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 Modeling 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
- Successfully designed, manufactured, and launched a model rocket with active attitude control on ascent
- 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 and built custom actuators to control aft fins used to aerodynamically stabilize rocket's yaw, pitch, and roll

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 modeling and simulation performed with MATLAB, and the control law was implemented in C++

Bi-copter Attitude Stabilization, *Simulation and Controls Lead, Senior Design Project* — January 2024 – May 2024
- Simulated rigid body dynamics of a bi-modal drone in MATLAB and Simulink using Euler Angle attitude representation
- Performed attitude response simulations using Runge-Kutta integration of Euler Angle kinematic differential equations
- Successfully simulated 3-DOF attitude stabilization using coupled PID controllers and rotor thrust vectoring

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
- Performed model discretization by a line-drawing algorithm used to define impermeable wall boundary conditions

LEADERSHIP

VEX Competitive Robotics, *Lead Controls Engineer, and Mechanical System Designer* — August 2016 – December 2021
- Led an interdisciplinary team to develop highly successful electromechanical robots that competed at an international level for over four years. Top Achievement: 2019 & 2020 World Championship Divisional 1st place
- Implemented autonomous control systems for accurate motion control of both holonomic and non-holonomic drive trains using PID, Odometry Position Tracking, Pure Pursuit Guidance, and Motion Profiling
- Led the development of autonomous motion control libraries in C++ for incoming Purdue students to use the existing control algorithms we already developed and tested in previous years