EHSAN TAHVILIAN

PH.D. STUDENT • MECHANICAL AND MECHATRONICS ENGINEERING

etahvili@uwaterloo.ca

+1 (519) 589 – 7275

SUMMARY

As a highly qualified candidate, I bring a deep dedication to enhancing the learning experience and a comprehensive skill set perfectly aligned with the responsibilities of a Teaching Assistant (TA). My experience includes conducting practice-solving sessions, where I facilitate student comprehension of complex subjects by offering additional guidance. I excel in designing comprehensive homework assignments to reinforce classroom teachings and challenge students to think critically. Administering quizzes to evaluate student progress and adjust teaching strategies is a part of my pedagogical approach. Furthermore, I possess the proficiency to teach various software and programming languages, making me an invaluable resource for students. I am enthusiastic about the opportunity to contribute to students' academic development and foster a conducive learning environment.

EDUCATION

Present
09/2023

Ph.D. Mechanical and Mechatronics Engineering

UNIVERSITY OF WATERLOO — Waterloo, ON, Canada

My project mainly focuses on controlling human locomotion via constructing an adaptive cost function coming from the central nervous system with the application of controlling an exoskeleton

- Supervisor : **Prof. Arash Arami**

07/2023
09/2020

M.Sc. Mechanical Engineering: Applied Design

SHARIF UNIVERSITY OF TECHNOLOGY — Tehran, Iran

My elected modules involve the study of Bio-Mechatronics, especially the application of wearable sensors for Parkinson's patients.

- GPA : 18.53/20.00 **or** 4.00/4.00
- Thesis Title : "**Complex Activity Recognition for PD Patients by Means of an IMU-Based Wearable System**"

09/2020
09/2016

B.Sc. Mechanical Engineering

ISFAHAN UNIVERSITY OF TECHNOLOGY — Isfahan, Iran

A general mechanical engineering program focused on Mechatronics

- GPA : 19.07/20.00 **or** 4.00/4.00
- Thesis Title : "**Design and Construction of Active Narrowband Noise Control System Based on AVR Microcontroller**"

ACADEMIC EXPERIENCES

University Teaching Assistant

Present
10/2023

UNIVERSITY OF WATERLOO — Waterloo, ON, Canada

- My experiences as a Teaching Assistant for university B.Sc. courses over the past semesters include:
  - ME 303 – Advanced Engineering Mathematics (Spring 2025, and Spring 2024)
  - MTE 202 – Ordinary Differential Equations (Winter 2025)
  - ME 203 – Ordinary Differential Equations (Fall 2024)
  - ME 547 – Robot Manipulators: Kinematics/Dynamics/Control (Winter 2024)
  - MTE 360 – Automatic Control Systems (Fall 2023)
- My responsibilities as a Teaching Assistant of the aforementioned courses mainly include:
  - Delivering selected lectures and instructing students on core course topics
  - Holding office hours and practice-solving tutorials
  - Designing a series of Lab instructions
  - Holding Lab sections and guiding students in completing their Lab assignments
  - Grading the assignments, projects, Lab reports, midterms, and final exams

06/2022
09/2018

Sharif University Of Technology — Tehran, Iran
Isfahan University Of Technology — Isfahan, Iran

- My experiences as a full Teaching Assistant for university B.Sc. and M.Sc. courses over the past semesters include:
    - Advanced Dynamics (Spring 2022)
    - Robotics (Fall 2021 and Spring 2022)
    - Statics (Spring 2021)
    - Applied Electrical and Electronics (Spring 2019 and Spring 2020)
    - Dynamics of Machinery (Fall 2019)
    - Technical Drawing 1 (Spring 2018 and Fall 2018)

- Moreover, my responsibilities as a full Teaching Assistant of the aforementioned courses mainly include:
    - Holding office hours and practice-solving classes, presenting related materials as extra lectures
    - Designing a series of homework, Lab assignments, and quizzes
    - Holding Lab Sections, providing some short lectures, and guiding students in completing their lab assignments
    - Teaching software and programming languages, such as SimScape Multibody, MATLAB, and Arduino

06/2023
09/2014

University and High School Course Instructor

- Instructor of Robotics-based courses in cooperation with the university students' scientific association of Isfahan University of Technology, Isfahan, Iran
- Instructor of different university and high school courses as a private teacher for Iranian students in Isfahan, Iran and Cologne, Germany

