Michael Astwood

github.com/mastwood mrastwoo@edu.uwaterloo.ca

Education

University of Waterloo - 2021
BSc Honours. Mathematical Physics
Pure Mathematics Minor
Astrophysics Specialization

Westwood Collegiate - 2017
International Baccalaureate Diploma
Graduated with Honours
CAP Physics Exam Scholarship
UWaterloo Merit Scholarship

Programming

Scientific Computing

- **MATLAB**
  CasADI, Optimization Toolkit, Parallelization Toolkit
- **Python**
  NumPy, GEKKO, FEniCS

General Programming

- **C#**
  NET, XNA, Monogame
- **JavaScript**
  NodeJS, Express, Cheerio, Request, DiscordJS
- **Java**
- **Arduino**
- **HTML, CSS, XML, Markdown**

Outreach

- **UWaterloo Science Ambassador**
  Represented mathematical physics as one of three ambassadors to incoming applicants and first year students at open houses and outreach events
- **Director, Physics Interconnected**
  Physics Interconnected is a mentorship service which connects first year physics students to upper year mentors
- **Creative Director, Science Society**
  Position held May-August 2018
  Designed marketing materials for science society events and the promotion of science at UWaterloo

Professional Experience

Ingalls Quantitative Cell Biology Group

Research Assistant (NSERC USRA) - May 2019 to September 2019

- Numerically simulated stochastic dynamical systems using the Gillespie stochastic simulation algorithm to characterize optimal experimental designs
- Developed and characterized suite of optimization tools for performing parameter fitting of bifurcated dynamical systems in systems biology
- Used aforementioned optimization tools to investigate likelihood analysis of a bifurcated system, producing novel results in optimal experimental design theory

iGEM UWaterloo Mathematics and Modeling

Team Lead - October 2018 to Present
Team Member - February 2018 to October 2018

- Developed reaction-diffusion model for chemical uptake and degradation in plant roots for use in environmental analysis and prediction of our system behaviour
- Performed bioinformatic analysis of incomplete enzymatic pathway in order to improve efficiency of pesticide degradation in root-nodule forming bacteria
- Previously researched and implemented a model predictive control scheme using the GEKKO dynamic optimization API in python for controlling biological systems
- Mentored and trained new team members in mathematics and biology

Physics Undergraduate Society

President - January 2019 to May 2019
Vice President - September 2018 to January 2019
Media Officer - September 2017 to September 2018
Volunteer/Librarian - May 2019 to September 2019

- Developed and ran a series of workshops in Calculus, Linear Algebra, Probability, and Statistics for first year students in physics at UWaterloo
- Sat on Science Society Board of Directors to oversee funding and planning for the Fall 2018 and Winter 2019 terms, as well as elections of science society admin
- Ran series of seminars and lectures on topics in math and physics, including a weekly lecture series in undergraduate quantum field theory

Presentations

Characterization of Optimal Experimental Designs and Parameter Estimation Methods for a Genetic Toggle-Switch
Conference Poster (Canadian Undergrad Math Conference 2019)

E.co-Light: Dynamic Optogenetic Control of Co-Cultures
Conference Poster and Competition Submission

- Team presented poster and gave talk at annual iGEM Jamboree in Boston, MA
- Won silver medal at iGEM Jamboree, fulfilling many gold medal criteria

Projects

PHYS375 - Astrophysics III (Stars) Final Project

- Implemented Runge Kutta 45 (Fehlberg) algorithm in order to solve equations of stellar structure for modified main sequence stars
- RK45 method was implemented using an adaptive stepsize integrator and the multiple direct shooting method in Python
- Developed conclusions about stellar structure and presented to class