Syllabus: Advanced Computational Methods for Differential Equations - MATH4701/MATH5407

Course Information

- Course Dates: TBD
- Lectures: TBD

Instructor

- Course Instructor: Emmanuel Lorin

Assessment

- Project including a presentation: 100%.
- The student will have to present and write a report on an *original* (recycling not allowed!) project of his/her choice which includes the following components: i) mathematical analysis, ii) mathematical modeling, and iii) advanced computational methods with programming.

Introduction to advanced computational methods for differential equations. I will cover different topics [in the form of 2-4 lectures], such as:

- Schwarz Waveform Relaxation Domain Decomposition Methods [principle and analysis for IBVP].
- Absorbing boundary conditions for wave equations.
- Parallel-in-time algorithm [principle for solving ODE].
- Numerical linear algebra for sparse matrices: CRS storage, conjugate gradient, Arnoldi.
- Introduction to parallel computing for BVP/IBVP (`C++`/`MPI`) [basic operations in message passing; application to simple algebraic operations such matrix-vector products,].
- Neural network-based learning algorithms for differential equations and inverse problems [learning algorithms for solving ODE, and inverse problems for PDE].

Requirements: some knowledge about ordinary and partial differential equations, basics computational methods, and programming in `matlab`, `C`,....