Abel Molinar - CV

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Education

- **University of New Mexico**
  PhD in Mechanical Engineering — Began Fall 2025
- **University of New Mexico** — **GPA: 4.10**
  Bachelor of Science in Mechanical Engineering; Minor in Mathematics — May 2025

Research Experience

- **Graduate Student Researcher** — 2025 - Present
  NSF GRFP Scholar
  - **Project Overview**: Currently exploring topics in estimation and control, especially focused on internal or multiplicative noise and disturbance analysis.
- **Trajectory Tracking in Unity Engine** — 2024 - 2025
  Honors Thesis; McNair Scholar
  - **Project Overview**: To simulate a moving object in the Unity Game engine and track it with a PID, LQR, and MPC controller.
  - **Work Done**: Designed the simulation framework, using Unity as the physics model and Python as the data processor. Data processing included a trajectory generator, Gaussian noise measurement function, linear Kalman filter for position and velocity state estimation, PID controller, LQR controller, and MPC using convex optimization.
- **SCARA Optimization for Agile Manufacturing** — 2022 - 2023
  El Puente Scholar
  - **Project Overview**: To propose a simulation framework for a Selective Compliance Assembly Robot Arm (SCARA) to carry objects of different weights in the most time optimal manner.
  - **Work Done**: Wrote a literature review and project proposal. Presented a poster at the UNM undergraduate research conference. Laid the foundations for a basic SCARA design in Simulink using Simscape Multibody.

Relevant Coursework

- **Estimation and Learning for Autonomous Systems**: Course focused on estimation (Kalman Filter robustness and verification, H_∞ filter, Bayesian recursive estimation) and learning (regression, neural networks, Gaussian process) along with convex optimization. Built a nonlinear model predictive controller for a realistic kinematic bicycle plant.
- **Learning Based Control for Robotics**: Course focused on reinforcement learning basics and new methods (Q learning, Deep Q learning Policy Gradient, Deep Deterministic Policy Gradient (DDPG), etc), and Markov chains. Built a DDPG algorithm to control a virtual humanoid robot.
- **Machine Learning**: Course focused on topics such as statistical learning theory, bias variance trade off, Hilbert spaces, and practical Python applications of classification tasks along with Gaussian processes.

Research Interests

Controls and Autonomy; Autonomous System Safety; State Estimation Filtering for High Uncertainty; Internal and Multiplicative Noise and Disturbances, Sensor Fusion; Applications of State Estimation; Autonomous Vehicle Control; Simulation and Virtual Reality; Machine Learning

Professional Experience

- **Albuquerque Bernalillo County Water Utility Authority** — 2025
  Engineering Intern
  - **Pipe Upkeep and Documentation**: Created work orders using Maximo along with relevant asset maps using ArcGIS PRO to plan and document pipe upkeep.
  - **Sensor Installation**: Installed H2S sensors under sewer manholes to analyze H2S concentrations.
  - **Sensor Data Analysis**: Analyzed H2S sensor data to generate reports and guide future actions concerning H2S management and prevention.
- **Hydrosonics Energy** — 2025
  R&D Engineering Intern

- **Electrochemical Sensing**: Responsible for creating the geometry and calibrating an electrochemical sensor for the purpose of detecting methanol concentrations in thermochemical liquid products.
- **Procedure Documentation**: Used LaTeX to write up cohesive yet straightforward documentation on experimental procedures that helped team members follow up on experiments.
- **Resin 3D Printing**: Successfully used and maintained a Formlabs Form 3L Resin 3D printer, making parts for use in electrolysis systems.
- **Literature Review**: Aided in developing a literature review for the purpose of submitting a research proposal to the Advanced Research Projects Agency - Energy (ARPA-E).

Program Management Experience

- **Big Lobo Rocket** 2024 - 2025
  Project Manager
  - **Project Overview**: To build and launch a 300-foot, single-stage, solid-fuel rocket to 1500 feet and safely return it to the ground. Project sub-teams include structures, launch rail, propulsion, system, and logistics.
  - **Work Done**: Conducted rocket simulations using OpenRocket, developed rocket parts using Solidworks, implemented and refined better organizational practices, designed the housing for the flight computer and CO2 ejection system.

Community Service

- **Mobile Kitchen Project at Polk Middle School** 2025
  NSF S-STEM Scholar
  - **Project Overview**: Tear down a truck trailer and rebuild it with kitchen appliances and conveniences. To be used for cooking food at community gatherings in the South Valley Albuquerque area, close to Polk Middle School.
  - **Work Done**: Demolished the trailer, leaving only the metal frame. Bought supplies that were used to establish the flooring and side walls of the trailer. Planned out the number, size, and location of the kitchen appliances all the while fulfilling food safety regulations.
- **Rooftop Garden Development at La Siembra Leadership High School** 2023 - 2024
  NSF S-STEM Scholar
  - **Project Overview**: To develop the economic, logistical, and technical aspects of constructing a rooftop garden for the school. To be used for vibrant aesthetics and student education in topics such as garden development and maintenance, growing and selling crops, cooking, and water management.
  - **Work Done**: Calculated the economic costs of various instruments necessary to develop the project.

Awards, Recognitions, and Scholarships

- **NSF GRFP Fellow** 2025 - Present
- **RAISE Fellow** 2025 - Present
- **McNair Scholar** 2023 - 2025
- **NSF S-STEM Scholar** 2023 - 2025
- **El Puente Scholar** 2022 - 2023
- **UNM Grand Challenges Achievement in Student Communication** 2023
- **UNM Achievers Scholarship** 2021 - 2025
- **Dr. Dan Trigg Scholarship** 2023 - 2024
- **Armijo Scholarship** 2024
- **Morrison Scholarship** 2024

Presentations

- **Trajectory Tracking in Unity Engine** April 2025
  UNM Undergraduate Research Opportunity Conference, Oral Presentation
- **Trajectory Tracking in Unity Engine** September 2024
  MKN McNair Heartland Research Conference, Oral Presentation
- **Trajectory Tracking in Unity Engine** September 2024
  UNM McNair Research Conference, Oral Presentation
- **Trajectory Tracking in Unity Engine** July 2024
  McNair Research Symposium, Oral Presentation
- **SCARA Robot Speed Optimization** April 2023
  UNM Undergraduate Research Opportunity Conference, Poster Presentation

Skills

- **Programming Languages/Software**: Python, Julia, MATLAB/GNU Octave, Simulink, C# (Unity Game Engine), LaTeX, Office, HTML, CSS
- **Languages**: Spanish (Native), English (Fluent)
- **CAD Software**: Solidworks, Fusion 360, Onshape
- **3D Printing**: Filament and Resin Based
- **Machining and Soldering**
- **Peer Tutor**: Helped classmates with test prep in courses such as Thermodynamics, Materials, and Controls by explaining concepts from different perspectives and working on practice problems. This led to improved grades for peers.
- **Goal Oriented**: Focused on learning additional topics, such as programming, linear algebra, and state estimation, outside the classroom.