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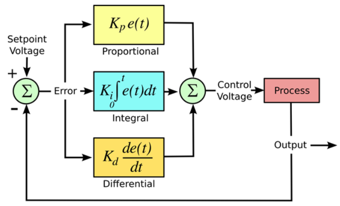
Canada's Capital University



Simulation and Optimization of Novel Control Methods for Improving Field Operation of Absorption Chiller Ice Storage System

Immediate Ph.D. Position Starting September 2020

Absorption chillers are devices that make use of a heat source to drive a cooling/refrigeration process. These systems are attractive as they can be driven from unconventional energy sources like waste heat, heat recovered from co-generation, or solar thermal heat, making them ideal for use in district tri-generation systems and decentralized locations. Ammonia-based absorption chillers, which have Zero GHG and GWP, are unique since they are capable of producing ice, which if stored and managed correctly can act as a buffer to integrate mismatched time-varying heat sources and cooling loads, thus increasing energy system efficiency. The on-going research at Carleton University aims to develop novel methods and technologies for improving the current state-of-the-art in ammonia-based absorption chiller systems being designed, built and marketed by an industry partner.
This research project aims to develop state-of-the-art controllers that can be used to optimally control a novel ammonia-based absorption chiller technology at any given operating point for various heat sources and loading scenarios. A range of technologies spanning classical and modern control, optimization and machine learning will be examined to improve, or supersede, the basic existing controller currently being used. The selected candidate will have the opportunity to test and apply his/her controller designs on an actual experimental absorption chiller that is being installed by the industry partner on campus. He/she will have to liaise with the industry partner and few suppliers to deliver an optimized controller that will be installed on their novel absorption chillers. The technology developed by the selected candidate will help control indoor temperatures and improve global food supplies and access to medicine by providing a cooling technology that utilizes unconventional energy sources in an environmentally-friendly way.

`The Industry-Grade Engineering Skills You Will Acquire:` Operating principles, design and modelling of state-of-the-art Ammonia-based absorption chillers; operation and programming of Siemens controllers; classical and modern control design for industry applications; optimization for engineering applications; machine learning algorithms; experimental testing of controllers; development of graphical-use-interface; liaison and communication skills within a research-industrial environment.

`The Ideal Candidate:` B.Eng and M.A.Sc in Systems/Mechanical/Electrical Engineering; enjoys systems modelling, simulation and control design; exposure to classical and modern control engineering; familiar and comfortable with Matlab and Simulink (other programming languages like LabVIEW, C++ and Python is an asset); familiar with PLC controllers; motivated and willing to learn new skills and applications.

What is Offered:

- Qualified candidates receive a minimum guaranteed funding package of $35,000/year for four years (including RA, TA, and scholarships). Additional top-ups will be provided for those awarded external scholarships (NSERC, OGS, etc...). <u>Note</u>: International Ph.D. students pay domestic tuition fees.
- The chance to get your novel research work being applied to improve the global security of food and medicine and provide cooling in an environmentally-friendly way.
- The strong possibility of a permanent employment with one of the suppliers or the industry partner.

If you are interested, please contact one of the principal investigators along with your CV, transcripts and a brief statement of interest at:

Principal Investigators: Prof. Fidel Khouli *or* Prof. Jean Duquette, Department of Mechanical & Aerospace Engineering, Carleton University.

Email: `fidel.khouli@carleton.ca` *or* `Jean.Duquette@carleton.ca`