

**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 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 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: 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. Parameter estimation for parameter-varying systems using optimization and sparse regression. (Manuscript in review)
- **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)
- Chang, K.J.; **Harrison, J.** Genetic sequence clustering using unsupervised clustering algorithms and applications in mapping genotype to phenotype. (Manuscript in review)

**PROJECTS:**

**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 ([PDF](#))

**Prediction of chronic kidney disease degeneration with machine learning** (Vironix)

- Used J48 decision trees, random forest algorithms, and statistical analysis to tease out important secondary features of a medical dataset ([PDF](#))

**CONFERENCE**

**Harrison, J.,** et al.:Uncertainty Quantification for a Bacterial Hybrid Promoter Library

**TALKS:**

- Society of Industrial and Applied Math [SIAM] Uncertainty Quantification 2024

**Harrison, J.,** et al.: Design of a Phase Dependent Hybrid Promoter Library in *E. Coli*

- 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)

<b>AWARDS &amp; DISTINCTIONS:</b>	<b>Mechanical Engineering Excellence Fellowship</b>	<b>2019</b>
	-Funding given to a select subset of incoming Ph.D. students	
	<b>Chancellor's Associates Scholarship (UCSD)</b>	<b>2015 - 2019</b>
	- 4-year full-ride scholarship	
	<b>University of California's Leadership Excellence through Advanced Degrees Fellowship (UC LEADs)</b>	<b>2017 - 2019</b>
	- Funding for 2 Summers of research and travel for conferences	
	<b>Fulfillment Fund Scholarship</b>	<b>2015 - 2019</b>
	- 4-year scholarship	
	<b>2018 SACNAS National Diversity in STEM Conference Presentation Award</b>	<b>2018</b>
<b>MENTORSHIP:</b>	<b>Bardia Khosravi</b>   <b>Biological Control Lab</b>	
	- Undergraduate research assistant at UCSB, 2023	
	- Continuing bachelor's degree at UCSD in fall 2023	
	<b>Kevin Chang</b>   <b>Biological Control Lab</b>	
	- Undergraduate research assistant at UCSB, 2023-Present	
	<b>Annie Nguyen</b>   <b>Biological Control Lab</b>	
	- Undergraduate research assistant at UCSB, 2023-Present	
	<b>Jai Mehra</b>   <b>Biological Control Lab</b>	
	- Undergraduate research assistant at UCSB, 2023-Present	
	<b>Isabella Escamilla</b>   <b>Biological Control Lab</b>	
	- Undergraduate research assistant at UCSB, 2023-Present	

<b>TECHNICAL SKILLSETS:</b>	<b>Programming:</b>
	-Syntax: <ul style="list-style-type: none"><li>• Python</li><li>• MATLAB</li><li>• Java</li><li>• SQL</li><li>• HTML &amp; CSS</li><li>• Julia</li></ul> -Environments: <ul style="list-style-type: none"><li>• Linux, Window, macOS</li></ul>

**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:**

- $\mu$ C: Arduino

**Graphic Design:**

- Adobe Photoshop
- Adobe Illustrator