

# Derek Fan

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## EDUCATION

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**University of California, Irvine – Irvine, CA**

Sept. 2020 – June 2024

*Bachelor of Science in Mechanical Engineering*

*GPA: 3.6/4*

## TECHNICAL SKILLS

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**Relevant Languages and Frameworks:** Python, MATLAB, C++, ROS

**Developer Tools and Platforms:** Git, Linux, Windows

**Engineering Software:** SolidWorks, EC-Engineer

**Additional Relevant Skills:** Model-Based Control, Classical Control, Dynamics, State Estimation, CAD

## EXPERIENCE

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**Safety-Critical Adaptive Control Research – Multirotor-Payload Trajectory Tracking**

May 2023 – Present

*Undergraduate Researcher*

*Irvine, CA*

- Benchmarking adaptive control barrier function (aCBF) against L1 for quadrotor trajectory tracking with unknown payloads. Investigating aCBF's adaptation and safety guarantees in the context of drone package delivery.
- Formulated nonlinear quadrotor dynamics model from Newton-Euler and Euler-Lagrange equations.
- Implemented a SQP approximation of nonconvex optimization for fast real-time nonlinear model predictive control.
- Designed control loop interfaces in Nvidia Isaac Sim and Gazebo to produce testing platforms for advanced control.

**Johnson & Johnson Robotics and Digital Solutions**

June 2023 – Sept. 2023

*Systems Engineering Intern*

*Santa Clara, CA*

- Built and deployed a CAN analysis Python package that allowed engineers to interpret CAN frames, catch missing nodes, and generate timestamped logs in real-time, which accelerated robot debugging efforts by 300%.
- Designed and manufactured a weighted fixture within specified constraints for robot arm verification. Verified with finite element analysis and formalized the required acceptance test that did not previously exist.
- Introduced parallel processing, more efficient matrix computations, and code refactorization for the in-house vision verification app in Python, effectively increasing its usability for offline image signal processing analysis by 300%.

**3D Infotech**

Oct. 2022 – Jan. 2023

*Automation Engineering Intern*

*Irvine, CA*

- Assembled robot arms, controllers, and sensors into robotic platforms to run demos for prospective customers.
- Troubleshooted and integrated individual components into robot systems for system-level verification.
- Controlled robotic arms manually and programmatically to validate functionality for customer use.

**Motion Planning and Control Testbed**

Apr. 2022 – Oct. 2022

*Research Assistant*

*Irvine, CA*

- Implemented a linear quadratic regulator (LQR) velocity controller on mobile robots for optimal trajectory tracking.
- Deployed a scalable OptiTrack server client that sends position feedback to a distributed ROS network.
- Introduced multiprocessing to the server client to parallelize position feedback visuals with ROS communication.

## PROJECTS

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**Autonomous Drone Team (SUAS Competition)**

Oct. 2021 – Oct. 2023

*Lead GN&C Engineer*

*Irvine, CA*

- Architected the team's very first software framework for online planning and control using ROS2, Python, and C++, which effectively increased the team's relevance in the SUAS competition by 200%.
- Developed an algorithm to transform RealSense depth images to an inertial coordinate frame. Applied camera intrinsic on depth images to generate 3D point clouds. Ran DBSCAN clustering to conceive cluster centroids and dimensions. Utilized sensor feedback to observe the camera's orientation and rotate points into the inertial coordinate frame. Optimized point cloud processing parameters to decrease runtime by 50%.
- Implemented a heading control obstacle avoidance algorithm to interface with point cloud clusters, incorporated the avoidance algorithm into the planning framework, and optimized calculations to decrease runtime by 90%.
- Improved the drone's performance by tuning sensor/Kalman filter parameters and PID controller, bringing stability and control to all 3 types of orientation.

## RELEVANT COURSEWORK

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Linear Systems, Classical Control, Robotic Motion Planning and Algorithms, Machines and Mechanisms

Computer-Aided Design, Dynamics, Statics, Differential Equations, Multivariable Calculus, Linear Algebra