

**CITIZENSHIP:** U.S. Citizen

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

- Ph.D. Mechanical Engineering
- 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, Computing, and Learning 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 modelled 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 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>**CONFERENCES: Harrison, J., Yeung, E.: Analysis and Validation of Parameter Varying Genetic Toggle Switches Using Koopman Operators**

- SIAM CSE23

**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****2019**

-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

- Funding to travel for research conferences.

**Fulfillment Fund Scholarship Recipient****2015 - 2019**

- 4-year scholarship  
**2018 SACNAS National Diversity in STEM Conference  
Presentation Award**

**2018**

**TECHNICAL  
SKILLSETS:**

**Programming**

**-Syntax:**

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

**-Environment:**

- Linux
- Windows
- macOS

**Machine Learning:**

- PyTorch
- TensorFlow
- SKLearn
- PCA
- Neural Networks
- Clustering: logistic regression, k-means

**Bio Lab:**

- 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

**Math:**

- Modelling and control of biological and physical processes
- Verification and falsification of claims through logic and reasoning
- Probabilistic and Statistical methods
- Numerical Analysis

**Circuits and Electronics:**

- $\mu$ C: Arduino

**Graphic Design:**

- Adobe Photoshop
- Adobe Illustrator