

CITIZENSHIP: U.S. Citizen

EDUCATION: **University of California, Santa Barbara** **2019 - Present**

Ph.D. Candidate, Mechanical Engineering

Advisor: Enoch Yeung

- Mechanical Engineering Excellence Fellowship

- GPA: 4.0

- Coursework:

- ME 203: Operator Theory
- ME 210 A/B: Numerical Analysis: Matrix Analysis, ODEs, PDEs
- ME 215 A: Applied Dynamical Systems
- ME 225EY: Biological Computing
- ME 225 MM: Mathematical Methods
- ME 236: Nonlinear Control Systems
- ME 243 A/B: Linear Control Systems
- ME 269: Network Systems
- ECE 283: Machine Learning (Supervised, Unsupervised)

- Teaching Assistantship and Tutoring:

- ME 14: Statics
- ME 155a: Control System Design
- ME 163: Vibrations
- ECE 179: Robot Dynamics and Control

University of California, San Diego

2015 - 2019

B.S. Math – Applied Science

- Chancellor's Associates Scholarship

- Selected Coursework:

- MAE 101 A: Intro to Fluid Mechanics
- MAE 108: Probability and Statistics for Engineers
- Math 103 A: Intro to Abstract Algebra
- Math 120 A: Complex Analysis
- Math 142 A/B: Real Analysis
- Math 154: Intro to Graph Theory
- Math 171 A: Linear Optimization

GRADUATE **Biological Control Laboratory**

Jan 2020 – Present

RESEARCH: **University of California, Santa Barbara**

- Designed and built genetic toggle switches with time-varying parameters for the purpose of optimizing plastic degradation done by bacteria.
- Mathematically modeled parameter varying genetic toggle switches.
- Provided stability analysis of time varying toggle switch models through the framework of Koopman Operator theory.
- Developed algorithms which fit time varying parameters to the pertinent toggle switch models.
- Built a library of promoters which give distinct gene expression profiles during different bacterial growth phases.

UNDERGRAD **Delplanque Research Group**

June 2018 – Aug 2018

RESEARCH: **University of California, Davis** (Funded by UC LEADs)

- Carried out numerical simulations of respiratory drug intake in the human trachea using OpenFOAM.

- Found correlations between parameters of the simulated particle injections and the evenness of the particle distributions.

Coimbra Research Group

June 2017 – Aug 2017

University of California, San Diego (Funded by UC LEADs)

- Conducted research on numerical methods to solve variable order differential equations (VODEs) using MATLAB.
- Devised an efficient numerical method that could solve VODEs 50% faster than conventional methods, so VODE model predictions could be made more quickly, improving the energy efficiency of the system.

Center for Advanced Surgical and Interventional Technology

June 2014 - Aug 2014

University of California, Los Angeles (Volunteer)

June 2016 - Aug 2016

- Assisted in the testing of an innovative way to treat prostate cancer known as focal laser therapy.
- Used CAD for the modeling of a human head to test remote trans-oral surgery.
- Developed molds using Solid Works to test the effects of a catheter-fed laser on phantom tissue.
- Compiled lists of potential treatment candidates within the UCLA health database using SQL.
- Tested haptic feedback on the da vinci remote surgical robot.

EMPLOYMENT: Supplemental Instructor

Sep 2016 - June 2019

University of California, San Diego

- Facilitated math workshops for college students consisting of tutoring and support to ensure their academic success.
- Worked with professors to develop lesson plans for the facilitation of math workshops that supplemented material from courses.
- Classes Supported: Linear Algebra, Calculus (1,2,3), Pre-Calculus.

PUBLICATIONS: Harrison, J.; Yeung, E. Stability analysis of parameter varying genetic toggle switches using Koopman Operators. Mathematics 2021, 9, 3133. <https://doi.org/10.3390/math9233133>

PROJECTS: -Quantitatively assessing wildfire risk (SIAM Grad Student Math Modeling Camp)
-Prediction of chronic kidney disease degeneration with machine learning (SIAM Mathematical Problems in Industry | Vironix)

CONFERENCES: Harrison, J., Yeung, E.: Analysis and validation of parameter varying genetic toggle switches using Koopman Operators

- SIAM CSE23 (2023)

Harrison, J., Ruvalcaba, C., Delplanque, J.-P.: Computational simulations for the improvement of respiratory drug intake in the human trachea

- SACNAS (2018) | UC LEADs Symposium (2019)
- SACNAS Presentation Award
- UC LEADs Symposium Honorable Mention.

Harrison, J., Orosco, J., Coimbra, C.F.M.: Efficient Numerical Methods for Solving Variable Order Differential Equations

- SACNAS (2017) | SCCUR (2017)

AWARDS & Mechanical Engineering Excellence Fellowship

2019

DISTINCTIONS: -Funding given to a select subset of incoming Ph.D. students

Chancellor's Associates Scholarship (UCSD) 2015 - 2019
- 4-year full-ride scholarship

University of California's Leadership Excellence through Advanced Degrees Fellowship (UC LEADs) 2017 - 2019
- Funding for 2 Summers of research and travel for conferences

Fulfillment Fund Scholarship 2015 - 2019
- 4-year scholarship

2018 SACNAS National Diversity in STEM Conference Presentation Award 2018

MENTORSHIP: **Bardia Khosravi, Biological Control Lab**
-Undergraduate research assistant at UCSB, 2023
-Currently in Ryan Stowers' lab
-Continuing bachelor's degree at UCSD in fall 2023

TECHNICAL SKILLSETS: **Programming:**
-Syntax:

- Python
- MATLAB
- Java
- SQL
- HTML & CSS
- Julia

-Environment:

- Linux
- Windows
- macOS

Machine Learning:
-PyTorch
-TensorFlow
-Sci-Kit Learn
-SciPy Optimize
-Principal Component Analysis
-Neural networks for classification and prediction
-Logistic Regression
-k means Clustering

Biological Lab Skills:
-Bacterial Cell Cultures
-Mammalian Cell Cultures
-DNA Design
-Golden Gate Assembly
-Genetic Editing
-DNA Sequence Analysis

- Genetic Circuit Design
- Gen5 Plate Reader Experiments

Design and Simulation:

- Geneious Prime
- Solid Works
- Meshmixer
- OpenFOAM
- 3D printing
- Simulink

Mathematics:

- Modelling and control of biological and physical processes
- Verification and falsification of claims through logic and reasoning
- Probabilistic and statistical methods
- Numerical analysis
- Model parameter fitting

Circuits and Electronics:

- μ C: Arduino

Graphic Design:

- Adobe Photoshop
- Adobe Illustrator