Massimiliano de Sa

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Education

California Institute of Technology Starting September 2023
PhD, Control & Dynamical Systems
Department of Computing and Mathematical Sciences

University of California, Berkeley August 2019 - May 2023
B.S. Mechanical Engineering, Minor in Mathematics
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

Hybrid Robotics Lab May 2021 - Present
PI: Professor Koushil Sreenath *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

UC Berkeley Mechanical Engineering Department Spring 2020 - Spring 2023
Undergraduate Instructor *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
- 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

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

1. Karan Jain, Prasanth Kotaru, **Massimiliano de Sa**, Mark Mueller, Koushil Sreenath. Tethered Power Supply for Quadcopters: Architecture, Analysis and Experiments, 2023. arXiv Link.

Skills

Languages & Packages MATLAB, Python, C++, Java, ROS, OpenCV, PyTorch, CasADi, Git
Design Creo, SolidWorks, GD&T, Machine Shop, 3D Printing