MOHAMMAD AMIN MIRZAEE

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EDUCATIONS

❖ **University of Tehran**
M.Sc. in Mechanical Engineering, Overall GPA 3.88/4 (18.01/20) — Sep 2020 – Present
B.Sc. in Mechanical Engineering, Overall GPA 3.75/4 (17.62/20) — Sep 2016 – Sep 2020
Last two years 3.93/4

RESEARCH INTEREST

- Mechatronics and Biomechatronics
- Control Systems Design
- Soft Actuation and Tactile Sensing
- Neuromechatronics
- Human-Robot Interaction
- Deep learning, Neural networks, and Optimization
- Image Processing and Computer Vision
- Haptic Systems

PUBLICATIONS

❖ Rabbani, M., **Mirzaee, M. A.**, Robati, M., & Sadighi, A. "Design and Fabrication of a Soft Magnetic Tactile Sensor." The 10th RSI International Conference on Robotics and Mechatronics (ICRoM 2022) © IEEE. (Accepted)
❖ **Mirzaee, M. A.,** Rabbani, M., Robati, M., & Sadighi, A. "A Soft Magnetic Tactile Sensor for Robotic Applications." (To be submitted)
❖ **Mirzaee, M. A.**, & Sadighi, A. "Design and Fabrication of a Vision-based Tactile Sensor for Robotic Manipulation." (To be submitted)

RESEARCH & WORK EXPERIENCE

❖ **Smart Electromechanical Energy Conversion Systems Lab (Director: Dr. A. Sadighi)** — Nov 2020 – Present

- **(M.Sc. thesis) Development of a vision-based tactile sensor for force estimation and slip detection for robotic grasp and manipulation**
  - Designed, simulated, and fabricated a soft vision-based tactile sensor.
  - Machined a 2-part aluminum mold using a customized tool bit (wire-cutting EDM) to cast PDMS as the soft compliance. Marked the white PDMS skin using a micropositioner and poured it with transparent PDMS.
  - Designed a custom ring light working with Raspberry Pi Camera Module V2.1 (tested on Raspberry Pi 4B and Jetson Nano)
  - Data acquisition for calibration and test using a 2-DOF force mechanism.
  - Implemented several image processing and machine learning algorithms (including: MLP, SVR, CNN, and LSTM) on the raw and processed data (OpenCV) for regression and estimated the forces and slip.
- **Soft Magnetic Tactile Sensor**
  - Performed tensile test to obtain the mechanical properties of the deformable resin.
  - Designed, simulated, and fabricated a low-cost tactile sensor based on a 3D Hall-effect sensor and 3D-printed components (PLA and deformable resin).
  - Proposed a technique for redesigning the sensor to meet desired specifications.
  - Calibrated the sensor, implemented MLP Neural Networks on the Atmel SAM3X8E, and investigated the deformable resin's viscoelasticity effect on the sensor response.
  - Estimated the sensor transfer function using the step response of the sensor.
- **Two-DOF Force Mechanism**
  - Designed the mechanism and machined the components needed to be attached to voice coil actuators.
  - Designed a custom PCB for power-supply filtering and signal conditioning of load cells and position sensors to be processed by STM32f429I-DISC1.
  - Position and force control of the voice coil actuators using H-bridge drivers alongside switching-noise filtering.
  - Using voice coil actuators to apply controlled force to the object.
- **Vision-based position control of an electromagnetic actuator using OpenCV**

❖ **Robotics Engineering Center (Director: Dr. F. Najafi)** — Sep 2019 – May 2021

- **(B.Sc. thesis) Rescue Robot for Crawler Machines**
  - Designed and prototyped a rescue machine used to bring stopped crawlers back.
  - Performed kinematic calculation, stress analysis, battery and energy consumption, and electronic circuit design.
- STEM education and educational robotics (Lego-compatible) for children.
- Content production and marketing.

❖ **Internship at Sarma Afarin Iran Industries Company (R&D)** — Summer 2019

- Model and assembly of air handling units using SolidWorks.
- Parameterized dimensions using SolidWorks' configuration module.

