Mahdis Rabbani

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Pursuing my Ph.D. in Mechanical Engineering at UC Davis, I specialize in control, robotics and mechatronics, being familiar with mechanical design and electromechanical systems. Proficient in SolidWorks and AutoCAD, I have applied these tools extensively to design complex assemblies and prototypes in academic and collaborative settings. Skilled in Python, MATLAB, and C/C++, I have developed simulation environments, optimized algorithms, and designed control systems for embedded applications. With hands-on experience in 3D-printing, machining, and prototyping, I bring a strong foundation in design and analysis to solve real-world engineering challenges.

Education

Ph.D. Student in Mechanical Engineering (GPA 3.83/4.00) — **California, USA**
University of Davis, California — Sep. 2022 – Present
Research focuses on system identification, decision-making, and path-planning for non-cooperative multi-agent systems, with applications in autonomous vehicles and human-robot interaction.
Relevant coursework: *Machine Learning, Estimation and Kalman Filtering, Autonomous Robots, Optimal Control, Game Theory, Optimization, Linear Systems and Signals*

B.Sc. in Mechanical Engineering (GPA 4.00/4.00) — **Tehran, Iran**
University of Tehran, Iran — Sep. 2018 – June 2022
Capstone Project: Design and Fabrication of a Soft Magnetic Tactile Sensor
Supervisor: Dr. Ali Sadighi
Relevant coursework: *Dynamics, Mechatronics, Robotics, Machine Learning, Statics, Strength of Material*

Technical Skills

Technical Expertise:	Computer-Aided Design (CAD), Embedded Systems, Simulation, Optimization, Decision-making and Path-planning, Machine Learning, Estimation and Filtering, Game Theory, Machining, 3D-printing
CAD Tools:	AutoCAD, SOLIDWORKS
Programming:	Python, C/C++, Julia, MATLAB
Software:	ADAMS, COMSOL, Altium, Fritzing, ANSYS, Simulink
Development Board:	STM32, Arduino, Jetson Xavier NX
Soft Skills:	Problem-Solving, Teamwork, Presentation, Teaching

Project & Research Experience

CORE Lab (https://nazarilab.ucdavis.edu/) — **UCD**
Research Assistant — Summer 2023 – Present
Autonomous Head-to-Head Racing
- Utilized DGSQP python solver to create the racing environment and generate racing dataset.
- Used Koopman operator to find the exact linear input-output relationship.

Path-Planning and Collision Avoidance of Ground Vehicles
- Created a vehicle dynamic model in Julia.
- Augmenting collision avoidance in optimal control problem in linear and nonlinear model predictive control (MPC) fashion.

RC Team Management
- Co-leading the CORE Lab RC car team.
- Designed and tested wheel encoder using infrared sensors and Arduino.

Estimation Theory (MAE 248, Spring 2023) — **UCD**
Spring 2023
Position and Orientation Estimation of an RC Car Using Kalman Filtering
- Modeled and simulated vehicle dynamics in MATLAB
- Designed Kalman and Extended Kalman Filters

Smart Electromechanical Energy Conversion Systems Lab (SEECS) — **University of Tehran**
Design and Fabrication of a Soft Magnetic Tactile Sensor — Researcher — Feb. 2022 – Sep. 2022

- Conducted mechanical analysis and tensile testing on 3D-printed resin.
- Conducted magnetic analysis and simulated the electrical parts using Altium.
- Designed and fabricated the sensor.
- Calibrated the sensor using multi-layer perceptron due to the nonlinear nature of the magnetic field data.
- Designed test bed for the sensor and integrated two cylindrical linear voice coil actuators to generate normal and tangential force.
- Designed the electrical circuit for embedded system including the derivers and filters.
- Designed PID controller for two voice coils using STM32 in C/C++.

Modal Analysis and Vibration Laboratory — **University of Tehran**
Hand Stabilizer Gloves for Parkinson Disease — Researcher — June 2020 – Jan 2021

- Design and manufacturing of a passive vibration absorber with a magnetic spring.

Smart Electromechanical Energy Conversion Systems Lab (SEECS) — **University of Tehran**
Macro-Atomic Force Microscopy — Intern — Summer 2021

- Modeling and analysis of the macro-AFM probe, including mechanical and magnetic simulations using ANSYS.
- Study of the frequency response and the feedback.

Mechanical Design — **University of Tehran**
Design of a Hydraulic Single-Column Aerial Work Platform — Fall 2021

- Designed parts and the mechanism in SOLIDWORKS.

Vibration Analysis — **University of Tehran**
Vibration Measurement Device with Electromagnetic Induction — Summer 2020

- Designed and fabricated a vibration amplitude measurement device using Arduino Uno.

Engineering Science Laboratory (ESLAB) — **University of Tehran**
Web-based Fingerprint Door Lock System — Researcher — Feb. 2019 – Aug. 2020

- Design and fabrication of a web-based system for opening and locking doors.

Teaching and Leadership

- EME 108: Measurement Systems — April 2023 – Dec. 2023
- ENG 004: Engineering Graphics in Design — Jan 2023 – Mar. 2023
- Dynamics — Mar 2020 – June 2022

Honors & Awards

2021 Achieved 30th place in the 26th Mechanical Engineering Olympiad for university students.

2021 Won research grant for the hand stabilizer gloves in *the 10th International Conference on Acoustics and Vibration (ISAV 2020)* student competition.

2015 Third place in *the 7th Student National AEROSPACE Competition* to design and build gliders, Amirkabir University of Technology, Tehran, Iran

2014 Third place in *the fifth National Competition to Design and Build aerospace systems* to design and build gliders, Sharif University of Technology, Tehran, Iran

Selected Publications

1. Shima Nazari, Norma Gowans, Mohammad Abtahi and **Mahdis Rabbani**, "Powertrain Hybridization for Autonomous Vehicles: Fuel Efficiency Perspective in Mixed Autonomy Traffic," in IEEE Transactions on Transportation Electrification, doi: 10.1109/TTE.2024.3451431.
2. Mohammad Abtahi, **Mahdis Rabbani**, and Shima Nazari. "An Automatic Tuning MPC with Application to Ecological Cruise Control." *IFAC-PapersOnLine* 56.3 (**2023**): 265-270.
3. **Rabbani, Mahdis**, et al. "Design and Fabrication of a Soft Magnetic Tactile Sensor." *2022 10th RSI International Conference on Robotics and Mechatronics (ICRoM)*. IEEE, **2022**.
4. Marofi, Daniyal, Marmarchinia, Sara, Rezvanfar, Erfaan, **Rabbani, Mahdis**, Namdari, Shahryar, and Miandoab, Ehsan Maani, "Web-based Fingerprint Door Lock System," in *Third International Conference on Interdisciplinary Research in Electrical, Computer, Mechanics and Mechatronics Engineering in Iran and Islamic World*, Karaj, **2020**. https://civilica.com/doc/1119497