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

- Advanced Mechatronic systems and Robotics
- Soft Actuation and Tactile Sensing
- Control Systems Design
- Bioinspired Design
- Machine Learning, AI
- Wearable Sensors and Biological Signal Processing

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) Best Paper Finalist, Oral Presentation.

❖ **Mirzaee, M. A.,** Rabbani, M., Robati, M., & Sadighi, A. " A Multi-axis Soft Magnetic Tactile Sensor for Robotic Applications: Design, Fabrication, and Calibration." (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

Development of a vision-based tactile sensor for force estimation and slip detection for robotic grasp and manipulation

- ***M.Sc. thesis*** – 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 and poured it with transparent PDMS. Utilized Raspberry Pi Camera Module V2.1 (tested on Raspberry Pi 4B and Jetson Nano). Data acquisition for calibration and test using a customized 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) and 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 and fabricated a two-DOF force application system based on **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 along with switching-noise filtering.

Vision-based position control

- Designed and implemented PI controller for position (shape detection using OpenCV) control of a voice coil actuator.

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

Design of a Rescue Robot for Crawler Machines

- ***B.Sc. thesis*** – Designed 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

- Modeled air handling units in SolidWorks. Parameterized dimensions using SolidWorks' configuration module.

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
❖ Teaching Assistant, "Engineering Mathematics" by Dr. M. Karimpour. — Fall 2018

SELECTED COURSE PROJECTS

- **Advanced Control** (instructor: Dr. MRH. Yazdi) — Spring 2021
  Nonlinear System Identification and control of Soft Robot Dynamics using Koopman Operator Theory and LSTM in Matlab.
- **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
  Designed and prototyped 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
  Simulated a piezoelectrically actuated diaphragm for check valve micropump in COMSOL.
- **Automatic Control** (instructor: Dr. A. Yousefi-Koma) — Spring 2019
  Designed 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.

SELECTED COURSES

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

PROGRAMMING AND ENGINEERING SOFTWARE SKILLS

Programming

C & C++ – General programming, image processing in C++, programming Arduino and STM32 development boards.
Python – General programming, machine vision, ML (SVM, MLP, CNNs, CCNNs, AE, Memory NNs, VAE, GANs, DCGANs,...).
STM32 – Programming STM32 boards using STM32CubeIDE in C language.
Arduino – 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 circuits and PCBs while considering design requirements.
NI Multisim – Designing and simulating electrical circuits, 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. 15. 2022
- GRE General Score – 320 (Q:170 V:150 W:4), Dec. 1. 2022

HONORS AND AWARDS

Honorable student reward (Scholarship, Granted by Supporter Foundation of the University of Tehran)
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

Photography and Filmmaking – Certificate of Photography (GPA 4/4), Filmmaking (GPA 4/4), *Iranian Youth Cinema Society*
Machining – Painting and Drawing - Adobe Ps, Lr, Ai, Pr, Ae

REFERENCES

Dr. Ali Sadighi,
Assistant Professor of ME at UT
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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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