Derek Fan

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EDUCATION

University of California, Irvine   Irvine, CA
Bachelor of Science in Mechanical Engineering   *Sept. 2020 – June 2024*
Anticipated Master of Science in Robotics & Control

TECHNICAL SKILLS

Languages: Python, C++, MATLAB
Platforms and Tools: Windows, Linux, Git, ROS, SolidWorks
Additional Skills: Model-Based Control (MPC, LQR, Adaptive), PID Control, CAD, Mechanical Design
Relevant Coursework: Linear Systems, Classical Control, Robotic Motion Planning and Algorithms

EXPERIENCE

Robust Adaptive Control Research at UCI   Irvine, CA
Undergraduate Researcher   *May 2023 – Present*

- Benchmarking adaptive control barrier function (aCBF) against adaptive tube MPC and L1 adaptive control for quadrotor trajectory tracking with unknown payloads. Exploring aCBF's adaptation and safety for drone delivery.
- Developed a lightweight Python quadrotor simulator to expedite controller prototyping and verification. Utilized to debug and tune a custom controller 5x faster than with more cumbersome simulators (Gazebo, Nvidia Isaac).
- Derived and formulated nonlinear quadrotor dynamics model from Newton-Euler and Euler-Lagrange equations.
- Formulated and implemented nonlinear programming for fast real-time nonlinear model predictive control.

Johnson & Johnson Robotics and Digital Solutions   Santa Clara, CA
Systems Engineering Intern   *June 2023 – Sept. 2023*

- Built and deployed a CAN analysis Python package that allowed engineers to interpret, log, and catch missing CAN frames in real time. Used to prove a memory leakage in the robot software and accelerate debugging efforts by 200%.
- Designed and manufactured a weighted fixture within specified constraints for robot arm verification. Verified the fixture with finite element analysis and formalized a necessary arm 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 increased its usability for offline image signal processing analysis by 300%.

UAV Forge Autonomous Drone Team   Irvine, CA
Lead GN&C Engineer   *Oct. 2021 – Sept. 2023*

- Architected the team's first software framework for online planning using ROS2, Python, and C++. Demonstrated it in simulation and real-life flight, increasing the team's relevance in the SUAS competition by a factor of 3x.
- Developed an algorithm to transform depth images into obstacle information. Applied DBSCAN clustering and IMU feedback to generate and rotate point cloud clusters. Optimized algorithm parameters to decrease runtime by 50%.
- Created a heading control obstacle avoidance algorithm to take in 3D point cloud input. Integrated the avoidance algorithm into the online planning framework and optimized calculations to decrease runtime by 90%.
- Tuned sensor, Kalman filter, and PID controller parameters to bring stable control to all 3 types of orientation.

3D Infotech   Irvine, CA
Automation Engineering Intern   *Oct. 2022 – Jan. 2023*

- 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 Research at UCI   Irvine, CA
Research Assistant   *Apr. 2022 – Oct. 2022*

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