

# Sajjad Arzemanzadeh

Tehran, Iran

Email: s.arzemanzadeh@gmail.com

Mobile: +98-9399982490

Personal Page: [sajjadarzemanzadeh.github.io](https://sajjadarzemanzadeh.github.io)

## EDUCATION

### University of Tehran

M.Sc. in Biomedical Engineering (Biomechanics)

GPA: 17.91/20 (3.88/4)

Tehran, Iran

Sept. 2020 – Present

### University of Tehran

B.Sc. in Mechanical Engineering

GPA: 16.62/20 (3.45/4), Last two years GPA: 17.52/20 (3.76/4)

Tehran, Iran

Sept. 2016 – Sept. 2020

## RESEARCH INTERESTS

- MD Simulation and Multi-Scale Modelling
- Finite Element Analysis
- Nanocomposites
- Nanomechanics and Quantum Mechanics
- MEMS and BioMEMS Fabrication
- Optimization and Machine Learning

## PUBLICATION

- **Sajjad Arzemanzadeh**, Olivier Pierron, and Ehsan Hosseini. “Understanding Compound Effect of Shear and Squeeze-film Dissipation in a Silicon Lateral Micro-resonator for MEMS-based Environmental Monitoring Applications.” *Sensors and Actuators A: Physical (Under Review)*, preprint: <http://dx.doi.org/10.2139/ssrn.4264611>.
- Erfan Nourozi, **Sajjad Arzemanzadeh**, Maryam Mahnama, and Ehsan Hosseini. “Atomistic Insights into Cross-linked Hydrogels: Effects of Chain Length and Degree of Cross-linking on Mechanical Properties of PNIPAM.” *ACS Macromolecules (To be submitted)*.
- **Sajjad Arzemanzadeh**, Erfan Nourozi, Ehsan Hosseini, and Maryam Mahnama. “Multi-scale Investigation of Tissue-like Strain Stiffening Mechanism of Starch-PNIPAM Nanocomposite.” *Scientific Reports (In Preparation)*.

## RESEARCH EXPERIENCE

### M.Sc. Thesis: Investigation of mechanical properties of particle reinforced PNIPAM hydrogel to create tissue-like nanocomposite

April 2022 – Present

Supervisors: Dr. E. Hosseini and Dr. M. Mahnama

University of Tehran

- Carried out MD simulation to compute mechanical properties of starch-PNIPAM nanocomposite.
- Derived Cohesive Zone Model (CZM) of starch-PNIPAM using pull test and umbrella sampling via GROMACS.
- Developed a MATLAB and COMSOL Multiphysics coupling framework to carry out numerical simulations of nanocomposites composed of various-sized starch nanoparticles randomly dispersed in the PNIPAM hydrogel matrix.
- Identified tissue-like strain stiffening mechanism of starch-PNIPAM nanocomposite.

### Graduate Research Assistant

Jan. 2021 – Present

Multiscale Simulation of Materials and Structures (MSMS) Lab, Head: Dr. M. Mahnama

University of Tehran

- Developed a robust dynamic crosslinking protocol for MD simulations of thermoset polymers and hydrogels.
- Investigated the effects of water content, degree of cross-linking, and degree of polymerization on mechanical properties of cross-linked PNIPAM hydrogels.

### Graduate Research Assistant

Jan. 2021 – Feb. 2022

Advisor: Dr. E. Hosseini

University of Tehran in collaboration with Georgia Institute of Technology

- Quantified the phase lag between fluid-induced resistant moment and the angle of rotation of silicon lateral micro-resonators by post-processing experimental results and compared them with obtained numerical results.
- Investigated the effects of variations in thermophysical properties of the fluidic medium (T, RH, P) on the Q factor of silicon micro-resonators.

### B.Sc. Thesis: Accurate modeling of shear and squeeze damping of a silicon lateral rotary micro-resonator and sensitivity optimization of it

Dec. 2019 – Sept. 2020

Supervisor: Dr. E. Hosseini

University of Tehran

- Developed a 3D CFD model for micro-resonators with complex geometries using dynamic meshing in ANSYS Fluent.
- Developed UDF codes to compute shear and squeeze energy loss in the vicinity of the micro-resonator's surface.
- Quantified shear-induced and squeezing flow contribution to different segments of micro-resonator's geometry.
- Optimized thickness of micro-resonator to minimize energy loss and maximize sensitivity.

## Undergraduate Research Assistant

April 2018 – June 2019

Surface Nano-Engineering (SNE) Research Center, Head: Dr. F. Chini

University of Tehran

- Designed a 3D-model concept for a force surface tensiometer that measures Critical Micelle Concentration (CMC) using the Wilhelmy plate method.
- Conducted research on the design of a bubble pressure tensiometer device that measures dynamic surface tension and analyses the mobility of surfactants.

## WORK EXPERIENCE

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### Teaching Assistant

Responsibilities: assigning and grading homework, quizzes, and projects and lecturing additional course materials.

