Carlos Morales

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EDUCATION

Purdue University | West Lafayette, IN — August 2020 - May 2024
Bachelor of Science in Mechanical Engineering
- GPA: 3.80 / 4.00

University of Washington| Seattle, WA — September 2024 – June 2026
Master of Science in Aeronautics and Astronautics – Concentration in Controls

TECHNICAL SKILLS & RELAVANT COURSEWORK

Skills: MATLAB, Simulink, Python, C++, Creo, SOLIDWORKS, NX, Onshape, Mechatronics and Embedded Electronics, Laser Cutting, 3D Printing, Dynamic System Modelling and Identification

Coursework: Automatic Control Systems (ME475), Intro to Computational Fluid Dynamics, Fluid Mechanics, Ordinary and Partial Differential Equations, Linear Algebra, Dynamics, Heat and Mass Transfer, Thermodynamics, Machine Design, Mechatronics, Noise Control, Mechanics of Materials, Multivariable Calculus

PROFESSIONAL EXPERIENCE

Automation and Controls Eli Lilly and Company, *Automation and Control Intern* — May 2023 – August 2023
- Designed and implemented a fluid dynamic automatic control system using Delta-V DCS for a reactor unit used to showcase Lilly's advancements in their proprietary reactors for siRNA synthesis
- Implemented script to automate the process of importing and exporting recipes from Delta-V for an oligonucleotide synthesizer, allowing for an increase in productivity and quality assurance

Viscoelastic Programmable Materials Research, *Undergraduate Research Assistant* — *June 2022 – August 2022*
- Performed mechanical characterization for materials that present both viscous and elastic properties for the use in programmable lattices used to set desired vibrational response characteristics
- Conducted ASTM testing including tensile and compression tests on individual and composite viscoelastic materials

PROJECTS | https://carlosmgnc.github.io/

Active Fin-Controlled Rocket, *Personal Project* — April 2024 – Present
- Developed a 6-DOF aerodynamic flight control simulation in MATLAB and Simulink to tune control parameters
- Developed embedded quaternion-based attitude estimation using integrated gyro measurements (dead reckoning)
- Designed custom actuators to control aft fins used to aerodynamically stabilize rocket's yaw, pitch, and roll
- Successfully launched and stabilized rocket attitude and recovered all rocket components

Optimal State-Space Control for Inverted Pendulum, *Personal Project* — May 2023 – December 2023
- Designed and built an inverted pendulum benchmark system to implement state space control methods
- Performed linearization of the nonlinear equations of motion for the cart-pole system
- Implemented Full-State Feedback with Linear Quadratic Regulator (LQR) to stabilize pendulum at its vertical equilibrium
- System modelling and simulation performed with MATLAB, and the control law was implemented in C++

Bi-copter Attitude Stabilization, *Senior Design Project, Simulation and Controls Lead* — January 2024 – May 2024
- Rigid body dynamics of a bi-modal drone simulated in MATLAB and Simulink using Euler Angle attitude representation
- Attitude integrated in time using Runge-Kutta numerical integration of the Euler Angle kinematic differential equations
- Successful attitude stabilization by coupled PID controllers for yaw, pitch, and roll controlling rotor thrust vector angles

2D Compressible Euler Equation CFD Solver, *Self-Guided Final Project* — January 2024 – May 2024
- Coded a CFD solver for the inviscid 2D Euler equations using a finite volume Lax Friedrich scheme from scratch in Python
- Problem formulation consisted of airflow around an inclined flat plate given a variable angle of attack
- The plate was discretized by a line-drawing algorithm used to define impermeable wall boundary conditions

LEADERSHIP

VEX Competitive Robotics, Controls Lead and Mechanical System Designer — August 2016 – December 2022
- Led an interdisciplinary team to develop highly successful electromechanical robots that competed at an international level for over four years
- Implemented autonomous control systems for accurate motion control of both holonomic and non-holonomic drive trains using PID, Odometry Position Tracking, Pure Pursuit, and Motion Profiling
- Developed autonomous motion control libraries in C++ for incoming Purdue students to use the existing control algorithms we had already developed and tested in previous years