernetics (SMC2023), Honolulu, Hawaii, October 1-4, 2023

Amirhossein Asgharnia, Howard M. Schwartz and Mohamed Atia, "Hierarchical Reinforcement Learning With Multi Discount Factors In A Differential Game ", Proceedings of the 2022 IEEE Symposium Series on Computational Intelligence (SSCI 2022), Singapore, Dec. 4-7, 2022.

Amirhossein Asgharnia, Howard M. Schwartz and Mohamed Atia, "Multi-Invader Multi-Defender Differential Game Using Reinforcement Learning ", Proceedings of The 2022 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2022), Padua, Italy, July 18 - July 23, 2022.

Mohammad Tayefe Ramezanlou, Howard Schwartz, Ioannis Lambadaris, Michel Barbeau, "Comparison of Cellular Network Controllers for Quadrotors Experiencing Time Delay", Proceedings of the 30th Mediterranean Conference on Control and Automation (MED2022), Athens, Greece, June 28 - July 1, 2022.

Ian Showalter, Howard Schwartz and Sidney Givigi, "The Behavioural and Topological Effects of Measurement Noise on Evolutionary Neurocontrollers ", Proceedings of 2021 IEEE International Conference on Systems, Man, and Cybernetics (SMC), Oct. 17-20, 2021.

Ian Showalter, Howard Schwartz and Sidney Givigi, "Evolutionary Inherited Neuromodulated Neurocontrollers with Objective Weighted Ranking ", Proceedings of 2021 IEEE Congress on Evolutionary Computation (CEC 2021), June 28 - Jul 1, 2021.

Ian Showalter and Howard Schwartz, "Objective Comparison and Selection in Mono- and Multi-Objective Evolutionary Neurocontrollers ", Proceedings of 2020 IEEE Symposium Series on Computational Intelligence (SSCI 2020), Canberra, Australia, Dec. 1-4, 2020.

Ian Showalter and Howard Schwartz, "Exploring the Relationship Between Topology and Function in Evolved Neural Networks ", Proceedings of 2020 IEEE Symposium Series on Computational Intelligence (SSCI 2020), Canberra, Australia, Dec. 1-4, 2020.

Ian Showalter and Howard Schwartz, "Self-Adaptation of Meta-Parameters for Lamarckian-Inherited Neuromodulated Neurocontrollers in the Pursuit-Evasion Game ", Proceedings of 2020 IEEE Symposium Series on Computational Intelligence (SSCI 2020), Canberra, Australia, Dec. 1-4, 2020.

Amirhossein Asgharnia, Howard M. Schwartz and Mohamed Atia, " Deception in A Muti-agent Adversarial Game: The Game of Guarding Several Territories ", Proceedings of 2020 IEEE Symposium Series on Computational Intelligence (SSCI 2020), Canberra, Australia, Dec. 1-4, 2020.

Amirhossein Asgharnia, Howard Schwartz and Mohamed Atia, " Deception In The Game of Guarding Multiple Territories: A Machine Learning Approach ", Proceedings of 2020 IEEE

International Conference on Systems, Man, and Cybernetics (SMC2020), Toronto, Canada, October 11-14, 2020.

Ammar Al-Mahbashi, Howard Schwartz and Ioannis Lambadaris, " Machine Learning Approach for Multiple Coordinated Aerial Drones Pursuit-Evasion Games ", Proceedings of 2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC2020), Toronto, Canada, October 11-14, 2020.

Ian Showalter and Howard Schwartz, "Multiobjective Neuromodulated Controllers for Efficient Autonomous Vehicles with Mass and Drag in the Pursuit-Evasion Game", Proceedings of the IEEE Congress on Evolutionary Computation (CEC2020), Glasgow, UK, July 19-24, 2020.

Howard Schwartz, "An Object Oriented Approach to Fuzzy Actor-Critic Learning for Multi-Agent Differential Games", Proceedings of 2019 IEEE Symposium Series on Computational Intelligence (SSCI 2019), Xiamen, China, Dec. 6-9, 2019.

Ian Showalter and Howard Schwartz, "Lamarckian Inheritance in Neuromodulated Multiobjective Evolutionary Neurocontrollers", Proceedings of the 27th Mediterranean Conference on Control & Automation (MED 2019), Akko, Israel, July 1-4, 2019.

Walter Aburime, Howard Schwartz and Sidney Givigi, "Compensation for Multiple Time Delays in the Navigation of Unmanned Aerial Vehicles", Proceedings of the 2019 IEEE International Systems Conference (SYSCON2019), Orlando, Florida, April 8-11, 2019.

RESEARCH FUNDING

Grants

2017-2023	NSERC Discovery Grant	$25,000/yr
2021-2023	Mitacs Accelerate Grant Navigation and Control of Drones over 5G networks: Enhanced Communication, Adaptive Control and Drone Swarm Collision Avoidance. (With, Michel Barbeau, loannis Lambadaris and Evangelos Kranakis)	$285,000

Curriculum Vitae

Chao Shen

Department of Systems and Computer Engineering, Carleton University
1125 Colonel By Drive, Ottawa, Ontario K1S 5B6, Canada
Tel: +1 (613)-520-2600 ext. 2470 E-mail: shenchao@sce.carleton.ca

Education

Ph.D. in Mechanical Engineering — Mar. 2018
University of Victoria (UVic) — *Victoria, BC, Canada*

- Dissertation: "Motion control of autonomous underwater vehicles using advanced model predictive control strategy"
- Supervisors: Prof. Yang Shi & Prof. Bradley Buckham

M.A.Sc. in Control Science & Engineering — Jul. 2012
Northwestern Polytechnical University (NPU) — *Xi'an, Shaanxi, China*

- Thesis: "Study on motion control of a flapping-wing underwater robot"
- Supervisor: Prof. Mingyong Liu

B.Eng. in Automation Engineering — Jul. 2009
Northwestern Polytechnical University — *Xi'an, Shaanxi, China*

- Thesis: "Simulation on cooperative underwater navigation algorithms"
- Supervisor: Prof. Mingyong Liu

OTHER CREDENTIALS

Certificate in University Teaching — Apr. 2022
Carleton University — *Ottawa, ON, Canada*

Research Interests

- Robotics and Control
  - ▷ Perception, navigation, and control of robotic systems
  - ▷ Model predictive control theory and applications
  - ▷ Cooperative control for multi-robot systems
  - ▷ Autonomous underwater vehicles
  - ▷ Machine learning for robotic applications
  - ▷ Simultaneous Localization and Mapping (SLAM)
- Mechatronic Systems
  - ▷ Design, modeling and control of intelligent mechatronic systems
  - ▷ Distributed cooperative control of multiple mechatronic systems
  - ▷ Autonomous driving control systems
  - ▷ State estimation, filtering and parameter identification
- Deep Learning and Machine Learning
  - ▷ Deep neural network design and implementation
  - ▷ Data collection and augmentation for efficient training
  - ▷ Deployment of (deep) learning model to embedded systems
  - ▷ Problem formulation and design of deep/machine learning applications

Work Experiences

- **Assistant Professor**
  Carleton University, Ottawa, Canada Jul. 2021 – Present
  - ▷ Perception, Navigation, and Control for Robotics
  - ▷ Autonomous Underwater Vehicles
  - ▷ Vision-based Intelligent Control
  - ▷ Cooperative and Coordination Control of Multi-Agent Systems
  - ▷ Optimal and Distributed Control of Large-scale Systems
- **Research Engineer**
  AltumView Systems Inc., Port Moody, Canada Apr. 2018 – Feb. 2020
  - ▷ Smart home robot system development
    - – Visual Simultaneous Localization and Mapping (VSLAM)
    - – Autonomous navigation system for mobile robots
    - – Vision-based cooperative fiducial tracking system
    - – Semantic enhanced VSLAM system for mobile robots
    - – Natural language processing (NLP) system for human-robot interaction
  - ▷ AI-enabled visual sensor development
    - – Design and implementation of deep learning based violence detection
    - – Design and implementation of deep learning based gesture recognition
    - – Design and implementation of deep learning based fall recognition
    - – Integration of advanced Kalman filtering techniques for smooth pose estimation

Research Experience

- **Postdoctoral Researcher**
  Real-time Adaptive Control Engineering Laboratory, University of Michigan Jan. 2021 – Jun. 2021
  - ▷ Planning and Control for Autonomous Underwater Vehicles (AUV)
    - – Energy management for AUVs
    - – Energy-efficient control for AUVs
    - – Localization algorithm design for AUVs
    - – Large-scale path planning for AUVs
- **Postdoctoral Researcher**
  Applied Control & Information Processing Laboratory, University of Victoria Mar. 2020 – Dec. 2020
  - ▷ Autonomous Robotic Vehicle Systems (ARVs)
    - – Control layer and autonomy layer design for ARVs
    - – Energy management for ARVs
    - – Implementation of advanced control algorithms
    - – Perception system design for ARVs
    - – System modeling and identification
    - – Observer and filter design
  - ▷ Nonlinear Model Predictive Control (NMPC)
    - – Control theoretic study on NMPC
    - – NMPC applications to robotic systems
    - – Distributed NMPC for large-scale control systems
    - – Fast implementation algorithm design for NMPC
- **Research Engineer**
  Robot Team/Research Team, AltumView Systems Inc. Apr. 2018 – Jan. 2020

▷ Simultaneous Localization and Mapping (SLAM)
- Design and implementation of Visual SLAM algorithms
- Design and implementation of autonomous navigation algorithms for mobile robots
- Design and implementation of semantic enhanced VSLAM systems for mobile robots
- Development of practical SLAM evaluation methods
- Robust navigation system for mobile robots based on multi-algorithm fusion

▷ Deep Learning based Computer Vision for Action Recognition (AR)
- Design and Implementation of Novel Neural Networks for Action Recognition
- Optimization of Neural Networks for Fast Deployment
- Data Collection and Augmentation Techniques for Efficient Training

▷ Deep Learning based Natural Language Processing (NLP)
- Design and Implementation of Novel Neural Networks for Intent Detection
- Design and Implementation of Novel Neural Networks for Dialog Flow
- Integration of NLP for Voice Control of Mobile Robots

- **Research Assistant**
  Applied Control & Information Processing Laboratory, University of Victoria — Sept. 2012 – Mar. 2018

  ▷ Advanced Guidance, Navigation and Control (GNC) of Marine Vehicles
  - Robust feedback controller designs for marine vehicles
  - Design of guidance law and navigation algorithm for marine vehicles
  - Simulation and implementation of GNC algorithms for marine vehicles

  ▷ Fast Optimization Algorithm Development
  - Development of novel optimization algorithms which adapt to the real-time automatic control systems
  - Distributed optimization algorithms for reducing computational complexity
  - Convergence analysis of the developed novel algorithms

- **Research Assistant**
  Marine Control System Lab, Northwestern Polytechnical University — Aug. 2009 – Jul. 2012

  ▷ Modeling and Control of a Flapping-Wing Underwater Robot
  - Modeling and identification of a flapping-wing underwater robot
  - Depth control and heading control of the robot

  ▷ Cooperative Underwater Navigation Algorithm Development
  - Simulation study on moving long baseline (MLBL) method for underwater navigation
  - Optimal estimation for MLBL-based underwater navigation using two surface vessels
  - Filter design: Extended Kalman filter, Unscented Kalman filter for nonlinear estimation

Teaching Activities

- **Contributions to Teaching**
  Developed New Graduate Course: *Model Predictive Control Theory and Design* — 2023 Winter
  Department of Systems and Computer Engineering, Carleton University — *Ottawa, ON, Canada*

  ▷ Course offered for the first time as SYSC 5807X in Winter 2023

  ▷ The course was offered with the name of *Constrained Optimal Control* in Winter 2024

  Participated in Revitalization of Undergraduate Course: *Systems and Simulation* — 2024 Winter
  Department of Systems and Computer Engineering, Carleton University — *Ottawa, ON, Canada*

  ▷ Worked with colleagues to propose new hardware lab equipment and redesign the lab assignments

- **Courses Taught**
  The following courses were taught at Carleton University, Ottawa, ON, Canada.

