Khushant Khurana

●Phone Number ● Email ● Portfolio● GitHub ● LinkedIn

EDUCATION

The Cooper Union for the Advancement of Science and Art, New York City, NY Sep 2024 - May 2025
Master of Engineering in Mechanical Engineering GPA: 3.81/4.0

The Cooper Union for the Advancement of Science and Art, New York City, NY Aug 2020 - May 2024
Bachelor of Engineering in Mechanical Engineering GPA: 3.81/4.0

INDUSTRIAL EXPERIENCE

Aviation Systems Engineer Intern | *Garmin* May 2024 - Aug 2024

- Modeled the short period dynamics of an aircraft - linearized trim state models, servo dynamics, and structural mode filters - to design a PD controller for pitch attitude tracking.
- Implemented algorithms to capture time domain response characteristics of the closed-loop system - overshoot, rise time, and steady state time - when subjected to a reference step input.
- Developed an optimization scheme to tune the gains of the PD pitch controller, in flight, using Newton's method, and tested it on the hardware-in-the-loop (HIL) test bench.
- Designed a Graphical User Interface in MATLAB to synthesize the auto-tuning process and make it easier for Flight Test Technician to test the algorithm on an aircraft.
- Performed system identification on aircraft's lateral dynamics to determine the pole for roll mode and tuned the gains of the PD roll controller using basic pole placement.

Controls Intern | *Oshkosh Corporation* May 2023- Aug 2023

- Modeled and simulated Modular Battery Thermal Management System in Amesim Simcenter to help the design team with their choice of mechanical devices through various parameterized simulations.
- Integrated the Modular Battery Thermal Management System model with Simulink and cosimulation to foster the development of the model-based control laws.
- Developed a Python script to automate extrapolating a Medium Duty Vehicle's E-motor's efficiencies and generate a completed 2D test dataset for easy injection into the Amesim model.
- Modeled the E-motor and the vehicle in Amesim Simcenter using the generated test data set to determine the thermal loss when subjected to UDDS drive cycle.
- Developed a Python script to automate the process of extracting CAN signals from a .mat file, removing high-frequency noise, and down sampling according to the user requirements to allow easier processing for hardware-in-the-loop systems.

RESEARCH

Crazyflie's Trajectory Optimization Using Dynamic Programming for Obstacle Avoidance. | *Cooper Union* Sep 2024 - Present

- Perform real-time trajectory optimization for a quadcopter to navigate around obstacles and reach a target, using Model Predictive Control (MPC) with multiple shooting.
- Use Robotic Operating System to provide a common framework for the hardware, mocap system, and model predictive controller.

LEADERSHIP EXPERIENCE

Steering Sub System Lead | *Cooper Union Formula Motorsports Team* Aug 2022 - April 2023

- Analyzed 2021's car track data for multiple laps to validate the steering geometry for 2022's car.
- Machined tie rod clevises, toe link clevises, rocker mounts, control arm clevises, wheel pegs, brake bobbins, pedal spacers, and shock end caps using mill and lathe.
- Designed the steering stops and performed an impact test to ensure its longevity.

Suspension Sub System Lead | *Cooper Union Formula Motorsports Team* Aug 2021 - May 2022

- Worked on the spring and damping mechanism of the 2020's Formula car using a quarter car model from Amesim Simcenter and analyzed vehicle's behavior under various damping coefficients.
- Conducted a tire model study using data from Tire Testing Consortium to determine the nominal loading conditions, such as lateral force and aligning moments, and wheel alignment parameters for the used tires.

- Validated the 2021's suspension geometry and chosen suspension parameters, such as castor and king pin inclination, using multibody simulations provided by Amesim Simcenter.
- Designed the control arms, rockers, and push rods for the suspension assembly and validated the linkages using Finite Element Analysis.

COMMUNITY SERVICE

Explainer Trainee | *New York Hall of Science* Nov 2019 - May 2023
- Interact with the visitors to educate them about the science exhibits and help them understand the STEM principles.
- Perform science-related demonstrations to lure the audience into learning about the science behind day-to-day machines.
- Create online educational videos regarding DIY projects for the visitors to learn from home. (YouTube- Explainer Tv)
- Participate in career-oriented workshops and learn critical presentational skills

PROJECTS

Implementing a PID controller on Irobot Create for following a wall while mapping an enclosed space | *Cooper Union* Jan 2024 - May 2024
- Designed a PID controller for Irobot, using the Robotic Operating System (ROS), to follow the external parameter of an enclosed space.
- Implemented a mapping algorithm that discretized the 2D space into a dynamic matrix and stored the robot's position as a grid point.

Controlling Data Driven Systems Using System Identification and Model Reduction | *Cooper Union* Jan 2024 - May 2024
- Subjected datasets - flow over airfoil and dynamics' models - to Principle Component Analysis (PCA) and Singular Value Decomposition (SVD) for model reduction.
- Performed system identification using methods such as Dynamic Mode Decomposition (DMD), Eigensystem Realization Algorithm (ERA), and Sparse Identification of Non Linear Dynamics (SINDy) to generate linear models/polynomial fittings for nonlinear systems.
- Designed controllers such as Linear Quadratic Controller (LQR) and Model Predictive Control (MPC) to control the low dimensional systems.

Implementing Guidance, Navigation, and Control System for a Missile to have a Successful Target Interception. | *Cooper Union* Jan 2023 - Dec 2023
- Designed a Linear Quadratic Gaussian Controller for estimating and controlling the longitudinal state of a missile to intercept a 2D target projectile.
- Implemented a simple 2D geometric model as the guidance system of the missile and a traditional PID controller for tracking the commanded flight path angle.

Simulating Dynamics and Controllers for Unmanned Aerial Vehicle | *Cooper Union* Sep 2022 - Dec 2022
- Implemented and simulated a 12 DOF model for fixed wing dynamics with linear aerodynamic models of the control surfaces.
- Designed PID controllers for the linear roll, pitch, and yaw autopilots to follow a pre-set trajectory.

AWARDS AND SCHOLARSHIPS

Summa Cum Laude Graduate | *Cooper Union* May 2024
Tau Beta Pi Engineering Honor Society | *Cooper Union* 2023 - 2024
Merit Scholarship | *Cooper Union* 2020 - 2024
New York Community Trust Scholarship | *New York Community Fund* 2021 - 2025
Dean's List | *Cooper Union* 2020 - 2024

SKILLS

Coding: Python, MATLAB, LaTeX , Simulink, C++

Programs: Robotic Operating System (ROS), Gazebo, Amesim Simcenter, SOLIDWORKS,Arduino C, Ansys Workbench, Microsoft Office,

Languages: English, Hindi, Punjabi