

**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 / EXPERIENCE:** **Nasa Jet Propulsion Lab Intern**

**May 2024 – Aug 2024**

- Developed a hypothesis-driven orbital space mission to gather atmospheric and geological data pertaining to Saturn's moon, Titan.
- Designed the comprehensive mission scope and incorporated life cycle considerations, cost analyses, 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. 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)
  - **Harrison**; Aminian; Brennan; Cao; Chang; Jones; Kim; Matsuda; Metherall; et al. Prediction of Chronic Kidney Disease Degeneration with Machine Learning. Mathematics in Industry Reports 2024 <https://doi.org/10.33774/miir-2024-lj5gd>

**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](#))

**CONFERENCE 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 *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)

AWARDS & DISTINCTIONS:	<b>Mechanical Engineering Excellence Fellowship</b> -Funding given to a select subset of incoming Ph.D. students	<b>2019</b>
	<b>Chancellor's Associates Scholarship (UCSD)</b> - 4-year full-ride scholarship	<b>2015 - 2019</b>
	<b>University of California's Leadership Excellence through Advanced Degrees Fellowship (UC LEADs)</b> - Funding for 2 Summers of research and travel for conferences	<b>2017 - 2019</b>
	<b>Fulfillment Fund Scholarship</b> - 4-year scholarship	<b>2015 - 2019</b>
	<b>2018 SACNAS National Diversity in STEM Conference Presentation Award</b>	<b>2018</b>
MENTORSHIP:	<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	
TECHNICAL SKILLSETS:	<b>Programming:</b> -Syntax: <ul style="list-style-type: none"><li>• Python</li><li>• MATLAB</li><li>• Java</li></ul>	

- SQL
- HTML & CSS
- Julia
- Environments:
  - Linux, Window, macOS

### **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