Course	Title	Term	Level
SYSC 4505	Automatic Control Systems I	Winter 2024	UG
SYSC 3600	Systems and Simulation	Fall 2023	UG
SYSC 5807F	Constrained Optimal Control	Fall 2023	G
SYSC 2510	Probability, Statistics, and Random Process	Winter 2023	UG
SYSC 5807X	Model Predictive Control Theory and Design	Winter 2023	G
SYSC 4505	Automatic Control Systems I	Fall 2022	UG
SYSC 2510	Probability, Statistics, and Random Process	Winter 2022	UG
SYSC 4505	Automatic Control Systems I	Fall 2021	UG

The following course(s) were taught at University of Victoria, Victoria, BC, Canada

▷ MECH 458/554: Mechatronics 2016 Fall

Supervision and Mentoring

- GRADUATE STUDENT SUPERVISION

  ▷ **Sana Zahid** Jan. 2024 - Present
  M.A.Sc. Electrical and Computer Engineering, Carleton University *Ottawa, ON, Canada*
  Thesis Topic: *Data-driven MPC for robotic systems*

  ▷ **Paul Desaulniers** Jan. 2024 - Present
  M.A.Sc. Electrical and Computer Engineering, Carleton University *Ottawa, ON, Canada*
  Thesis Topic: *Safe reinforcement learning for control of UAVs*
  Co-supervisor: *Junfeng Wen*

  ▷ **Fatemeh Mohammad Zamani** Sept. 2023 - Present
  Ph.D. Aerospace Engineering, Carleton University *Ottawa, ON, Canada*
  Thesis Topic: *Optimization-based control for UAV applications*
  Co-supervisor: *Hashim Mohamed*

  ▷ **Junzhuo Wu** Sept. 2023 - Present
  M.A.Sc. Mechanical Engineering, Dalhousie University *Halifax, NS, Canada*
  Thesis Topic: *Model predictive control for sailing boats*
  Co-supervisor: *Ya-Jun Pan*

  ▷ **Hang Gu** Sept. 2022 - Present
  M.A.Sc. Electrical and Computer Engineering, Carleton University *Ottawa, ON, Canada*
  Thesis Topic: *Robust MPC for vision-based control of robotic systems*

  ▷ **Niankai Yang** (Informal) 2020 - 2021
  Ph.D. Naval Architecture and Marine Engineering, University of Michigan *Ann Arbor, MI, USA*
  Thesis Topic: *Energy-optimal planning and control of autonomous underwater vehicles under ocean currents*

  ▷ **Henglai Wei** (Informal) 2018 - 2019
  Ph.D. Mechanical Engineering, University of Victoria *Victoria, BC, Canada*
  Thesis Topic: *Robust and distributed model predictive control with application to cooperative marine vehicles*

- UNDERGRADUATE STUDENT SUPERVISION

  ▷ **Espen Swift** Jan. 2024 - present
  Undergraduate Student Research, Carleton University, *Ottawa, ON, Canada*
  Project Topic: *Development of high-fidelity underwater robot simulator in ROS*

  ▷ **Aryan Singh** Jun. 2024 - Sept. 2024
  Mitacs Globalink Program Intern, Carleton University, *Ottawa, ON, Canada*
  Project Topic: *Improved simultaneous localization and mapping system for mobile robots*

▷ **Ahaan Banerjee** May 2024 - Aug. 2024
Mitacs Globalink Program Intern, Carleton University, *Ottawa, ON, Canada*
Project Topic: *Improved simultaneous localization and mapping system for mobile robots*

▷ **Roopsa Sen** May 2024 - Aug. 2024
Mitacs Globalink Program Intern, Carleton University, *Ottawa, ON, Canada*
Project Topic: *Motion planning and robust control of autonomous robots with safety guarantees*

▷ **Raneem Abouseta** Oct. 2022 - Jan. 2023
I-CUREUS Undergraduate Student Researcher, Carleton University *Ottawa, ON, Canada*
Project Topic: *Vision-based docking control system design for autonomous underwater robots*

▷ **Rahul Rustagi** May 2023 - Aug. 2023
Mitacs Globalink Program Intern, Carleton University, *Ottawa, ON, Canada*
Project Topic: *Designing AI-based vision system for improved simultaneous localization and mapping*

- FOURTH-YEAR CAPSTONE DESIGN PROJECTS

▷ **Vision-based Control for Robotics - 2023 Group 1** Sept. 2023 - Apr. 2024
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Keertikumar Kubareea, Aaryan Ahuja, Isha Verma, Pranath Pathak, Teshwar Tarachand*

▷ **Autonomous Driving: Road Sign and Traffic Light Detection** Sept. 2023 - Apr. 2024
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Shishir Vatsa, Akshay Vashisht, Matthew Parker*
Co-supervisor: *Richard Dansereau*

▷ **Autonomous Driving: Autonomous Navigation** Sept. 2023 - Apr. 2024
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Sagar Syal, Ray Prina, Sangat Buttar, Himanshu Singh, Sundar Vengadeswaran*
Co-supervisor: *Richard Dansereau*

▷ **Autonomous Driving: Lane Detection and Lane Keeping** Sept. 2023 - Apr. 2024
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Liam Gaudet, Ian Holmes, Curtis Davies, Robert Simionescu*
Co-supervisor: *Richard Dansereau*

▷ **Autonomous Driving: Lidar Mapping and Positioning** Sept. 2023 - Apr. 2024
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Mohamed Selim, Aymaan Newaz, Basel Syed, Mohammed Jemal*
Co-supervisor: *Richard Dansereau*

▷ **Vision-based Control for Robotics - 2022 Group 1** Sept. 2022 - Apr. 2023
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Guanqun Dong, Han Gao, Jiatong Han, Boshen Zhang*

▷ **Vision-based Control for Robotics - 2022 Group 2** Sept. 2022 - Apr. 2023
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Mingzhi Chen, Justin Huang, Kevin Johnson, Leenesh Kumar, Benjami Ransom*

▷ **Simultaneous Localization and Mapping (SLAM) Robot** Sept. 2022 - Apr. 2023
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Nick Fejes, Mike Purcell, Hari Saravanan, Weihong Shen*

▷ **Autonomous Vehicles: Intersection Control and Safety** Sept. 2022 - Apr. 2023
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Muhammad Furqan, Imran Latif*
Co-supervisor: *Richard Dansereau*

▷ **Vision-based Control for Robotics - 2021 Group 1** Sept. 2021 - Apr. 2022
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Yifeng Liu, Rutvik Shah, Yulin Wang, Liwei Yang, Samuel Zhu*

▷ **Vision-based Control for Robotics - 2021 Group 2** Sept. 2021 - Apr. 2022
Department of Systems and Computer Engineering, Carleton University *Ottawa, ON, Canada*
Team Members: *Caleb Turcotte, John Grabkowski, Paul Chen, Mohamed Mahmoud, Hang Gu*

Thesis Examination Committees

- Examiner - Member of the Joint Institute
  - ▷ **Fahed Hassanat** March 2023
    Ph.D. Electrical and Computer Engineering (Thesis Proposal Defense) *Ottawa, ON, Canada*
    School of Electrical Engineering and Computer Science, University of Ottawa
    Thesis Title: *Detections and Classifications with mm-Wave Radar Sensor*
- Examiner - Internal Examiner
  - ▷ **Arezo Shevidi** December 2023
    M.A.Sc. Mechanical Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Mechanical and Aerospace Engineering, University of Ottawa
    Thesis Title: *Quaternion Sliding Mode-based Backstepping Control Design for Quadrotors in the Presence of Unknown Uncertainties*
  - ▷ **Steffan Lloyd** May 2023
    Ph.D. Mechanical Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Mechanical and Aerospace Engineering, University of Ottawa
    Thesis Title: *Precision Robotic Machining: Modelling and Control Innovations for Improved Performance*
- Examiner - Member of the Department
  - ▷ **Ammar AL-Mahbashi** December 2023
    M.A.Sc. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
    Thesis Title: *Machine Learning Approach for Multiple Coordinated Aerial Drones*
  - ▷ **Rachel Haighton** August 2023
    M.A.Sc. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
    Thesis Title: *Multi-Agent Cooperative Fuzzy Reinforcement Learning*
  - ▷ **Hoorieh Mazdarani** June 2023
    Ph.D. Electrical and Computer Engineering (Comprehensive Exam) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
  - ▷ **Mahla Abdolahnejad** August 2022
    Ph.D. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
    Thesis Title: *Deep Generative Models for Unsupervised Scale-Based and Position-Based Disentanglement of Concepts from Face Images*
- Examination Committee Chair
  - ▷ **Beck Langstone** August 2023
    M.A.Sc. Human-Computer Interaction (Thesis Defense) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
    Thesis Title: *Design and Development of NLP-Enriched Time-Series Text Visualizations*
  - ▷ **Mahsa Sinaei Hamed** June 2023
    Ph.D. Electrical and Computer Engineering (Comprehensive Exam) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
  - ▷ **Sushmi Thushara Sukumar** January 2023
    M.A.Sc. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Systems and Computer Engineering, Carleton University
    Thesis Title: *Knowledge Graph Generation for Unstructured Data Using Data Processing Pipeline*
  - ▷ **Shahad Shakir** January 2023
    M.A.Sc. Biomedical Engineering Engineering (Thesis Defense) *Ottawa, ON, Canada*
    Department of Mechanical and Aerospace Engineering, Carleton University
    Thesis Title: *Morphological Effects of the Microenvironment Structure on Human Fetal Lung Fibroblast Cells*

▷ **Jintao Liang** January 2023
M.A.Sc. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
Department of Systems and Computer Engineering, Carleton University
Thesis Title: *System Analysis for Satellite Networks with Free-Space Optical Links*

▷ **Raveen Narendra Babu** January 2023
M.A.Sc. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
Department of Systems and Computer Engineering, Carleton University
Thesis Title: *Performance Evaluation of Transformer-based NLP Models on Fake News Detection Datasets*

▷ **Junwen Fu** September 2022
M.A.Sc. Electrical and Computer Engineering (Thesis Defense) *Ottawa, ON, Canada*
Department of Systems and Computer Engineering, Carleton University
Thesis Title: *Decoding Passenger's Brain Signals to Detect and Analyze Emergency Road Events*

▷ **Joshua Poole** September 2022
M.A.Sc. Biomedical Engineering (Thesis Defense) *Ottawa, ON, Canada*
Department of Systems and Computer Engineering, Carleton University
Thesis Title: *Characterization and Classification of Fibrillar Collagen Networks using Gray-Level Texture Analysis*

Honors/Awards

- Recipient of NSERC Postdoctoral Fellowship 2020
- Winner of IEEE SMCS (Systems, Man, and Cybernetics Society) Thesis Grant Initiative 2018
- Best Paper Award in The IEEE International Conference on Unmanned Systems 2017
- Outstanding Reviewer for IET Control Theory & Applications 2017
- UVic The Albert Hung Chao Hong Scholarship 2016
- Best Session Presentation Award in The American Control Conference 2016
- UVic Faculty of Graduate Studies Travel Grant 2016
- UVic The Charles S. Humphrey Graduate Student Award 2015
- UVic Faculty of Graduate Studies Travel Grant 2015
- University of Victoria Graduate Award 2012
- NPU Outstanding Undergraduate Award (top 5% of the undergraduates) 2009

Research Funding

- **Awarded Research Funding**

[G7] **Mitacs Globalink Research Internship Project** 2024 Summer
Title: *Motion Planning and Robust Control of Autonomous Robots with Safety Guarantees*
Role: Principal Investigator.

