# MAX J. EMERICK

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## SUMMARY

Ph.D. Candidate at UC Santa Barbara and NDSEG Graduate Fellow specializing in dynamical systems, control theory, and applied mathematics. Current research focuses on optimal control of density-based systems, with applications in fluids, stochastics, and swarm robotics. Experienced in research, teaching, industry, and leadership, with recognized achievements across all areas.

## EDUCATION

**Ph.D. in Mechanical Engineering,** University of California Santa Barbara — Sep 2022 – Present
Focus in **Dynamical Systems and Control Theory** — **4.0 GPA**

**M.S. in Mechanical Engineering,** University of California Santa Barbara — Sep 2020 – Sep 2022
Focus in **Dynamical Systems and Control Theory** — **4.0 GPA**
Thesis: *Control of Continuum Swarm Systems via Optimal Control and Optimal Transport Theory*

**B.S. in Mechanical Engineering,** California Polytechnic State University — Sep 2015 – Jun 2020
Concentration in **Mechatronics**, Minor in **Mathematics** — **3.9 GPA**
Capstone Project: *Surface Autonomous Vehicle for Emergency Rescue*

## HONORS & AWARDS

**National Defense Science and Engineering Graduate Fellowship** — Sep 2024 – Present

**Outstanding Teaching Assistant Award,** UCSB Mechanical Engineering Department — May 2025

**Outstanding Student Paper Award,** 62nd IEEE Conference on Decision and Control — Dec 2023

**Best Teaching Assistant Award,** UCSB Mechanical Engineering Department — Oct 2023

**IFAC Young Author Award,** 9th IFAC Conference on Networked Systems — Jul 2022

**Graduated Summa Cum Laude,** California Polytechnic State University — Jun 2020

**Cal Poly Outreach Academic Scholarship** — Sep 2015 – Jun 2019

## WORK & RESEARCH EXPERIENCE

**Graduate Student Researcher,** Bamieh Lab, UC Santa Barbara — Apr 2021 – Present

- Conducting fundamental research on mathematical methods for control of distributed systems
- Developed new techniques for control design for various swarm-based, stochastic, and fluid systems
- Published and presented results in peer-reviewed journals and at various international conferences

**Graduate Teaching Assistant/Associate,** UC Santa Barbara — Jan 2021 – Dec 2024

- Provided teaching, tutoring, grading support, and hands-on training to students in a variety of courses, including Dynamic Systems Modeling, Vibrations, Controls, Robotics, Mechatronics, Nonlinear Phenomena, and Design for Test Automation
- Developed and taught (as instructor of record) a new TA training course for the UCSB Mechanical Engineering Department

**Engineering Intern,** Tesla, Fremont, CA — Jun 2021 – Sep 2021

- Worked in manufacturing for the castings team on the pilot line for the “Giga Press”, the largest aluminum die-casting machine in the world
- Took on a wide variety of responsibilities including controls engineering, new station development and testing, line-down recovery, project management, and project coordination

- Improved process and workflow throughout the casting and finishing lines by adding new stations, improving interfaces, and automating and optimizing processes

**Student Researcher,** Flight Test Data System Lab, Cal Poly Jun 2019 – Sep 2020
- Designed, programmed, and tested embedded systems for taking real-time measurements of boundary layers on aircraft
- Assisted in writing and maintaining C/C++ libraries for numerous devices and applications
- Designed experiments and performed data analysis for device testing and calibration
- Completed three projects, authored four internal reports, and devised new firmware architecture to accelerate the research group's progress

**Engineering Intern,** Panasonic Avionics Corporation, Bothell, WA Jul 2017 – Aug 2017
- Designed and implemented mounting systems for avionics onboard Boeing 747s and Airbus A330s
- Provided on-site engineering support for system installations and retrofits

**Teaching Assistant,** Cal Poly Jan 2017 – Mar 2017
- Provided teaching and tutoring support to three sections of Electricity & Magnetism

**Private Tutor,** Self-Employed Sep 2013 – Jun 2018
- Provided high school and college-level tutoring in mathematics, physics, and engineering

## PUBLICATIONS

**"Incompressible Optimal Transport and Applications in Fluid Mixing,"**
M. Emerick and B. Bamieh, 64th IEEE Conference on Decision and Control. In review.

**"Optimal Assignment and Motion Control in Two-Class Continuum Swarms,"**
M. Emerick, S. Patterson, and B. Bamieh, IEEE Transaction on Control of Network Systems. In review.