Graduate Research Assistant

Present
09/2023

Arami Research Lab – Neuro-Mechanics and Assistive Robotics — Waterloo, ON, Canada

- Working on Human Locomotion Control aspects, such as:
    - Developing an Inverse Optimal Control (IOC)-based algorithm to estimate the human CNS's individualized cost function and the resulting 3D joint and Ground Reaction Force (GRF) trajectories.
    - Investigating Human Gait Individuality and how the optimality of human gait changes due to different neural and physical conditions.
    - Developing a controller for our Indego human lower-limb exoskeleton to assist individuals with incomplete spinal cord injuries (levels C and D) in walking normally.
- Mentoring Undergraduate Research Assistants:
    - Teaching how various sensors and systems work, such as Inertial Measurement Units (IMU), Electromyography (EMG), marker-based Vicon Motion Capture, Indego Exoskeleton, and Bertec treadmill and force plates.
    - Defining projects for the URAs and guiding them toward achieving their corresponding research goals.
- Managing numerous lab group meetings and follow-ups with other MSc and PhD lab members as a senior member of Arami lab.

07/2023
09/2020

Djavad Mowafaghian Research Center for Intelligent Neuro-Rehabilitation Technologies — Tehran, Iran

- Working on Complex Human Activity Recognition (CHAR) algorithm development for the online application of an IMU-based wearable system for Parkinson's patients' therapy
- Practical acquaintance with different medical constructions and concepts, including Inertial Measurement Unit sensors, Kinect sensors, Marketing Techniques, Gait Analysis, PD and CP Patients Treatments, etc.
- Supervisor of interns during the 2022 summer internship

09/2019
06/2019

International Research Intern

M&MoCS Research Center — L'Aquila, Italy

- Working on computational algorithms of composite materials under the supervision of Prof.Erden Yildizdag from the Faculty of Naval Architecture and Ocean Engineering, Istanbul Technical University, Istanbul, Turkey.
- Publishing a paper on composite materials, with the title of "*3-D multi-patch isogeometric analysis of composite laminates with a discontinuous Galerkin approach*" in the journal of Engineering for the Maritime Environment

Relevant Courses

- STAT 946 – Generative AI and LLMs (95/100, at UW)
- SYDE 652 - Dynamics of Multibody Systems (80/100, at UW)
- Robotics (19.60/20.00, at Isfahan UT)
- Optimal Design (19.10/20.00, at Sharif UT)
- Intelligent Systems and Control (17.50/20.00, at Sharif UT)
- Advanced Engineering Mathematics (19.60/20.00, at Sharif UT)
- Digital Control Systems (17.00/20.00, at Isfahan UT)
- Fundamentals of Mechatronics Systems (18.80/20.00, at Isfahan UT)
- ME 780 - Computational Intelligence (93/100, at UW)
- ME 780 – Adaptive Control (Audit, at UW)
- ME 780 – Neuro-mechanics of Human Movement (80/100, at UW)
- Surgery Robotics (18.70/20.00, at Sharif UT)
- Advanced Dynamics (18.20/20.00, at Sharif UT)
- Applied Electrics and Electronics (19.50/20.00, at Isfahan UT)
- Automatic Control (19.50/20.00, at Isfahan UT)
- Signal Processing of Mechatronics Systems (20.00/20.00, at Isfahan UT)

Selected Projects

08/2022 – 05/2022 **Simple and Complex Human Activity Recognition using a CNN-LSTM-based multi-task deep neural network**
- Implementation of a CNN-LSTM Deep Neural Network Using TensorFlow and Keras Libraries in Python3

08/2022 – 12/2021 **Collecting a dataset of Functional (daily routines) and LSVT-BIG (Lee Silverman Voice Treatments with big body movements) activities for Parkinson's Disease therapy from 43 normal male and female subjects, containing both simple and complex activities labels**
- Designing 14 Complex activities containing 51 Simple activities, Using four Inertial Measurement Unit sensors (two on wrists and two on thighs) with a self-design Android Application to capture the data