[G6] **Mitacs Globalink Research Internship Project** 2024 Summer
Title: *Designing AI-based Vision System for Improved Simultaneous Localization and Mapping*
Role: Principal Investigator.

[G5] **Mitacs Globalink Research Internship Project** 2023 Summer
Title: *Designing AI-based Vision System for Improved Simultaneous Localization and Mapping*
Role: Principal Investigator.

[G4] **Carleton University I-CUREUS Fund** 2022 Fall - 2023 Winter
Title: *Vision-based Docking Control System Design for Autonomous Underwater Robots*
Role: Principal Investigator.

[G3] **NSERC Discovery Grants Program** 2022 - 2027
Title: *Towards A Reliable Optimization-based Design Framework for Autonomy and Control of Robotic Systems*
Role: Principal Investigator.

[G2] **NSERC Discovery Launch Supplement** 2022 - 2023
Title: *Towards A Reliable Optimization-based Design Framework for Autonomy and Control of Robotic Systems*
Role: Principal Investigator.

[G1] **Carleton University Start-Up Fund** 2021
Role: Principal Investigator.

Publications

- **Refereed journal papers that have been published or accepted for publication**

[J12] L. Hao, R. Wang, **C. Shen**, Y. Shi, "Trajectory Tracking Control of Autonomous Underwater Vehicles Using Improved Tube-Based Model Predictive Control Approach", IEEE Transactions on Industrial Informatics **(Impact Factor: 12.3)**, accepted, 2024

[J11] L. Hao, Z. Wu, **C. Shen**, Y. Cao, and R. Wang, "Tube-Based Model Predictive Control for Constrained Unmanned Marine Vehicles with Thruster Faults", IEEE Transactions on Industrial Informatics **(Impact Factor: 12.3)**, accepted, 2023

[J10] N. Yang, **C. Shen**, Z. Song, M. Johnson-Roberson, and J. Sun, "Robust Energy-optimal Control for Three-dimensional Path-following of Autonomous Underwater Vehicles under Ocean Currents", IEEE Transactions on Control Systems Technology **(Impact Factor: 5.418)**, accepted, 2023

[J9] L. Hao, Z. Yang, Y Liu, and **C. Shen**, "TRCA-Net: Stronger U Structured Network for Human Image Segmentation", Neural Computing and Applications, **(Impact Factor: 5.102)**, vol. 35, pp. 9627-9635, 2023

[J8] L. Hao, Y. Zhang, **C. Shen**, and F. Xu, "Fault-Tolerant Control for Unmanned Marine Vehicles via Quantized Integral Sliding Mode Output Feedback Technique", IEEE Transactions on Intelligent Transportation Systems **(Impact Factor: 9.551)**, vol. 25, no. 5, pp. 5014-5023, 2023

[J7] H. Wei, **C. Shen** and Y. Shi, "Distributed Lyapunov-based Model Predictive Formation Tracking Control for Autonomous Underwater Vehicles Subject to Disturbances", *IEEE Transactions on Systems, Man, and Cybernetics: Systems* **(Impact Factor: 11.471)**, vol. 51, no. 8, pp. 5198-5208, 2021. **(Google Scholar Citations: 88)**

[J6] **C. Shen** and Y. Shi, "Distributed Implementation for Nonlinear Model Predictive Tracking Control of an AUV", *Automatica* **(Impact Factor: 6.15)**, vol. 115, pp. 108863, 2020 **(Google Scholar Citations: 96)**

[J5] **C. Shen**, Y. Shi and B. Buckham, "Trajectory Tracking Control of an Autonomous Underwater Vehicle using Lyapunov-based Model Predictive Control", *IEEE Transactions on Industrial Electronics* **(Impact Factor: 8.162)**, vol. 65, no. 7, pp. 5796-5805, 2018. **(Google Scholar Citations: 356)**

[J4] **C. Shen**, Y. Shi and B. Buckham, "Path-Following Control of an AUV: A Multi-Objective Model Predictive Control Approach ", *IEEE Transactions on Control Systems Technology* **(Impact Factor: 5.418)**, vol. 27, no. 3, pp. 1334-1342, 2018. **(Google Scholar Citations: 118)**

[J3] **C. Shen**, Y. Shi and B. Buckham, "Integrated Path Planning and Tracking Control of an AUV: A Unified Receding Horizon Optimization Approach ", *IEEE/ASME Transactions on Mechatronics* **(Impact Factor: 5.867)**, vol. 22, no. 3, pp. 1163 - 1173, 2017. **(Google Scholar Citations: 185)**

[J2] **C. Shen**, B. Buckham and Y. Shi, "Modified C/GMRES Algorithm for Fast Nonlinear Model Predictive Tracking Control of an AUV", *IEEE Transactions on Control Systems Technology* **(Impact Factor: 5.312)**, vol. 25, no. 5, pp. 1896 - 1904, 2017. **(Google Scholar Citations: 114)**

[J1] Y. Shi, **C. Shen**, H. Fang and H. Li, "Advanced Control in Marine Mechatronic Systems: A Survey", *IEEE/ASME Transactions on Mechatronics* **(Impact Factor: 5.867)**, vol. 22, no. 3, pp. 1121-1131, 2017. **(Google Scholar Citations: 218)**

- **Refereed conference papers that have been published or accepted for publication**

[C9] A. Ali, **C. Shen**, and H. Hashim, "MPC Based Linear Equivalence with Control Barrier Functions for VTOL-UAVs ", *The 2024 American Control Conference*, Toronto, Canada, 2024.

[C8] N. Yang, **C. Shen**, M. Johnson-Roberson, and J. Sun, "Energy-optimal Three-dimensional Path-following Control of Autonomous Underwater Vehicles under Ocean Currents", *The 2022 6th IEEE Conference on Control Technology and Applications*, Trieste, Italy, 2022.

[C7] **C. Shen**, and Y. Shi, "NMPC Design for AUV Dynamic Positioning Control with Incremental Input Constraints", *The 5th IEEE International Conference on Industrial Cyber-Physical Systems*, University of Warwick, Coventry, United Kingdom, 2022.

[C6] Z. Wu, L. Hao, and **C. Shen**, "Fault-Tolerant Control for Constrained Unmanned Marine Vehicles Based on Model Predictive Control with Integral Sliding Mode Control", *The 5th International Symposium on Autonomous Systems*, Hangzhou, China, 2022.

[C5] **C. Shen**, Y. Shi and B. Buckham, "Lyapunov-Based Model Predictive Control for Dynamic Positioning of Autonomous Underwater Vehicles", *The 2017 IEEE International Conference on Unmanned Systems*, Beijing, China, 2017. (**Best Paper Award**)

[C4] **C. Shen**, K. Zhang, Y. Shi and B. Buckham, "Dynamic Positioning of an AUV: A Lyapunov-based Model Predictive Control Approach", *The 26th Canadian Congress of Applied Mechanics*, Victoria, BC, Canada, 2017.

[C3] **C. Shen**, Y. Shi and B. Buckham, "Nonlinear Model Predictive Control for Trajectory Tracking of an AUV: A Distributed Implementation", *The 55th IEEE Conference on Decision and Control*, Las Vegas, NV, USA, 2016.

[C2] **C. Shen**, Y. Shi and B. Buckham, "Path-Following Control of an AUV using Multi-Objective Model Predictive Control", *The 2016 American Control Conference*, Boston, MA, USA, 2016.

[C1] **C. Shen**, Y. Shi and B. Buckham, "Model Predictive Control for an AUV with Dynamic Path Planning", *The Joint 34th Chinese Control Conference and SICE Annual Conference 2015* , Hangzhou, China, 2015.

Patents

- **Refereed patents that have been published and filed**

[P4] Y. Gao, X. Wang, R. Ma, **C. Shen**, M. Chen, J. Liang, and J. Wu, "Real-time Visual Object Tracking for Unmanned Aerial Vehicles (UAVs)", AltumView Systems Inc., Canada. *Published in April 2022*, US20220114739A1.

[P3] Y. Gao, X. Wang, E. Honsch, R. Ma, **C. Shen**, M. Chen, Y. Lu, J. Liang, and J. Wu, "High-Performance Visual Object Tracking for Embedded Vision Systems", AltumView Systems Inc., Canada. *Published in December 2021* , US11205274B2.

[P2] R. Ma, **C. Shen**, Y. Gao, Y. Lu, M. Chen, J. Liang, and J. Wu, "Obstacle Avoidance System Based on Embedded Stereo Vision for Unmanned Aerial Vehicles", AltumView Systems Inc., Canada. *Published in September 2020* , US10776939B2.

[P1] J. Zheng, **C. Shen**, D. Zhang, and J. Liang, "Video-based Fall Risk Assessment System", AltumView Systems Inc., Canada. *Published in July 2020*, US20200205697A1.

Books

- **Refereed books that have been published or accepted for publication**

[B1] Y. Shi, **C. Shen**, H. Wei, and K. Zhang, "Advanced Model Predictive Control for Autonomous Marine Vehicles", Springer Nature, 2023, In Press, ISBN 978-3-031-19353-8.

Presentations

- **Technical Talks**
  - ▷ Invited Talk - "MPC for Dynamic Positioning Control of Autonomous Underwater Vehicles" *The Second International Conference on Naval Architecture and Ocean Engineering,* 2023
  - ▷ Invited Talk - "MPC: A New Control Design Framework for Underwater Robotic Systems" *Dalian Maritime University,* 2023
  - ▷ Invited Talk - "Model Predictive Control: A Unified Framework for Marine Control System Design" *Shanghai Jiaotong University,* 2022
  - ▷ Invited Talk - "Transition to Faculty Series" *Dept. Systems & Computer Eng., Carleton University,* 2022
  - ▷ Invited Panel Presentation *The Industrial Intelligence Summit 2021, 2021*
  - ▷ Conference Technical Session Presentation *The 26th Canadian Congress of Applied Mechanics,* 2017
  - ▷ Conference Technical Session Presentation *The 55th IEEE Conference on Decision and Control,* 2016
  - ▷ Conference Technical Session Presentation *The 2016 American Control Conference,* 2016
  - ▷ Conference Technical Session Presentation *The 54th SICE Annual Conference,* 2015
  - ▷ Pre-conference Workshop Presentation *The 34th Chinese Control Conference,* 2015

Professional Activities

- **Journal Editorial Board**

  Associate Editor for *IEEE/ASME Transactions on Mechatronics* 2023-Present

  Associate Editor for *IEEE Canadian Journal of Electrical and Computer Engineering* 2022-Present

  Guest Associate Editor for *IET Control Theory and Applications* 2022-2023

  Guest Associate Editor for *Journal of Marine Science and Engineering* 2022-2023

  Special Topic Editor (Guest Associate Editor) for MDPI Journals including *Energies*; *Vehicles*; *Safety*; *Automation*; *International Journal of Environmental Research and Public Health* 2022-2023

  Guest Associate Editor for *Frontiers in Control Engineering* 2021

- **Conference Organization**

  Financial Chair *The 6th IEEE International Conference on Industrial Cyber Physical System,* 2024

  Special Session Chair *The 2nd IEEE Industrial Electronics Society Annual Online Conference,* 2023

  Publicity Chair *The 6th IEEE International Conference on Industrial Cyber Physical System,* 2023

  Technical Program Committee *The 2023 IEEE International Conference on Industrial Informatics (INDIN),* 2023

  Techincal Program Chair *The 2022 IEEE Electrical Power and Energy Conference,* 2022

  Program Track Co-chair *The 16th International Conference on Underwater Networks & Systems,* 2022

  Program Track Co-chair *The 17th IEEE International Conference on Control & Automation,* 2022

  Program Track Co-chair *The 5th IEEE Int. Conference on Industrial Cyber-Physical Systems,* 2022

