

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 RESEARCH: **Biological Control Laboratory** **Jan 2020 – Present****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 circuits.
- Provided stability analysis of time varying toggle switch models through the framework of Koopman Operator theory.
- Developed modular framework for the estimation varying parameters in nonlinear dynamical system models.
- Built a library of promoters which give distinct gene expression profiles during different bacterial growth phases.

UNDERGRAD RESEARCH: **Delplanque Research Group** **June 2018 – Aug 2018****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 Meshmixer to design a model 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
/ EXPERIENCE:**

NASA Jet Propulsion Lab Intern

May 2024 – Aug 2024

Attitude Control Systems Engineer

- Developed a hypothesis-driven orbital space mission to gather atmospheric and geological data pertaining to Saturn's moon, Titan.
- Designed fully redundant attitude control system with contingency plans in the case of partial system failure.
- Aggregated sensing and control components driven by pointing requirements, propellant margins, life cycle considerations, costs, scheduling, and trade-offs.

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 which would supplement 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>
- **Harrison, J.;** Yeung, E. Estimating Varying Parameters in Dynamical Systems: A Modular Framework Using Switch Detection, Optimization, and Sparse Regression <https://doi.org/10.48550/arXiv.2412.16198>
- **Harrison, J.;** et al. Data-driven engineering, optimization, and phenotypic clustering of a novel hybrid promoter library for mixed-phase expression in prokaryotes (*Manuscript in review*)
- **Harrison** et al. Prediction of Chronic Kidney Disease Degeneration with Machine Learning. *Mathematics in Industry Reports* 2024 <https://doi.org/10.33774/miir-2024-lj5gd>
- Hess, B.; Stromberg, Z.; Phillips, S.; Reichart, N.; **Harrison, J.;** et al. Permafrost is a source of potential bacterial pathogens identified by a phenotyping platform (*Manuscript in review*)

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| PROJECT: | Data driven assessment of wildfire risk (SIAM Grad Student Math Modeling Camp) - Used clustering, statistical analysis, dynamic mode decomposition, ODE and PDE modeling to predict and interpret wildfire risk across the United States. (PDF) | |
| CONFERENCES / TALKS: | Harrison, J., et al.: Uncertainty Quantification for a Bacterial Hybrid Promoter Library - Society of Industrial and Applied Math [SIAM] Uncertainty Quantification 2024 Harrison, J., et al.: Design of a Phase Dependent Hybrid Promoter Library in <i>E. Coli</i> - Quantitative Biology [Q-BIO] 2024 Harrison, J., Yeung, E.: Analysis and validation of parameter varying genetic toggle switches using Koopman Operators - Society of Industrial and Applied Math [SIAM] Computational Science and Engineering 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 & DISTINCTIONS: | Mechanical Engineering Excellence Fellowship -Funding given to a select subset of incoming Ph.D. students | 2019 |
| | Chancellor's Associates Scholarship (UCSD) - 4-year full-ride scholarship | 2015 - 2019 |
| | University of California's Leadership Excellence through Advanced Degrees Fellowship (UC LEADs) - Funding for 2 Summers of research and travel for conferences | 2017 - 2019 |
| | Fulfillment Fund Scholarship - 4-year scholarship | 2015 - 2019 |
| | 2018 SACNAS National Diversity in STEM Conference Presentation Award | 2018 |
| MENTORSHIP: | Bardia Khosravi Biological Control Lab - Undergraduate research assistant at UCSB, 2023 - Continuing bachelor's degree at UCSD in fall 2023 Kevin Chang Biological Control Lab - Undergraduate research assistant at UCSB, 2023-Present Annie Nguyen Biological Control Lab - Undergraduate research assistant at UCSB, 2023-2024 - Graduate researcher at UCSB, 2024-Present Jai Mehra Biological Control Lab - Undergraduate research assistant at UCSB, 2023-Present Isabella Escamilla Biological Control Lab - Undergraduate research assistant at UCSB, 2023 | |

**TECHNICAL
SKILLSETS:**

Programming:

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

Data Science and Machine Learning:

- PyTorch
- TensorFlow
- Sci-Kit Learn
- SciPy Optimize
- Principal Component Analysis
- Neural networks for classification and prediction
- Logistic Regression
- k means Clustering
- c means Probabilistic Soft 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 and Illustrator