SELECTED COURSE PROJECTS

- **Advanced Control** (instructor: Dr. MRH. Yazdi) — Spring 2021
  Nonlinear System Identification of Soft Robot Dynamics using Koopman Operator Theory and LSTM in Matlab. Then, utilized the model for designing trajectory controller. Applied reinforcement learning algorithm for trajectory control.
- **Machine Learning** (instructor: Dr. MRA. Dehaghani) — Spring 2021
  Face Detection after feature extraction on images and using data in supervised and unsupervised ML models.
- **Adaptive Control** (instructor: Dr. M. Ayati) — Spring 2021
  Fixed-Wing MAV Adaptive PD Control Based on a Modified MIT Rule with Sliding-Mode Control.
- **Mechatronics** (instructor: Dr. F. Najafi) — Spring 2020
  Designing and prototyping a hexapod robot using Arduino UNO and multiple sensors for navigation.
- **Neural Networks** (instructor: Dr. A. Kalhor) — Spring 2020
  Supervised and unsupervised NNs projects in Python (SVM, MLP, CNNs, CCNNs, AE, Memory NNs, VAE, GANs, DCGANs...)
- **Smart Structure** (instructor: Dr. A. Yousefi-Koma) — Spring 2020
  Simulation of a piezoelectrically actuated diaphragm for check valve micropump in COMSOL.
- **Automatic Control** (instructor: Dr. A. Yousefi-Koma) — Spring 2019
  Designing a PID controller for a ball and beam system.
- **Applied Finite Element Method** (instructor: Dr. M. Mahnama) — Fall 2019
  Three-dimensional finite element analysis of a Helical Gear Drive using ABAQUS.

TEACHING EXPERIENCE

- Teaching Assistant, "Mechatronics Lab" by Dr. Sadighi. — Fall 2022
- Teaching Assistant, "Measurement Systems & Instrumentation" by Dr. A. Sadighi. — Fall 2021 & Spring 2022
- Teaching Assistant, "Applied Finite Element Method" by Dr. M. Mahnama. — Fall 2020

SELECTED COURSES

Machine Learning, 20/20
Mechatronics, 20/20
Adaptive Control, 18.75/20
Digital Control Systems Design, 18/20
Advanced Control, 18.4/20
Automatic Control, 18.6/20
Neural Networks, 17.5/20
Measurement systems & Instrumentation, 19/20
Smart Structure, 18.3/20
Circuit and Electric Machines, 20/20
Applied Finite Element Method, 19.6/20
Introduction to Micro and Nanosystems, 18.6/20
Biological Signal Processing, 17.9/20
Biological Sensors (Biosensors), 18.8/20

PROGRAMMING AND ENGINEERING SOFTWARE SKILLS

Programming

C & C++ – General programming, image processing in C++, programming Arduino and STM32 development boards.

Python –ML and NN libraries for supervised and unsupervised learning (SVM, MLP, CNNs, CCNNs, AE, Memory NNs, VAE, GANs, DCGANs,...) in addition to general coding and machine vision.

STM32 – Programming STM32 boards using STM32CubeIDE in C language

Arduino – Worked with Arduino Due, Mega, UNO, and Nano with different sensors and actuators.

Matlab – General coding; SysId and controller design, FE & frequency analysis, Matlab App Designer, Deep Learning Toolbox, etc.

Design & Simulation

SolidWorks – Modeling parts/assembly; Motion Analysis, Configuration, Simulation, Animation, and Render tools.

Altium Designer – Designing schematics and PCBs, including various electrical components while considering voltage and current design requirements, decoupling and bypass filtering, etc.

NI Multisim – Simulating electrical circuits, designing filters, etc.

Simulink – Modeling and solving equations, frequency analysis, SYSID, control systems, and NNs.

Abaqus – Static, dynamic, and frequency FEA, partitioning & meshing of mechanical parts & assemblies.

COMSOL – Simulation of various physics-included problems.

Linux – (Ubuntu and Raspbian) Scripting Python and C++ projects, networking, and basic HTML servers.

MS Office – Word, Excel, PowerPoint, OneNote

*Also familiar with SolidWorks composer, Fritzing, ADAMS, SAM, AutoCAD, EdrawMax, and Grapher.

LANGUAGES

English: Professional Working Proficiency

Persian: Native

- TOEFL iBT Score – 108 (R:30 L:29 S:23 W:26), Oct. 2022

HONORS AND AWARDS

Ranked 17th among 128 mechanical engineering students at UT. Excellent students' MS admission offer.
Ranked 472nd amongst more than 160000 participants in the nationwide university entrance exam.
Qualified for the 2nd round of the national Physics Olympiad and Mathematics Olympiad.
Ranked 1st in a regional photography competition. Ranked 2nd in a regional caricature drawing competition.

OTHER SKILLS AND ACTIVITIES

Machining – Turning, milling, grinding, drilling machines, and designing customized tool bits.
Photography and Filmmaking – Certificate of Photography (GPA 4/4), Filmmaking (GPA 4/4), *Iranian Youth Cinema Society*
Painting and Drawing
Adobe Ps, Lr, Ai, **Pr, Ae**

REFERENCES

Dr. Ali Sadighi,
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Dr. Farshid Najafi,
Assistant Professor of ME at UT
Ph.D., University of Manitoba, 2009
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Dr. Maryam Mahnama,
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Ph.D., Sharif University of Technology, 2013
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