  Program Track Co-chair *The 31st IEEE International Symposium on Industrial Electronics,* 2022

  Technical Program Committee *The 15th Int. Conference on Underwater Networks & Systems,* 2021

  Program Track Co-chair *The 4th IEEE Int. Conference on Industrial Cyber-Physical Systems,* 2021

Industry Forum Committee	*The 4th IEEE Int. Conference on Industrial Cyber-Physical Systems,* 2021
Program Track Co-chair	*The 16th IEEE International Conference on Control & Automation,* 2020
Financial Chair	*The 28th IEEE International Symposium on Industrial Electronics,* 2019
Program Track Co-chair	*The 28th IEEE International Symposium on Industrial Electronics,* 2019
Industry Forum Committee	*The 28th IEEE International Symposium on Industrial Electronics,* 2019
Technical Session Co-chair	*The 2016 American Control Conference,* 2016

- **Active Reviewer for**

  Journals:

  IEEE/ASME Transactions on Mechatronics
  IEEE Transactions on Automatic Control
  IEEE Transactions on Industrial Electronics
  IEEE Transactions on Control Systems Technology
  IEEE Transactions on Cybernetics
  IEEE Transactions on Systems, Man, and Cybernetics: Systems
  IEEE Robotics and Automation Letters
  IEEE Journal of Oceanic Engineering
  IEEE Canadian Journal of Electrical and Computer Engineering
  IEEE Access
  Automatica
  IET Control Theory and Applications
  Ocean Engineering
  ASME Journal of Dynamic Systems, Measurement and Control
  Journal of Control Science and Engineering
  Journal of The Franklin Institute
  Soft Robotics
  Control and Intelligent Systems
  Mathematical Methods in the Applied Sciences
  Control Theory and Technology

  Conferences:

  IEEE Conference of Decision and Control (CDC)
  American Control Conference (ACC)
  IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
  IEEE International Conference on Industrial Cyber Physical System (ICPS)
  IEEE International Symposium on Industrial Electronics (ISIE)
  Annual Conference of the IEEE Industrial Electronics Society (IECON)
  IEEE/ASME Conference on Advanced Intelligent Mechatronics (AIM)
  IEEE International Conference on Control & Automation (ICCA)
  IEEE International Conference on Robotics and Biomimetics
  IEEE Conference on Control Technology and Applications
  International Conference on Neural Information Processing
  Chinese Control Conference (CCC)
  Chinese Control and Decision Conference (CCDC)

- **Member of**

  Institute of Electrical and Electronics Engineers (IEEE).

  Engineers and Geoscientists BC (EIT Member).

CURRICULUM VITAE

A) NAME: Robert Niall Tait

B) EDUCATION:

Ph.D.	Electrical Engineering	University of Alberta	1992
	"Thin Film Microstructure Effects in VLSI Metalization"		
M.A.Sc.	Engineering Physics	University of British Columbia	1988
	"Ignition of Arc Discharges at High Pressure"		
B.Sc.(Hon)	Engineering Physics	University of Alberta	1986

C) EMPLOYMENT:

1) Academic	*July 1 2014-present*	Department Chair
	2011-present	Professor
	2001-2011	Associate Professor
	1997-2001	Assistant Professor Department of Electronics Carleton University
	1992-1993	Sessional Lecturer Electrical Engineering University of Alberta
2) Industrial	*1992-1997*	Research Scientist Alberta Microelectronic Corporation (Micralyne)
3) Consulting	*May 2012*	Patent review
	May-July, 1998	Canadian Microelectronics Corporation, Study of micro-systems activities in Canada

D) ACADEMIC AND PROFESSIONAL RESPONSIBILITIES

1) Teaching

1a) Courses

2023-24	fall	ELEC 4709 Integrated Sensors
		ECOR 1055 Introduction to Engineering Disciplines
2022-23	fall	ELEC 4709 Integrated Sensors
		ECOR 1055 Introduction to Engineering Disciplines
2021-22	fall	ELEC 4709 Integrated Sensors
		ECOR 1055 Introduction to Engineering Disciplines
2020-21	fall	ELEC 4709 Integrated Sensors
		ECOR 1055 Introduction to Engineering Disciplines

2019-20	fall	ELEC 4709 Integrated Sensors	
		ECOR 1055 Introduction to Engineering Disciplines	
2018-19	winter	ELEC 3907 Design project	
	fall	ELEC 4709 Integrated Sensors	
2017-18	winter	ELEC 4703 Solar Cells	
	fall	ELEC 4709 Integrated Sensors	
2016-17	winter	ELEC 4703 Solar Cells	
	fall	ELEC 4709 Integrated Sensors	
2015-16	winter	ELEC 4703 Solar Cells	
	fall	ELEC 4709 Integrated Sensors	
2014-15	winter	ELEC 5707 Microelectronic Sensors and MEMS	
	fall	ELEC 4709 Integrated Sensors	
2013-14	winter	ELEC 5707 Microelectronic Sensor and MEMS	
	fall	ELEC 4709 Integrated Sensors	
		ELEC 3605 Electrical Engineering	
2012-13	winter	ELEC 5707 Microelectronic Sensor and MEMS	4.68
	fall	ELEC 4709 Integrated Sensors	4.33
		ELEC 3605 Electrical Engineering	3.99
2011-12	winter	ELEC 5707 Microelectronic Sensor and MEMS	4.25
	fall	ELEC 4709 Integrated Sensors	4.21
		ELEC 3605 Electrical Engineering	4.32
2010-11	summer	ELEC 2501 Circuits and Signals	4.44
2009-10	fall	ELEC 4709 Integrated Sensors	4.30
		ELEC 3605 Electrical Engineering	3.80
2008-09	fall	ELEC 4709 Integrated Sensors	3.59
		ELEC 3605 Electrical Engineering	3.95
2007-08	winter	ELEC 5707 Microelectronic Sensors and MEMS	4.80
	fall	ELEC 4709 Integrated Sensors	4.41
		ELEC 3605 Electrical Engineering	3.88
2006-07	winter	ELEC 5707 Microelectronic Sensors and MEMS	4.48
		ELEC 4709 Integrated Sensors	4.53
	fall	ELEC 3605 Electrical Engineering	3.89
2005-06	winter	ELEC 3105 Basic EM and Power Engineering	4.24

	fall	ELEC 5707 Microelectronic Sensors	
		ELEC 4906 Special Topics: Integrated Sensors	3.94
2004-05	sabbatical		
2003-04	winter	ELEC 2607 C Switching Circuits	4.18
	fall	ELEC 5707 Microelectronic Sensors	
		ELEC 4705 Elect. materials, devices, & trans. media	3.13
2002-03	winter	97.267 A&B Switching Circuits	4.47
	fall	97.577 Microelectronic Sensors	4.25
2001-02	winter	97.577 Microelectronic Sensors	4.11
		97.257 Electronics I	4.04
	fall	97.469 IC Design and Fabrication	3.97
2000-01	winter	97.257A&B Electronics I	4.04
	fall	97.577 Microelectronic Sensors	4.72
1999-00	winter	97.257A&B Electronics I	3.97
	fall	97.577 Microelectronic Sensors	4.35
1998-99	winter	97.257 Electronics I	3.78
	fall	97.470 Modeling of integrated devices	4.30
		97.475 Elect. materials, devices, & trans. Media	4.11
1997-98	winter	97.470 Modeling of integrated devices	

University of Alberta

1992-93	winter	ENCMP 100 Computer programming for engineers

1b) Graduate project supervision

In Progress

2023- Yousef Karimi Yonjali, Ph.D. “Microwave to photonic signal transduction for quantum applications”

Completed

2016-2019 Muhammad Asif, M.A.Sc. “Wafer bonded plasmonic biosensors” (with P. Berini).

2013-2019 Muhammad Ali, Ph.D. “Metasurfaces for engineered-bandwidth thermal emitters” (with S. Gupta)

2015-18 Pengshuai Ren, M.A.Sc. “Improved fabrication of long-range surface plasmon devices in CYTOP” (with P. Berini)

2011-17 Elham Keshmarzi, Ph.D. “Long-range surface plasmon single-mode lasers” (with P. Berini)

2009-16	N. Fong Ph.D. “Hydrogen sensing with long-range surface plasmon membrane waveguides” (with P. Berini)
2013- 15	Howard Northfield, M.A.Sc. “Fabrication of long range surface plasmon polariton Bragg waveguide biosensors on Cytop and multilayer substrates” (with P. Berini).
2013-15	Amrita Vikram Singh, M.A.Sc. “Fabrication of a micro-hotplate for application as an infrared emitter”
2011-14	Sa’ad Hassan, M.A.Sc. “Microfabrication of plasmonic devices: PPBG biosensor in Cytop, intensity modulator, and atomically flat nanohole array” (U. Ottawa, with P. Berini)
2009-12	Behzad Yadegari, M.A.Sc., ”CMOS radiation sensors” (with N.G.Tarr, L. Roy)
2009-12	Hamoudi Asiri, M.A.Sc. “Integration of microfluidics with plasmonic sensors” (U. Ottawa, with P. Berini)
2008-11	R. Hanif, M.A.Sc. “Microfabrication of Plasmonic Biosensors in CYTOP Integrating a Thin SiO2 Diffusion and Etch-barrier Layer” (U. Ottawa, with P. Berini)
2007-11	E. Ghias-Begloo M.A.Sc. “ISFET arrays for DNA detection” (with N.G. Tarr, D. Landheer)
2003-10	C. Raum Ph.D. “Thermal tuning of SOI waveguides” (with R. Gauthier)
2007-10	S. Agha-Mirbaha M.A.Sc. “Thin film germanium photodetectors integrated with silicon micromirrors”
2007-09	C. Chiu, M.A.Sc. “Fabrication of Surface Plasmon Waveguide Devices in *CYTOP* with Microfluidic Channels” (U. Ottawa, with P. Berini).
2006-09	N. Fong M.A.Sc. “Membrane characterization for plasmonic devices” (with P. Berini)
2006-09	R. Daviau M.A.Sc. “Fabrication of surface Plasmon waveguides on Cytop” (U. Ottawa, with P. Berini)
2005-08	A. Rankin M.A.Sc. “ISFET based label-free DNA detection with hafnia gate dielectrics” (with N.G. Tarr)
2004-07	F. Saleh M.A.Sc. “The design and integration of CMOS readout circuitry with an a-$Ge_xSi_{1-x}O_y$ un-cooled infrared micro-bolometer”
2002-05	M. Mariani M.A.Sc. “Microwave coplanar waveguide tunable filters using RF MEMS” (with L. Roy)
2002-05	J. Danson M.A.Sc. “Tunable amplifiers using RF MEMS” (with C. Plett)
2001-04	A. Zaki, Ph.D. "$Ge_xSi_{1-x}O$ CMOS compatible infrared detector"
2001-04	A. Mirfazli M.A.Sc. “Thin film AlN for RF acoustic wave filters”
2001-04	N. Scales M.A.Sc. “Modeling of electrokinetic microfluidics”

2002-04 K. Ramdas M.A.Sc. "SOI waveguide tunable Bragg grating filters" (with N.G. Tarr)

2000-03 J. Rose, M.Sc. "MEMS Switches for Smart Antennas" (with L. Roy)

1c) Undergraduate project supervision

2023-24 S Camci, A. Oronsaye, G. Ni, P. Lawrence, S. Shirobokov, "Wireless monitoring for assisted living"(with A. Ross)

2022-23 A. Abihana, M. Hamza, J. Kajjouni, R. Sultmanis, Z. Ukeje, "Wireless environmental monitoring platform"(with A. Ross)

2021-22 J. Hammel, C. Onyebuchie, A. Pietrobon, S. Sehinde-Ibini, "Wireless sensor network" (with A. Ross)