- Mechanics of Materials I, Instructor: Dr. M. Mahnama Spring 2022
- Optimization of Mechanical Systems, Instructor: Prof. F. Kowsary Fall 2021
- Design of Machine Elements II, Instructor: Dr. A. Daneshmehr Fall 2021
- Fluid Mechanics I, Instructor: Dr. F. Chini Fall 2019

### Mechanical Engineer

Nov. 2020 – June 2022

Micro-Proteomics Lab, Head: Dr. V. Bazargan

- Designed a universal microfluidic platform using Nucleic Acid Amplification Test (NAAT) procedure for clinical quantitative and qualitative diagnosis.
- Conducted a feasibility study, and prepared a business plan for proposed product in Iran's market.

### Mechanical Engineering Intern

June 2019 – Sept. 2019

SINA Robotics and Medical Innovators

- Learned the basics of PLC programming, specifically TwinCAT 3, to rewrite codes for Sina robotic telesurgery system.
- Assembled Maxon DC motor test setups and Implemented PID controllers for them.

## SELECTED PROJECTS

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### Multiscale Modelling of Polyethylene-Carbon Nanotube Nanocomposites

Spring 2022

Course: Nanocomposites

- Conducted atomistic MD simulations to compute mechanical properties of PE-CNT nanocomposite.
- Developed multi-scale RVE models composed of various sized and disoriented CNT fillers randomly dispersed in PE matrix.

### Neural Networks and Deep Learning Course Projects

Spring 2021

Course: Neural Networks

- Implemented data augmentation and CNN network on Cifar10 dataset, transfer learning (DenseNet), object detection with YOLOv5, semantic segmentation (U-Net) on Cam Vid dataset, "LSTM, ConvLSTM, and GRU" on BTC-USD dataset, embedding and LSTM network on Sentiment context dataset, variational autoencoder on MNIST dataset, and CycleGAN on Monet2Photo dataset using Python.

### A Novel Bubble-driven Micromixer/Micropump Based on Thermal-inkjet Technology

Fall 2020

Course: Fluid Mechanics in Biological Systems

- Designed an extensible square-wave microchannel toward reaching an optimal design.
- Implemented a Coupled Level Set and Volume-Of-Fluid (CLSVOF) method for bubble-fluid and fluid-fluid interface tracking using ANSYS Fluent.

### Piezoelectrically Actuated Diaphragm For Check Valve Micropump

Spring 2019

Course: Introduction to Micro and Nanosystems

- Simulated the relationship between stroke volume and backpressure of the micropump using COMSOL Multiphysics.
- Investigated effect of piezoelectric thickness on average displacement to achieve desired pumping rate.

## TECHNICAL SKILLS

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**Engineering Software** ANSYS Workbench, COMSOL Multiphysics, SolidWorks, ABAQUS, Digimat

**Molecular Dynamics** GROMACS, LAMMPS, Materials Studio, Gaussian

**Programming Language** MATLAB, Python

**Operating System** HPC, Linux, Windows

**Other** Microsoft Office, L<sup>A</sup>T<sub>E</sub>X, Adobe Photoshop, Adobe Illustrator

## HONOURS & AWARDS

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<b>Ranked 16<sup>th</sup> in Nationwide Scientific Student Olympiad in Mechanical Engineering</b>	2021
<b>Full Scholarship, M.Sc. Program, Iranian University Entrance Exam</b> School of Mechanical Engineering, University of Tehran	2020 – Present
<b>Ranked 49<sup>th</sup> among 10,988 Participants in Nationwide Universities Entrance Exam (M.Sc.)</b>	2020
<b>Full Scholarship, B.Sc. Program, Iranian University Entrance Exam</b> School of Mechanical Engineering, University of Tehran	2016 – 2020
<b>Ranked 486<sup>th</sup> among 162,879 Participants in Nationwide Universities Entrance Exam (B.Sc.)</b>	2016
<b>Semi-finalist in Iranian National High School Student Olympiads</b> Olympiads of Mathematics and Computer	2014

## LANGUAGE

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<b>English:</b> Professional Working Proficiency • TOEFL iBT: <b>104/120</b> (Reading: 28/30, Listening: 27/30, Speaking: 22/30, Writing: 27/30)	Nov. 2022
<b>Persian:</b> Native	

## VOLUNTEER EXPERIENCE

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<b>Member of Scientific Association of Mechanical Engineering (University of Tehran)</b>	May 2018 – May 2019
<ul style="list-style-type: none"><li>Managed and held 20 engineering software courses</li><li>Contributed to organizing and holding of faculty events, including faculty's Opening Day, Orientation Day, and Annual Event (2018)</li></ul>	

## REFERENCES

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### **Dr. E. Hosseinian**

Assistant Professor of Mechanical Engineering  
University of Tehran  
ehosseinian@ut.ac.ir

### **Dr. A. Daneshmehr**

Associate Professor of Mechanical Engineering  
University of Tehran  
daneshmehr@ut.ac.ir

### **Dr. M. Mahnama**

Assistant Professor of Mechanical Engineering  
University of Tehran  
m.mahnama@ut.ac.ir

### **Dr. V. Bazargan**

Assistant Professor of Mechanical Engineering  
University of Tehran  
vbazargan@ut.ac.ir