**"Causal Tracking of Distributions in Wasserstein Space: A Model Predictive Control Scheme,"**
M. Emerick, J. Jonas, and B. Bamieh, 63rd IEEE Conference on Decision and Control, pp. 7606-7611, 2024.

**"Continuum Swarm Tracking Control: A Geometric Perspective in Wasserstein Space,"**
M. Emerick and B. Bamieh, 62nd IEEE Conference on Decision and Control, pp. 1367-1374, 2023.

**"Optimal Combined Motion and Assignments with Continuum Models,"**
M. Emerick, S. Patterson, and B. Bamieh, *IFAC-PapersOnLine*, vol. 55, no. 13, pp. 121-126, 2022.

## CONFERENCE PRESENTATIONS

**"SIAM presentation"** Jul 2025
Oral Presentation, 2025 SIAM Conference on Control and Its Applications Montreal, Canada

**"Causal Tracking of Distributions in Wasserstein Space: A Model Predictive Control Scheme"**
Oral Presentation, 63rd IEEE Conference on Decision and Control Dec 2024, Milan, Italy

**"Tracking Control in The Wasserstein Space"** Nov 2024
Oral Presentation, 44th Southern California Control Workshop Los Angeles, United States

**"Optimal Control of Distributions in Wasserstein Space"** Aug 2024, Cambridge, United Kingdom
Oral Presentation, 26th International Symposium on Mathematical Theory of Networks and Systems

**"Continuum Swarm Tracking Control: A Geometric Perspective in Wasserstein Space"** Dec 2023
Oral Presentation, 62nd IEEE Conference on Decision and Control Singapore

**"Optimal Combined Motion and Assignments with Continuum Models"** Jul 2022
Oral Presentation, 9th IFAC Conference on Networked Systems Zurich, Switzerland

## TECHNICAL SKILLS

- **Applied Mathematics** (Linear Algebra, Differential Equations, Numerical Analysis, Optimization)
- **Systems Modeling and Analysis** (MATLAB, Simulink, Python, Mathematica)
- **Control Systems Design** (Classical, Linear, Nonlinear, Optimal, Robust)
- **Hardware Programming** (C/C++, Python, Assembly, LabView, PLC)
- **Software Development** (Git, Doxygen, Debugging Tools)
- **Research** (Experimental Design, Modeling, Data Analysis)

## CERTIFICATIONS & ASSOCIATIONS

**Engineer-in-Training,** State of California (#172585) Dec 2020 – Present

**Affiliate Member,** International Federation of Automatic Control (IFAC) Aug 2022 – Present

**Graduate Student Member,** IEEE & IEEE Control Systems Society Jul 2022 – Present

**Graduate Student Member,** Society for Industrial and Applied Mathematics Jul 2022 – Present

## LEADERSHIP & INVOLVEMENT

**Member,** UCSB SIAM Student Chapter Sep 2024 – Present
- Attending and participating in weekly discussions on various topics in applied mathematics

**Lead Teaching Assistant (TA),** Mech. Eng. Dept., UC Santa Barbara Apr 2023 – Jun 2025
- Selected to serve as Lead TA for over 70 graduate students in Mechanical Engineering
- Developed new TA training and mentorship programs and courses within the department

**Founding Board Member/Secretary,** UCSB Mech. Eng. Grad. Student Assn. Nov 2023 – Jun 2025
- Helped to organize and set up a new departmental graduate student association
- Took meeting notes, kept records, met with department administration, and helped organize events

**STEM Outreach Speaker,** Various Nov 2016 – Aug 2022
- Helped organize and deliver STEM workshops at middle schools in underprivileged communities

**Member,** Cal Poly Simple Group (Undergraduate Math Seminar) Sep 2016 – Mar 2020
- Attended and participated in weekly discussions on various topics in pre and applied mathematics

**Member,** Cal Poly Bike Builders Club Sep 2017 – Jun 2019
- Helped to design and build custom steel-frame bicycles from the ground up

**NCAA Division I Athlete,** Cal Poly Men's Swim Team Sep 2015 – Mar 2017
- Competed as a varsity athlete for two seasons for the Cal Poly Men's Swim Team

**Volunteer Swim Instructor,** Various Sep 2013 – Mar 2017
- Taught swimming at all levels from fundamentals to competition to children of all ages