2020-21 J. Bhachoo, F. Baccin-Smith, C. Bezanson, A. Skerlan, D. Tomar, J. Williams, "IoT Sensor Network" (with A. Ross)

2019-20 A. Daheeye, N. Fahood, C. Gibson, D. Harnett, A. Jayasinghe, Y. Shen, "Radon monitor" (with A. Ross)

2018-19 P. Alahmar, T. Armstrong, L. Elayoubi, S. Khan, "Sound localization using a MEMS microphone array"

2017-18 A. Bhola, A. Giles, O. Iyamah, H. Rihan, "Acoustic beamforming using a MEMS microphone array"

2016-17 A. Goslett, M. Hachem, J. Wu, "Mackenzie building photovoltaic power system"

2015-16 N. Nieman, B. Tighe, M. Codogno, S. Whyte, M. Tittonel, C. Tsang, "IoT applications for a smart home"

J. Pike, E. Chan, G. Lawan, A. Cortens, A. Knight, "Resonant plate mass sensor".

2014-15 A. Natsvlichvili, K. Khanal, A. MacCormack, V. Maharajh, "RFID energy harvesting sensor node"

2013-14 H. Deol, M. Dozios, T. Egan, A. Duke, "RFID energy harvesting sensor node"

2012-13 H. Albedawi, C. Barr, C. Buchanan, E. Geiger, C. Ross, "Energy harvesting system for greenhouse control"

2011-12 R. Borodowski, E. Cathcart, M. Rocque, "Energy harvesting for building monitoring sensors"

2009-10 K. Chabba, M. Mobarhani, M. Tayeh, "High performance housing design" with Mechanical and Aerospace Engineering

2008-09 T. Ahmad, H. Al Azzouni, D. Mantha, N. Rajabalee, "Wireless health monitoring system"

2007-08 L. Cuadros, P. Nguyen, "FPGA Pulse oximeter"

2006-07 A. Burk, V. Lavigne, E. Ghias-Begloo, M. Joshi, "Pulse oximeter"

2005-06	M. Bienasz, M. Goulet, D. Joyce, and M. Brooks, “Accelerometer Design”
2003-04	K. Mia, M. Kneebone, L. Hoang, K. Nagalingam, F. Diriye, D. Zivic, “Integrated MEMS accelerometer”
2002-03	C. Millen, W. Moynihan, C. Carson, D. Harris, S. Cramp, A. Mathur, A. Choy, “MEMS accelerometer”
2001-02	C. Amaya, M. Mmbaidjo, H. Gunabalasingam, I. Ali, T. Tran, D. Triantafillou, ”CMOS integrated accelerometer”
2000-01	J. Palacios, A. Rodriquez, R. Snair "Altimeter design and integration"
	N. Scales, A. Mirfazli, J. Zavala "Blood flow monitoring system for a coronary bypass graft"
1999-00	A. Zukich, A. Fong, R. Jabbari "Temperature, pressure, and humidity multisensor designed using the Mitel 1.5 um CMOS process"
	L. Wilson "CMOS image sensor based spectrometer"
1998-99	P. Gunaratnam "Design of a pressure sensor for materials processing equipment"
	T. Leong "Design of a pressure sensor for automotive applications"
	J. Wang "Design of an accelerometer for medium g-force applications"
	K. Doherty "Static capacitance measurement circuitry"
	N. Gonzalez "File conversion for three dimensional IC layout visualization"
	L. Smith "Response surface analysis software for IC process development"
1997-98	Z. Zhang "Voltage Multiplier"

2) Scholarly Studies and Research

2a) Publications

Papers in refereed journals:

J1) Howard Northfield, Oleksiy Krupin, R. Niall Tait, Pierre Berini, “Tri-layer contact lithography process for high-resolution lift-off”, Microelectronic Engineering 241, 111545 (2021); https://doi.org/10.1016/j.mee.2021.111545

J2) Muhammad Asif, R. Niall Tait, Pierre Berini, “Hot Embossing of Microfluidics in Cyclic-Olefin Co-Polymer using a Wafer Aligner-Bonder", Microsyst Technol (2021); https://doi.org/10.1007/s00542-020-05188-8

J3) Muhammad Asif, Oleksiy Krupin, Wei Ru Wong, Zoreh Hirbodvash, Ewa Lisicka-Skrzek, Choloong Hahn, R. Niall Tait, Pierre Berini, “Wafer-bonded surface plasmon waveguide biosensors with in-plane microfluidic interfaces”, J. Micromech. Microeng. **30**, 095004 (2020); https://doi.org/10.1088/1361-6439/ab92e9

J4) Joseph Botros, Muhammad O. Ali, Niall Tait, Rony E. Amaya, and Shulabh Gupta, "Direct thermal emission testing of aperiodic dielectric stack for narrowband thermal emission at mid-IR", Journal of Applied Physics **127**, 114502 (2020); https://doi.org/10.1063/1.5140010

J5) Muhammad O. Ali, R. Niall Tait, Shulabh Gupta, "Conductor-backed dielectric metasurface thermal emitters for mid-infrared spectroscopy", J. Appl. Phys. 127, 033105 (2020); https://doi.org/10.1063/1.5125652

J6) Maryam Khodami, Howard Northfield, Ewa Lisicka-Skrzek, R. Niall Tait, Pierre Berini, "Reactive Ion Etching of Cytop and Investigation of Residual Microstructures" (2020), https://doi.org/10.1109/JMEMS.2019.2959262

J7) Zohreh Hirboodvash, Maryam Khodami, Norman R. Fong, Ewa Lisicka-Skrzek, Anthony Olivieri, Howard Northfield, R. Niall Tait, and Pierre Berini, "Grating couplers fabricated by e-beam lithography for long-range surface plasmon waveguides embedded in a fluoropolymer", Applied Optics 58, pp. 2994-3002 (2019), https://doi.org/10.1364/AO.58.002994

J8) Choloong Hahn, Maude Amyot-Bourgeois, Maryam Al-Shehab, Howard Northfield, Youngsun Choi, Seok Ho Song, R Niall Tait, Pierre Berini, "Nanofabrication of plasmonic structures on insulating substrates by resist-on-metal bilayer lift-off", Nanotechnology 30 (2019) 054003 (8pp), https://doi.org/10.1088/1361-6528/aaefd6.

J9) Pengshuai Ren, Oleksiy Krupin, Pierre Berini, R. Niall Tait, "Fabrication of long range surface plasmon waveguide biosensors in a low-index fluoropolymer", J. Vac. Sci. Technol. B 36, 042601 (2018), https://doi.org/10.1116/1.5027859

J10) Elham Karami Keshmarzi, Niall Tait, Pierre Berini, "Single-mode surface plasmon distributed feedback lasers", Nanoscale **10**, 5914-5922, (2018); http://dx.doi.org/ 10.1039/C7NR09183D

J11) Muhammad Ali, Niall Tait, Shulabh Gupta, "High-Q All-dielectric Thermal Emitters" J. Opt. Soc. Am. A 35 (1), pp 119-124 (2018); https://doi.org/10.1364/JOSAA.35.000119

J12) Maude Amyot-Bourgeois, Elham Karami Keshmarzi, Choloong Hahn, R. Niall Tait, and Pierre Berini, "Gain optimization, bleaching, and e-beam structuring of IR-140 doped PMMA and integration with plasmonic waveguides," Opt. Mater. Express **7**, 3963-3978 (2017); https://doi.org/10.1364/OME.7.003963

J13) Norman R. Fong, Matteo Menotti, Ewa Lisicka-Skrzek, Howard Northfield, Anthony Olivieri, Niall Tait, Marco Liscidini, and Pierre Berini, "Bloch Long-Range Surface Plasmon Polaritons on Metal Stripe Waveguides on a Multilayer Substrate", ACS Photonics, 2017, 4 (3), pp 593–599; http://dx.doi.org/10.1021/acsphotonics.6b00930

J14) Elham Karami Keshmarzi, R. Niall Tait, Pierre Berini, "Parity-time symmetry-broken Bragg grating operating with long-range surface plasmon polaritons", Applied Physics A 122:279 (2016)); http://dx.doi.org/10.1007/s00339-016-9832-1

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J17) Norman R. Fong, Pierre Berini, Niall Tait, “Characterization of grating-coupled long range surface plasmon polariton membrane waveguides”, Optics Express 23, 17421-17430 (2015); http://dx.doi.org/10.1364/OE.23.017421

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J22) Sa’ad Hassan, Maryam Khodami, R. Niall Tait, Pierre Berini, “Fabrication of Long-Range Surface Plasmon-Polariton Bragg Gratings with Microfluidic Channels in Cytop Claddings”, Microelectronic Engineering 135, 5 March 2015, Pages 38–44, doi:10.1016/j.mee.2015.03.001

J23) Sa'ad Hassan, Ewa Lisicka-Skrzek, Anthony Olivieri, R Niall Tait and Pierre Berini, “Fabrication of a plasmonic modulator incorporating an overlaid grating coupler”, *Nanotechnology* 25 495202 (2014), doi:10.1088/09574484/25/49/495202

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J26) Gabriela Andrea Cervantes Tellez, Sa’ad Hassan, R. Niall Tait, Pierre Berini, Reuven Gordon, “Atomically flat symmetric elliptical nanohole arrays in a gold film for ultrasensitive refractive index sensing”, Lab Chip, advance article, 2013, doi:10.1039/C3LC41411F.

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J36) A. Akbari, R. N. Tait, P. Berini, "Surface plasmon waveguide Schottky detector", Optics Express, Vol. 18, Issue 8, pp. 8505-8514 (2010), doi:10.1364/OE.18.008505

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J39) N. Scales, R.N. Tait, "Modeling wall effects in capillary electrochromatography", Journal of Chromatography A (2008) doi:10.1016/j.chroma.2008.08.002

J40) N. Scales, R.N. Tait, "Modeling electroosmotic and pressure driven flow in porous microfluidic devices: zeta potential and porosity changes near the channel walls", Journal of Chemical Physics v125, 094714, (2006). Also selected for the Virtual Journal of Nanoscale Science and Technology, Sept. 18 2006.

J41) John Danson, Calvin Plett, and Niall Tait, “Using MEMS Capacitive Switches in Tunable RF Amplifiers”, EURASIP Journal on Wireless Communications and Networking 2006 (2006), Article ID 16518, 9 pages.

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J43) A.H.Z. Ahmed and R.N. Tait, “Characterization of an amorphous $Ge_xSi_{1-x}O_y$ microbolometer for thermal imaging applications”, IEEE Trans. Electron Devices 52, 1900-1906 (2005).

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J47) R.C. Gauthier, R.N. Tait, M. Ubriaco, "Activation of micro-components using light for MEMS and MOEMS applications", *Applied Optics*, v 41, p 2361-2367 (2002).

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J49) R.C. Gauthier, R.N. Tait, H. Mende, and C. Pawlowicz, "Optical selection, manipulation, trapping, and activation of a micro-gear structure for applications in Micro-Opto-Electro-Mechanical Systems", Applied Optics-LP 40, 930-937, (2001).

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J52) Bing He, Niall Tait, Fred Regnier, "Fabrication of nanocolumns for liquid chromatography", Analytical Chemistry, V. 70, 3790-3797 (1998).

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J55) R.N. Tait, S.K. Dew, W. Tsai, D. Hodul, M.J. Brett, and T. Smy, “Simulation of uniformity and lifetime effects in collimated sputtering”, JVST B 14, 679-686 (1996).

J56) Y.B. Ning, A.W. Mitchell, and R.N. Tait, "Fabrication of a silicon micromachined capacitive microphone using a dry-etch release process", Sensors and Actuators A 53, pp. 237-242 (1996).

J57) R.N. Tait, T. Smy, S.K. Dew, and M.J. Brett, "Nodular defect growth and structure in vapor deposited films", Journal of Electronic Materials 24, 935-940 (1995).

