

# Massimiliano de Sa

E-mail: [mz.desa@berkeley.edu](mailto:mz.desa@berkeley.edu) \* Website: [Link](#)

## Education

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### California Institute of Technology

PhD, Control & Dynamical Systems

Department of Computing and Mathematical Sciences

Starting September 2023

### University of California, Berkeley

B.S. Mechanical Engineering, Minor in Mathematics

August 2019 - May 2023

GPA: 3.8/4.0

**Honors:** Alexander and Ethel Levens Award for Excellence in Engineering Graphics, Dean's List

**Selected Coursework:** Robotic Manipulation & Interaction, Advanced Control Systems, Lagrangian Dynamics, Data Structures, Real Analysis, Advanced Linear Algebra, Probability Theory

## Work experience

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### Hybrid Robotics Lab

PI: Professor Koushil Sreenath

May 2021 - Present

University of California, Berkeley

- Devised high efficiency control barrier function controllers & constraints using image processing
- Applied image-based control barrier functions to develop safety critical quadcopter controllers
- Published work on the dynamics of interlinked quadcopters with offboard, tethered charging
- Developed vision-based grasp-planning algorithms for grasping with systems of quadrotors
- Utilized reinforcement learning to learn the Lie derivatives of dynamical systems for safe control
- Designed and manufactured quadrotor sensor mounts & vibration-isolating frames

### UC Berkeley Mechanical Engineering Department

Undergraduate Instructor

Spring 2020 - Spring 2023

University of California, Berkeley

- Taught engaging weekly discussion sections for the course Introduction to Robotics on topics such as Lagrangian dynamics, computer vision, and nonlinear robotic control
- Developed theory and simulation-based assignments on quadcopter & vision-based controller design
- Taught weekly lab and discussion sections for the course Electronics for the Internet of Things on concepts ranging from embedded programming to sequential logic circuits
- Developed original course notes on kinematics of robotic systems and a complete course textbook on introductory electronics (circuit analysis, amplifiers, digital electronics) for mechanical engineers

## Notable Projects

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### Autonomous Bicycle: Energy Critical Path Planning & Safety Critical Control

Skills Applied: Nonlinear & Model Predictive Control, Nonholonomic Path Planning, Embedded C++

- Developed a fully autonomous bicycle using a custom-written simulation & custom-made hardware
- Implemented a control barrier function controller to provide safety-critical bicycle balancing
- Applied MPC to find energy efficient paths subject to 3D terrain and obstacle avoidance constraints
- Wrote a custom 3D rigid body dynamics simulator in Python to validate control design

## Publications

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1. Karan Jain, Prasanth Kotaru, **Massimiliano de Sa**, Mark Mueller, Koushil Sreenath. Tethered Power Supply for Quadcopters: Architecture, Analysis and Experiments. *Submitted to International Conference on Robotics & Automation (ICRA), 2023.* [arXiv Link](#).

## ***Skills***

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<b>Languages</b>	MATLAB, Python, C++, Java, Git
<b>Packages</b>	ROS, CasADi, OpenCV, LibRealSense, PyTorch, Stable Baselines
<b>Design</b>	Creo, SolidWorks, GD&T, Lathe, Mill, Waterjet, Laser Cutter, 3D Printing