04/2021 – 01/2021 **Algorithm development for estimation of the Step Length in the Gait cycle using a wearable system, consisting of IMU sensors attached to the ankles**
- Using integration from Inertial Measurement Unit sensors signal along with preventing accumulative error and evaluating through the Vicon system of markers

09/2020 – 03/2020 **Design and construction of an Active narrowband Noise Control system based on an AVR microcontroller**
- Construction of the physical system, Designing of the related boards using Altium Designer, Implementation of FxLMS algorithm

10/2020 – 06/2020 **Design and construction of an educational board using microcontroller STM32F103C8T6**
- Electronic Circuit Design using Altium Designer, Assembly of electric and electronic elements, Connecting the board to the computer and Programming In Keil uVision

06/2020 – 05/2020 **Kinematic Modelling and Control Simulation of Franka Emika Panda which is a 7-DoF robot manipulator**
- Simulation using online data transfer from MATLAB Simulink to CoppelaSim, Implementation of DLS control method over different spatial trajectory and motion plannings

Publications

- **Tahvilian E**, Partovi E, Ejtehadi M, Bakhshayesh PR, Behzadipour S. Accuracy improvement in simple and complex Human Activity Recognition using a CNN-BiLSTM multi-task deep neural network. In2022 8th Iranian Conference on Signal Processing and Intelligent Systems (ICSPIS) 2022 Dec 28 (pp. 1-5). IEEE. (Link to paper)

- **Tahvilian E**, Iranpour M, Loghmani A. Narrowband active noise control in a duct using FxLMS method based on the AVR microcontroller. Modares Mechanical Engineering. 2022 Sep 10;22(9):625-35. (Link to paper)

- Obohat MA, **Tahvilian E**, Yildizdag ME, Ergin A. Three-dimensional multi-patch isogeometric analysis of composite laminates with a discontinuous Galerkin approach. Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment. 2021 Nov;235(4):820-33. (Link to paper)

Software Skills

Programming Languages	Python, MATLAB, C/C++, Arduino, HTML/CSS
Simulation	MATLAB Simulink, MATLAB Simscape Multibody, OpenSim, CoppeliaSim
Computer-Aided Design	CATIA, SolidWorks, Inventor
PCB Design	Altium Designer

Research Interests

- Machine Learning, especially Deep Learning and AI
- Intelligent Control using Reinforcement Learning
- Mechanism Design
- Robotics, especially Medical and Soft Robotics
- Neuro-Science and Tele-rehabilitation
- Programming and Algorithm Design

Honors and Awards

2020 | **Ranked 1st** among all 127 Bachelor Students in All Semester

2020 | **Merit-based Admission** for Master's Program from Sharif University of Technology, Tehran, Iran

2019 | Accepted to take part in the **2019 Summer Internship** at the International Research Center of Mathematics and Mechanics of Complex Systems (M&MoCS), L'Aquila, Italy

2016 | **Ranked in the Top 1%** among nearly 163,000 University Entrance Exam Participants

Languages

English Full Proficiency

Persian Native Language

References

Dr. Arash Arami (My Ph.D. Thesis Advisor)
Assistant Professor, Department of Mechanical and Mechatronics Engineering, University of Waterloo, Waterloo, ON, Canada
Email: arash.arami@uwaterloo.ca
Phone: +1 (519) 888 – 4567
Personal Webpage | Google Scholar

Dr. Saeed Behzadipour (My M.Sc. Thesis Advisor)
Professor, Department of Mechanical Engineering, Sharif University of Technology, Tehran, Iran
Email: behzadipour@sharif.edu
Phone: +98 (216) 616 – 5542
Personal Webpage | Google Scholar

Dr. Ali Loghmani (My B.Sc. Thesis Advisor)
Assistant Professor, Department of Mechanical Engineering, Isfahan University of Technology, Isfahan, Iran
Email: a.loghmani@iut.ac.ir
Phone: +98 (313) 391 – 9011
Fax: +98 (313) 391 – 2628
Personal Webpage | Google Scholar

Dr. Mohammad Mashayekhi (My Courses Instructor)
Professor, Department of Mechanical Engineering, Isfahan University of Technology, Isfahan, Iran
Email: mashayekhi@cc.iut.ac.ir
Phone: +98 (313) 391 – 5216
Fax: +98 (313) 391 – 2628
Personal Webpage | Google Scholar