J58) W. Tsai, M.J. Brett, S.K. Dew, D. Liu, T. Smy, and R.N. Tait,"Bombardment and gas rarefaction effects on the properties of sputtered Ti thin films", Thin Solid Films 253, pp. 386-390 (1994).

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J60) R.N. Tait and A.W. Mitchell, "Sensitivity limitations in the fabrication of integrated acoustic sensors", Sensors & Actuators A, 41-42, pp. 455-459 (1994).

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J65) R.N. Tait, S.K. Dew, T. Smy, and M.J. Brett, "Density variation of tungsten films sputtered over topography", J. Appl. Phys. 70 (8), pp. 4295-4300 (1991).

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2) Norman Fong, Matteo Menotti, Ewa Lisicka-Skrzek, Howard Northfield, Anthony Olivieri, Niall Tait, Marco Liscidini, and Pierre Berini 10.1109/ICTON.2017.8024773

3) Norman Fong, Matteo Menotti, Ewa Lisicka-Skrzek, Howard Northfield, Anthony Olivieri, Niall Tait, Marco Liscidini, and Pierre Berini, “Bloch long-range surface plasmon polaritons in metallic stripe waveguides”, Conference on Lasers and Electro-Optics, OSA Technical Digest 2017, paper SM3N.3, doi: 10.1364/CLEO_SI.2017.SM3N.3

4) EK Keshmarzi, RN Tait, P Berini “Surface plasmon distributed feedback lasers”, PQE-2017, Jan, 8-13

5) Karami Keshmarzi*, E., Hahn*, C., Song, S. H., Oh, C. H., Tait, R. N., Berini, P.(2016). “Surface plasmon distributed feedback lasers and parity-time symmetric gratings”, PIERS: Progress in Electromagnetics Research Symposium: Plasmonic Nanolasers and Active Metamaterials, Shanghai, China Conference Date: 2016/8

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10) Karami Keshmarzi, E., Tait, R. N., Berini, P. (2015). “Nonreciprocal Bragg gratings based on surface plasmons”, Meta 2015 – 6th International Conference on Metamaterials, Photonic Crystals and Plasmonics, New York City, United States Conference Date: 2015/8

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32) R.N. Tait, "Metallization issues for MEMS", invited paper in Advanced Metallization Conference 2003, edited by G.W. Ray, T. Smy, T. Ohta, M. Tsujimura, Materials Research Society, Warrendale PA, pp. 557-566 (2004).

33) J. Rose, L. Roy, N. Tait**, "**Development of a MEMS microwave switch and application to adaptive integrated antennas"**,** IEEE CCECE 2003, Montreal PQ, pp. 1901 –1904, May 2003.

34) J.W.M. Rogers, L. Tan, T.J. Smy, R.N. Tait, and N.G. Tarr, "High Q on chip Cu inductor post-process for Si integrated circuits", 1999 International Interconnect Technology Conference, San Francisco, June 1999, p. 239.

35) T. Smy, L. Tan, K. Chan, J.N. Broughton, R.N. Tait, S.K. Dew, and M.J. Brett, "Simulation and experimental verification of long throw sputtering of Ti", IEEE VLSI Multilevel Interconnection Conference, Santa Clara, CA, June 1997.

36) B. Ghodsian, A. Parameswaran, M. Syrzycki, and N. Tait, "Fabrication of affordable metallic microstructures by electroplating and photoresist molds", Canadian Conference on Electrical and Computer Engineering, Calgary, AB, May 26-29, 1996.

37) R.N. Tait, L.M. Landsberger, J.F. Currie, G.H. McKinnon, M. Parameswaran, A.M. Robinson, and D.J. Gale, "A design and implementation methodology for micromachining", Canadian Conference on Electrical and Computer Engineering, Calgary, AB, May 26-29 1996.

38) R.N. Tait, W. Tsai, D. Hodul, D. Su, S.K. Dew, M.J. Brett, T. Smy, "Compositional variation of sputtered TiW thin films on topography: TEM/EDX measurements and SIMBAD simulations" Proc. Advanced Metallization and Interconnect Systems in 1995, Portland, OR, Oct. 3-5, 1995.

39) R.N. Tait and A.W. Mitchell, "Residual stress modification due to die attach of micromachined sensors", Proc. Canadian Conference on Very Large Scale Integration, Banff, Alberta, November 14-16, pp. 3A-18 3A-21 (1993).

40) R.N. Tait, S. Dew, T. Smy, and M.J. Brett, "Ballistic simulation of optical coatings deposited over topography", Proc. SPIE 1324, Modeling of Optical Thin Films II, San Diego CA, 12-13 July 1990 pp. 112-119.

41) S.K. Dew, R.N. Tait, T. Smy, and M.J. Brett, "SIMBAD: A new process simulation tool for thin films deposited over topography", poster at the 5th Canadian Semiconductor Technology Conference, Ottawa, Aug. 1990.

42) T. Smy, R.N. Tait, and M.J. Brett, "Simulation of density variation and step coverage for via metallization", IEEE VLSI Multilevel Interconnection Conference, Santa Clara CA, June 1989.

Papers in non-refereed conferences

43) Karami Keshmarzi, E., Amyot-Bourgeois, M., Tait, R. N., Berini, P.(2016). Surface Plasmon Distributed Feedback Lasers. Annual Meeting of the Max Planck Institute for the Science of Light, Tergensee, Germany Conference Date: 2016/7

44) Karami Keshmarzi, E., Hahn, C., Song, S. H., Tait, R. N., Berini, P.(2015). Active Plasmonics: Asymmetric active Bragg gratings based on long-range surface plasmons. Annual Meeting of the uOttawa Max Planck Centre for Extreme and Quantum Photonics, Ottawa, Canada Conference Date: 2015/10

45) W. H. Jiang, D. Landheer, G. Lopinski, W.R. McKinnon, A. Rankin, E. Ghias-Begloo, R. Griffin, N.G. Tarr, N. Tait, J. Liu, and W.N. Lennard, "Hf Silicate Gate Insulators in Field Effect Sensors used to Detect DNA Hybridization*",* ECS Trans. 2008 volume 16, issue 11, 441-450, doi: 10.1149/1.2981149.

46) W.H. Jiang, D. Landheer, G. Lopinski, A. Rankin, J. Liu, R. Griffin, N.G. Tarr, N. Tait, and W.N. Lennard, "Field Effect Detection of Oligonucleotides with HfSiOx Gate Insulator", 214th ECS Meeting, Abstract #3145, October 2008.

47) F. Saleh, R.N. Tait, "Integration of a Micro-bolometer with a CMOS read-out circuit", CWMEMS 2007, Montreal, August 13, 2007.

48) D. Landheer, W. Jiang, G. Lopinski, A. Rankin, G. Tarr, N. Tait, M. Shinwari, and M. Deen, "Post-processing of CMOS chips for BioFET DNA sensor array", Canadian Semiconductor Technology Conference, Montreal, August 14-17, 2007.

49) M.A. Mariani, L. Roy, R.N. Tait, "A coplanar waveguide RF MEMS tunable filter using a patterned centre conductor", Canadian Semiconductor Technology Conference, Ottawa, August 16-19, 2005.

50) K. Ramdas, P. Chyurlia, H. Panesar, L. Winchiu, W. Jiang, S. Demtchenko, N.G. Tarr, R.N. Tait and T.J. Smy, "Electronically tuned silicon-on-insulator Bragg filter for 1.5 μm light" 12th Canadian Semiconductor Technology Conference, August 2005.

51) A.H.Z. Ahmed and R.N. Tait, "Fabrication of a self-absorbing, self-supported CMOS compatible micromachined bolometer", presented at the Canadian Semiconductor Technology Conference, Ottawa, August 20, 2003.

52) R.N. Tait and A.M. Robinson, "Education in Microsystems Technology in Canada", presented at the World Micromachine Summit, Freiburg, Germany, 2 May 2001.

53) R.N. Tait, "Micromachined switches for RF and microwave applications", poster presented at the Canadian Workshop in MEMS, Ottawa, August 13, 1999.

54) K. Chow, R.N. Tait, C. Plett, and J. Ohja, "Integrated acoustic wave devices", poster presented at the Canadian Workshop on MEMS, Ottawa, August 13, 1999.

55) Dan Gale and Niall Tait, "Technology development and research for microsystems technology", invited talk at the Canadian Semiconductor Technology Conference, Ottawa, 14 August, 1997.

56) R.N. Tait, "Silicon micromachined microphone technology", invited talk at the NRC workshop on Semiconductor Based Sensors and Sensor Systems in Canada, Ottawa, Ontario, July 15-16, 1996.

57) R.N. Tait, "Microfabrication activities in AMC's materials and devices laboratory", invited talk at the Canadian Workshop on Micro Electro Mechanical Systems, Waterloo, Ontario, Feb. 19, 1996

58) R.N. Tait, T. Smy, S.K. Dew, and M.J. Brett, "Nodular defect growth and structure in vapor deposited films", invited talk at the fall meeting of the Minerals, Metals, and Materials Society, Rosemont, Ill, Oct. 3-6, 1994.

59) R.N. Tait, D. Liu, S.K. Dew, T. Smy, and M.J. Brett, "Simulation of inhomogeneities in sputtered refractory metal films", poster at the 14th Canadian Seminar on Surfaces, Winnipeg, Canada, May 26-29, 1993.

60) T. Smy, R.N. Tait, S.K. Dew, and M.J. Brett, "Simulation of microstructure and density inhomogeneities in sputter deposited refractory metals", invited talk at the Second International Symposium on Sputtering and Plasma Processes, Tokyo, Japan, May 27-28, 1993.

Book Chapters

61) N. Scales and R. N. Tait, "Modeling electroosmotic flow in microchannels containing porous media" in *Surface Electrical Phenomena in Membranes and Microchannels*, 2008: 209-231 ISBN: 978-81-7895-326-7 Editor: Anthony Szymczyk.

Patents

62) U.S. Patent 5,573,679, Alan W. Mitchell, Yuebin B. Ning, and R. Niall Tait, "Fabrication of a surface micromachined capacitive microphone using a dry-etch process", Nov. 12, 1996.

Citations: 61

Reports

63) T.J. Hubbard and R.N. Tait, "MST in Canada and recommended directions for CMC: Improving CMC support for Micro-Systems Technology", prepared for the Canadian Microelectronics Corporation, July 1998.

