# Derek Fan

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## EDUCATION

**University of California, Irvine – Irvine, CA**                    *Sept. 2020 – Present*
*Bachelor of Science in Mechanical Engineering*                    GPA: 3.6/4

## TECHNICAL SKILLS

**Relevant Languages and Frameworks**: Python, MATLAB, C++, ROS, ROS2, CAN bus, PyTorch
**Developer Tools and Platforms**: Git, Linux, Windows
**Engineering Software**: SolidWorks, EC-Engineer
**Additional Relevant Skills**: Control systems, Control theory (PID, LQR, MPC), Trajectory Planning

## EXPERIENCE

**Johnson & Johnson Robotics and Digital Solutions**                    *June 2023 – Present*
*Systems Integration Engineering Intern*                    Santa Clara, CA
- Built a C++ CAN bus tool to interpret and catch missing frames, boosting robot debugging efficiency by 300%.
- Assisted in measuring discrepancies between motor encoders in robot arms via the in-house Python API, which helped design a more accurate fail-safe condition for dangerous motions.
- Designed and manufactured a weighted fixture within specified constraints for robotic arm verification, formalizing a necessary test that did not previously exist.
- Improved upon the in-house vision verification app's GUI and backend in Python, introducing 4 new features for offline image signal processing and effectively increasing its usability by 400%.

**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 their functionality for customer use.

## PROJECTS

**Neural Network & MPC Research – Multirotor Multi-Payload Trajectory Tracking**    *May 2023 – Present*
*Undergraduate Researcher*
- Formulated nonlinear quadcopter dynamics and approximated nonlinear control SQP to engineer an efficient real-time MPC.
- Leveraged PyTorch's automatic differentiation in the development of nonlinear and neural network dynamics to implement adaptive gradient-based (as opposed to sampling-based) MPC.
- Designed control loop interfaces with Nvidia Isaac Gym and Gazebo to produce realistic testing environments for control and reinforcement learning.

**Autonomous Drone Team (SUAS Competition)**                    *Oct. 2021 – Present*
*Lead GN&C Engineer*
- Architected the team's very first high-level system design for online planning and control using ROS2 in Python and C++, effectively increasing the team's relevance in the competition by 200%.
- Developed a linear obstacle avoidance algorithm to be used with 3D point clouds, incorporated it into online planning, and optimized its calculations to decrease runtime by 90%.
- Combined point cloud processing algorithms and RealSense RGBD cameras with obstacle avoidance, and optimized their parameters to decrease runtime by 50%.
- Improved the drone's performance by tuning its sensor/extended Kalman filter parameters and PID controller, bringing stable control to all 3 types of its orientations.

**Motion Planning and Control Testbed**                    *Apr. 2022 – Oct.2022*
*Undergraduate Research Assistant*
- Implemented a linear quadratic regulator (LQR) velocity controller for optimal trajectory tracking.
- Deployed a scalable OptiTrack server client that sends position feedback to a distributed network via ROS nodes.
- Introduced multiprocessing to the server client to parallelize position feedback visuals with ROS communication.

## RELEVANT COURSEWORK

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

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