2c) Research Grants

i) Funding under review

ii) NSERC Discovery Grants

2019-2025 “Infrared MEMS” $28,000/yr

2014-2018 “Thermal micro-systems for gas monitoring” $25,000/yr

2006-2012 “MEMS device integration” $33,000/yr

2002-2005 “MEMS for telecommunications” $35,000/yr

1998-2001 "Materials and processes for silicon based sensors" $19,355/yr

iii) NSERC Alliance

2024-2026, S. Gupta and R.N. Tait with Mitacs, Dell EMC $90,000/yr

"Reconfigurable millimeter-wave metasurface refractors based on advanced electromagnetic materials"

iv) NSERC Collaborative Research and Development

2011-2013, P. Berini and R. N. Tait with Test Photonics Canada, Inc. $50,000/yr

“Surface plasmon optoelectronics in silicon for non-contact wafer probing”

v) NSERC Equipment Grants

2020 T. Koffas et. al., $147, 218

“Deep level transient spectroscopy for semiconductor device development

2000 R.N. Tait, T.J. Smy, N.G. Tarr $41,701
"Enhanced capability sputtering system"

1998 "Plasma system for processing of insulators and conductors" $42,657

vi) NSERC Major Facilities Access Grant

2006-2008 N.G. Tarr, T.J. Smy, R.N. Tait, R. Gauthier $50,000/yr

2002-2005 N.G. Tarr, T.J. Smy, R.N. Tait, R. Gauthier $50,000/yr

1999-2001 N.G. Tarr, T.J. Smy, S.P. McAlister, R.N. Tait $50,000/yr

vii) Centre for Photonics Fabrication and Research (CPFR)

2006-2008 “Fabrication of surface plasmon waveguides on membranes”
with Pierre Berini (PI), Phil Waldron $25,000/yr

viii) Micronet (National Centers of Excellence)

2001-2005 N.G. Tarr, R. N. Tait “Semiconductor Devices (04-05) $76,000

for Advanced Telecommunications" (03-04) $85,000
(02-03) $90,000
(01-02) $121,000

1999-2000 N.G. Tarr, R.N. Tait, S.P. McAlister, and D.J. Walkey (00-01) $94,000
"Silicon Microelectronic and Photonic Devices for (99-00) $71,000
Advanced Telecom. Systems"

1998 N.G. Tarr, R.N. Tait, S.P. McAlister, and D.J. Walkey $52,000
"Devices for RF IC's Compatible with Silicon Technology"

ix) CIPI (Canadian Institute for Photonics Innovations)

2009-2011 P. Berini, R.N. Tait "Design and fabrication of sensor Chips based on long-range surface plasmons" Technology Exploitation and networking (TEN) Program $55,000/yr

2009-2012 P. Jessop, R. Gauthier, S. Janz, R. Kleiman A. Knights, P. Mascher, A. Meldrum, T. Smy, R.N. Tait, N.G. Tarr, D-X. Xu, D.Yevick, "Silicon-based photonic Microsystems" $266,000/yr

2006-2008 P. Jessop, R. Gauthier, A. Knights, P. Mascher, T. Smy, R.N. Tait, N.G. Tarr, D. Yevick, "Silicon-based photonics" $205,000/yr

2003-2005 P. Jessop, R. Gauthier, A. Knights, P. Mascher, T. Smy, R.N. Tait, N.G. Tarr, D. Yevick, "Silicon-based photonics" $257,000/yr

x) Carleton University GR-5 Grants

1997 "Materials and processes for silicon based sensors" $ 3,500

3) Administrative Duties

2014-present Chair, Department of Electronics

2014-2017 Carleton University Senate

2008-2010 Associate Chair (Undergraduate) Dept. of Electronics

2007-08 EE Coordinator

1999-2004 ELEC 4907/4908 Fourth Year Projects (Coordinator)

E) PROFESSIONAL HONOURS AND EXTRA-UNIVERSITY ACTIVITIES

NSERC Industrial Research Fellow 1992-1994

UBC University Graduate Fellow 1987-1988

Reviewer for

NSERC,
US Army Research Office,
Fonds Québécois de la Recherche sur la Nature et les Technologies,
Scientific Reports (Nature)
Talanta (Elsevier)
Optik (Elsevier)
Results in Optics (Elsevier)

Sensors and Actuators (Elsevier)
Infrared Physics and Technology (Elsevier)
Journal of Computational Physics (Elsevier)
Thin Solid Films (Elsevier)
Journal of Micro/Nanolithography, MEMS, and MOEMS (SPIE)
IEEE Sensors Journal,
IEEE Electron Device Letters,
IEEE Transactions on Electron Devices,
IEEE Photonics Technology Letters,
IEEE Transactions of Ultrasonics, Ferroelectrics, and Frequency Control,
Journal of Vacuum Science and Technology (AVS)
Micromachines (MDPI)
Canadian Journal of Physics,
Canadian Journal of Electrical and Computer Engineering,

F) MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional Engineers of Ontario	1998-present
IEEE	1998-present
American Vacuum Society	1998-present

G) OTHER PROFESSION-RELATED ACTIVITIES OUTSIDE CARLETON

Member, editorial board for Micromachines, 2019-present

Member, local organizing committee for International Conference on the Physics of Semiconductors, 2024.

Member, technical committee for the 36th Canadian Medical and Biological Engineering Society Conference, 2013.

Member, technical committee for the 55th International Mid-West Symposium on Circuits and Systems, Bioengineering Circuits and Systems, 2012.

Session chair, optical sensors and detectors, SPIE Photonics North, Ottawa, 2007.

Track chair, MEMS and Nanotechnology, IEEE Canadian Conference on Electrical and Computer Engineering, Ottawa, 2006.

Member, technical committee for the 4th Canadian Workshop on MEMS, Ottawa, 2003.

Professional Engineers of Ontario:
National Examiner for

98-Comp-A1, Electronics	1999-2016
17-Comp-A1, Electronics	2016-2024

CMC:

Member of Task Force on Test Equipment,	October 1999-October 2000
Silicon Allocation Review	October 2004, September 2009

External Examiner:

Ph.D. Thesis by Heiko Fettig, Dalhousie University, June 2001

Ph.D. Thesis by Tahereh Arezoo Emadi, University of Manitoba, August 2011

Ph.D. thesis by Qing Zhang, McGill University, April 2014

Curriculum Vitae (CV) 2023

Karen Taylor, PhD, PEng

Instructor II

Department of Mechanical and Aerospace Engineering

Faculty of Engineering and Design
Carleton University
1125 Colonel by Dr, Ottawa On, K1S 5B6
Email: karentaylor@cunet.carleton.ca

Karen Taylor PhD, PEng Curriculum Vitae

ACADEMIC AND PROFESSIONAL CREDENTIALS

Education

Doctor of Philosophy, Human Kinetics - Biomechanics **2018**
University of Ottawa, Ottawa, ON
Use of Decoupling Structures in Helmet Liners to Reduce Maximum Principal Tissue Strain

Master of Applied Science, Mechanical Engineering **2006**
University of Ottawa, Ottawa, ON
Development of Functionally Graded Titanium and Hydroxyapatite Coating for Bone Implantation with the use of a Cold-Gas Dynamic Spraying System

Bachelor of Applied Science, Mechanical Engineering **2003**
University of Ottawa, Ottawa, ON

Bachelor of Science, Exercise Science - Athletic Therapy **1998**
Concordia University, Montreal, QC

Academic Appointments and Positions

Instructor II **2019 - Present**
Associate Chair of Undergraduate Student Affairs – Academic Advising
Carleton University, Ottawa, ON,
Department of Mechanical and Aerospace Engineering

Part-Time Professor **2014 - 2019**
University of Ottawa, Ottawa, ON
General Engineering "Engineering Design" (GNG1103)
Biomedical Engineering; "Design of Artificial Implants" (MCG4151)
Human Kinetics; "Introduction to Biomechanics" (APA 2114)

Part-Time Professor **2017**
Algonquin College of Applied Arts and Technology, Ottawa, ON
Technical Mathematics for Computer Science (MAT8001C)

Visiting Professor **2016**
Université Catholique de Lille, France - Hautes Etudes D'Ingénieur - Summer Program
Biomedical Engineering; "Biomechanics: Artificial Limbs and Intelligence"

Industrial Experience

Senior Project Delivery Engineer **2011 - 2013**
Shell Chemicals Americas Incorporated, Calgary, AB
- Groundbirch Gas Plant – Senior Project Delivery Engineer

Lead Project Engineer **2006 – 2011**

IMV Projects Limited/AMEC/Rally Engineering, Calgary, AB

- Steepbank / Millennium Extraction - On Site Project Engineer
- Mildred Lake – North Mine Replacement - Senior Civil Engineer

Record of Service to Carleton University

- 2023, SAPP program participation
- 2022 - present, FED Board Secretary
- 2020 – 2022, FED representative member for the Carleton Senate
- 2020 – present, MAAE – Graduate Attributes Committee
- 2020 – present Biomedical Mechanical Curriculum Committee
- 2020-2022, MAAE - Instructor Hiring Committee
- 2020, MAAE – Financial & Communications Assistant Hiring Committee
- 2019, Engineering Outreach – Rev Up: Women in Engineering and IT

Evidence of Professional Development

- 2023, Kinemagawin Indigenous Learning Certificate (Fall)
- 2023, Carleton Center for Research in Engineering Education (CCREE)
- 2023, Canadian Engineering Education Conference, June 2023
- 2022, Carleton Certificate in University Teaching
- 2019-2023, Guest lecturer in BMG 5112/5010
- 2019, Course development of new ECOR 1054 Fundamentals of Engineering IV (2019) (Now ECOR 1047, ECOR 1048, ECOR 1057); Development of new ECOR 1055 – Introduction to Engineering Disciplines I (2019)
- 2020/2021, Shared Online Projects Initiative (SOPI)
- 2021, EDC/TLS training sessions on Brightspace “Assignments and Rubrics”, “Zoom for Brightspace”, “Brightspace Basics”.
- 2019, Applied Suicide Intervention Skills Training (ASIST) (LivingWorks/Carleton)
- 2019, Worker Health & Safety Awareness Training (Carleton), Violence & Harassment Training (Carleton), Lab Safety (Carleton)
- 2009 – 2013, The Association of Professional Engineers and Geologists of Alberta - APEGA

Performance on other Assigned duties

- 2019-present, Favorite Faculty Member - Department of Housing & Residence Life Services
- 2019 Service, Excellence - Team Nomination (ECOR Curriculum)

Co-Written/Collaboration Grants

2017-2020 **CHRP**

- Development of a next-generation polymeric head-form surrogate for concussion and helmet evaluation
- Co-investigator: T. Blaine Hoshizaki, Amount: $150,002

2017-2019 **National Operating Committee on Standards for Athletic Equipment**

- Development of a next-generation polymeric head-form surrogate for concussion and helmet evaluation
- Principal investigator: Oren Patel, Co-investigator: T. Blaine Hoshizaki, Amount: $234,952

2016-2019 **Natural Sciences and Engineering Research Council (NSERC) Collaborative Research and Development (CRD) & Sport Maska**

- Documenting and reconstructing the mechanisms of head impacts in youth non-body checking ice hockey
- Principal investigator: T. Blaine Hoshizaki, Amount: $364,175

2016-2017 **Canadian Standards Association (CSA)**

- Development and validation of a test protocol for hockey helmets to measure rotational velocity using the angular velocity change
- Principal investigator: T. Blaine Hoshizaki, Amount: $69,600

2016-2017 **National Football League – Players Association (NFL-PA)**

- Enhance ability to prevent injury, make better diagnosis, or mitigate early injury or enhance, what resilience or ability to tolerate an injury.
- Brain trauma profiles associated with player positions in American football.
- Principal investigator: T. Blaine Hoshizaki, Amount: $131,419

Patent Applications

- United States Patent 11,073,454. Canada Patent 3,029,939.
  Cineradiography-based method and apparatus for testing protective headgear
  Inventors: Oren Petel, Stéphane Magnan, Scott Dutrisac, **Karen Taylor,** Ashley Mazurkiewicz, Sheng Xu, MacKenzie Brannen. Priority Date: Jan 14, 2019. Status: Issued

Written Publications

- **Taylor K**, Post A, Hoshizaki TB, Gilchrist MD. 2020. The relationship between directional components of dynamic response and maximum principal strain for impacts to an American football helmet. Sports Engineering and Technology. Sports Engineering and Technology. DOI: 10.1177/1754337120932016
- **Taylor K**, Hoshizaki TB, Gilchrist MD. 2019. The influence of impact force redistribution and redirection strategies on maximum principal strain. Computer Methods in Biomechanics and Biomedical Engineering. 22 (13): 1047-1060, DOI: 10.1080/10255842.2019.1626840
- **Taylor K**, Post A, Hoshizaki TB, Gilchrist MD. 2019. The effect of a novel impact management strategy on maximum principal strain for reconstructions of American football concussive events. Sports Engineering and Technology. 233 (4): 503-513 doi.org/10.1177/1754337119857434
- Clark JM, **Taylor K,** Post A, Hoshizaki TB, Gilchrsit MD. Comparison of ice hockey goaltender helmets for concussion type impacts. Annals of Biomedical Engineering (In Press)

- **Taylor K,** Hoshizaki, T.B. "Evaluating the Influence of The American Football Helmet on Directional Components of Dynamic Response and the Magnitude of Maximum Principal Strain". *In Proceedings: International Society of Biomechanics,* Brisbane, Australia 2017
- Post A, **Taylor K,** Hoshizaki TB, Brien S, Cusimano MD, Marshall MD. 2017. A biomechanical analysis of traumatic brain injury for slips and falls from height. *TRAUMA*. Doi.org/10.1177/1460408617721564
- Post A, Kendall M, Cournoyer J, **Taylor K,** Hoshizaki TB, Gilchrist MD, Brien S, Cusimano MD, Marshall S. 2017. Falls resulting in mild traumatic brain injury and focal traumatic brain injury: A biomechanical analysis. International Journal of Crashworthiness. 23(3): 278-289.
- Post, A, Hoshizaki,T.B, Karton, C, Clark JM, Dawson, L, **Taylor, K,** Oeur RA, Gilchrist, MD, Cusimano, MD. 2019 "The Biomechanics of Concussion for Ice Hockey Head Impact Events". *Computer Methods in Biomechanics and Biomedical Engineering.* Online DOI: 10.1080/10255842.2019.1577827
- Hoshizaki T.B, Post A, Clark JM, Cournoyer J, Dawson L, Karton C, Oeur RA, **Taylor K,** Gilchrist MD, Cusimano MD. "Dynamic response and tissue strain analysis of concussive impacts in American football." *Journal of Biomechanical Engineering.* 2017 (Submitted)
- **Taylor, K.** Hoshizaki, T.B., Gilchrist, M.D. "Dynamic Head Response and Maximum Principal Tissue Strain for Helmeted (American Football) and Non-Helmeted Impacts. In Proceedings: *International Research Council on Biomechanics of Injury Conference (IRCOBI),* Malaga, Spain; IRC-16-30. 2016
- **Taylor, K**. "Development of Functionally Graded Titanium and Hydroxyapatite Coating for the Bone Implantation with the use of a Cold-Gas Dynamic Spraying System" *Master's Thesis, University of Ottawa* 2006.
- **Taylor, K.,** Jodoin, B., Karov, J. "Particle Loading Effect in Cold Spray" *Journal of Thermal Spray Technology*. June 2006 pp. 273-279(7)
- **Taylor, K.,** Jodoin, B., Karov, J. "Utilization of Composite Powders to Apply Ceramic Coatings in Cold Spray". *In Proceedings: International Surface Engineering Conference (ISEC).* Seattle, U.S.A. June 2006
- **Taylor, K.,** Jodoin, B., Karov, J. "Particle Loading Effect in Cold Spray." *In Proceedings: International Thermal Spray Conference (ITSC).* Basel, Switzerland. May 2005
- Richer, P., **Taylor, K**., Jodoin, B., Sansoucy, E., Johnson, M. "Effect of Particle Geometry and Substrate Preparation in Cold Spray" *In Proceedings: International Thermal Spray Conference (ITSC).* Basel, Switzerland. May 2005

Oral/Poster Presentations

- **Taylor, K.,** Post A, Hoshizaki TB, Gilchrist, MD 2022. Protective capacity of head gear designed to protect older adults under fall conditions. 11th European Solid Mechanics Conference, July 2022, Galway, Ireland – Accepted for presentation.
- **Taylor, K.,** Hoshizaki, TB, Gilchrist, MD. 2018. Effect of a novel impact management strategy on MPS for reconstructions of American football concussive events. 8th World Congress of Biomechanics, Dublin, Ireland July 8-12.
- **Taylor, K.**, Cournoyer, J., Dawson, L., Post, P., Hoshizaki, T.B., Gilchrist, M.D. (2017). Dynamic response variables predictive of maximum principal strain for impacts using an ice hockey protocol.

Mayo Clinic Sports Medicine Ice Hockey Summit III: Action on Concussion 2017, Rochester, MN, US, Sept 28-29.

- Karton, C., Post, A., Hoshizaki, T.B., Clark, J.M., Dawson, L., Cournoyer, J., **Taylor,** K., Oeur, R.A., Gilchrist, M.D., Cusimano. M.D. (2017). The biomechanics of head impact events occurring in ice hockey. Mayo Clinic Sports Medicine Ice Hockey Summit III: Action on Concussion 2017, Rochester, MN, US, Sept 28-29.
- **Taylor, K.,** Hoshizaki. T.B. Evaluating the Influence of the American Football Helmet on Directional Components of Dynamic Response and the Magnitude of Maximum Principal Strain. International Society of Biomechanics, July 23-27, Brisbane, Australia.
- Adanty, K, **Taylor,** K., Salama, F., Hoshizaki, T.B. (2017). Dynamic Head Response for Helmeted (American Football) and Non-Helmeted Impacts With Horizontal Offsets. International Society of Biomechanics Conference, Brisbane, Australia, July 23-27.
- **Taylor, K**., Hoshizaki T.B. (2016). Dynamic head response and maximum principal tissue strain for helmeted (American football) and non-helmeted impacts for 5 locations and 4 directions. IRCOBI, Malaga, Spain, September 14-16.
- **Taylor, K**., Hoshizaki, B. & Hoshizaki, T.B. (2014). Efficacy of alpine helmet liner in managing impacts for different injury mechanisms. American Academy of Neurology, The Sport Concussion Conference, July 11-13, Chicago, IL
- Post, A., **Taylor, K.,** Rousseau, P., Kendall, M., Walsh, E.S. & Hoshizaki, T.B. (2014). Determination of high risk impact sites on a hybrid III headform by finite element analysis. 7th World Congress of Biomechanics, July 6-11, Boston MA.
- Winegarden, A., Karton, C., **Taylor, K.L**. & Hoshizaki, T.B. (2014). The influence of head surface condition on dynamic response of the head. European College of Sport Science, Amsterdam, The Netherlands, July 2-5.
- Sansoucy, E, Richer, P., **Taylor, K.,** Berube, G., Ajdelsztajn, L., Jodoin, B Canadian Materials in Science Conference. Presented of behalf of E. Sansoucy "Mechanical Properties of Cold Spray Aluminum Alloy Coatings" Montreal, Canada (June 2006)
- **Taylor, K.,** Jodoin, B., Karov, J. ISEC (International Surface Engineering Conference) "Utilization of Composite Powders to Apply Ceramic Coatings in Cold Spray" Seattle, U.S.A. (May 2006)
- **Taylor, K.,** "Cold Gas Dynamic Spray of Titanium and Hydroxyapatite for Improving Biocompatibility for Metal Implants." Joint Injury and Arthritis Research Group Seminar Series University of Calgary, Calgary, Alberta (January 2006)
- **Taylor, K.,** Jodoin, B., Karov, J. ITSC (International Thermal Spray Conference) "Particle Loading Effect in Cold Spray" Basel, Switzerland. (May 2005)
- **Taylor. K.,** "Biomedical Engineering and the University of Ottawa Cold Spray Laboratory: Future Work." Thermodynamics and Fluids Research Group Seminar Series. University of Ottawa, Ottawa, Ontario. (April 2004)
- **Taylor, K**. ASM (American Society of Materials) "Cold Spray for Biomedical Applications" Ottawa, Canada. July 2004
- Richer, P., **Taylor, K.,** Sansoucy, E., Jodoin, B., Johnson, M. MMO (Materials and Manufacturing Ontario) "Cold Spray: An Innovative Technology" Toronto, Canada. June 2004

Volunteer Involvement

- Faculty member – CUBES Biomed and Bowties networking event 2023

- Empower Voices Panel Participant – High School Outreach February 2021
- Cover picture of the Carleton Universities President's Report 2021
- Engineering Frosh - Boat Building Inspector – Volunteer 2019
- Academic Spring Break – Team Advisor – Costa Rica 2019
- Judge for University of Ottawa Engineering Design Day 2018
- Safety judge for the Canadian University concrete toboggan building and race competition
- Supervisor/Advisor for students completing 4th Year undergraduate research project

Academic Honors and Awards

2017-2018	Ontario Graduate Scholarship in Science and Technology	$15,000
2017-2018	Excellence Scholarship, University of Ottawa	$18,000
2016-2017	Ontario Graduate Scholarship in Science and Technology	$15,000
2016-2017	Excellence Scholarship, University of Ottawa	$18,000
2016	Neurotrauma Impact Sport Laboratory Bursary	$8,000
2015-2016	Excellence Scholarship, University of Ottawa	$18,000
2015	Neurotrauma Impact Sport Laboratory Bursary	$7,000
2014-2015	Excellence Scholarship, University of Ottawa	$18,000
2013-2014	Admission Scholarship, University of Ottawa	$18,000

XIN WANG

CURRICULUM VITAE

(A) NAME

Xin Wang, Ph.D., P.Eng.
(Scopus Author ID: 55619294228; ORCID: 0000-0002-2689-9689;
Google Scholar: https://scholar.google.ca/citations?user=fRk8NnIAAAAJ&hl=en)

(B) EDUCATION

- Doctor of Philosophy (Mechanical Engineering)
  University of Waterloo, Waterloo, Ontario, Canada, December 1997
- Master of Applied Science (Mechanical Engineering)
  University of Waterloo, Waterloo, Ontario, Canada, October 1994
- B.A.Sc. (Engineering Mechanics)
  Dalian University of Technology, Dalian, China, July 1985

(C) PROFESSIONAL EXPERIENCE

(a) <u>Academic</u>

- 2011/07-present
  Professor, Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Ontario, Canada
- 2004/07-2011/06
  Associate Professor, Dept. of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Ontario, Canada
- 2000/07-2004/06
  Assistant Professor, Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Ontario, Canada

(b) <u>Visiting Positions</u>

- 2020/07-2023/07
  Visiting Professor, Department of Civil and Environmental Engineering, Clarkson University, Potsdam, New York, USA
- 2014/07-2023/07
  Adjunct Professor, School of Chemical Engineering, Tianjin University, Tianjin, China
- 2007/01-2007/06
  Visiting Professor, Department of Mechanical Engineering, University of Waterloo, Waterloo, Ontario, Canada
- 2006/07-2006/12
  Visiting Scientist, Canada Center for Mineral & Energy Technology (CANMET), Natural Resources Canada, Ottawa, Canada

(c) Industrial Experience

- 1997/12-2000/06
  Senior Design Engineer, Nuclear Engineering,
  Babcock and Wilcox Canada, Cambridge, Ontario, Canada

(d) Journal Editors

Guest editor for the journal *Metals*, and an associate editor for the journal *Frontiers in Materials*, *Mechanics of Materials* section. Serve on the editorial board for the journal of *Advances in Bridge Engineering*.

(e) Conference Organizers

Member of the international scientific committees and the session organizer for *ASME International Conference on Ocean, Offshore, and Arctic Engineering*, (ASME OMAE conferences, 2004 – Present), Member of the international scientific committees for International Conference on Fracture, ICF 09, ICF 10, ICF 11 and ICF 12)

(f) Awards and Honors

- Carleton University Research Achievement Award, 2007-2008
- Conference Appreciation Award for Organizing OMAE 2020 Conference, ASME, 2020

(D) SCHOLARLY STUDIES AND RESEARCH PUBLICATIONS

Refereed Journal Publications (Published)

[91] J. Wang, J. Hu, P. Jin, H. Chen, S. Fu, Z. Liu, H. Gao, X. Wang, X. Chen, "Fracture parameters analysis of compact tension specimens with deflected fatigue cracks: ZK60 magnesium alloy", *Theoretical and Applied Fracture Mechanics*, Vol. 127. Article number 104068, pp. 1-16, 2023.

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study using SENT specimens", *Theoretical and Applied Fracture Mechanics,* Vol. 114. Article number 103025, pp. 1-17, 2021.

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