Mohammad Zamani

Tehran, Iran mail.zamani.m@gmail.com +98 912 417 1524
LinkedIn GitHub Website Google Scholar

Education

University of Tehran
M.Sc. in Structural Engineering 2019 - 2022

- School of Civil Engineering - High-Performance Computing Laboratory
- **Thesis:** Mathematical Modeling of Bone Fracture Healing
- Developed a novel computational framework using finite element methods to simulate and analyze the complex biological processes involved in bone fracture healing, incorporating coupled reaction-diffusion equations.
- **GPA:** 16.80/20.0 (Upper Half of Class)
- **Key Courses:** (Non)linear FEM, Continuum Mechanics, Multiscale Methods, Optimization, ML and RL
- **Research Focus:** Computational Mechanics, Multiscale Modeling, Machine Learning, Biomechanics

Hekmat University
B.Sc. in Civil Engineering 2014 - 2017

- School of Civil Engineering
- **GPA:** 15.62/20.0 (Upper Half of Class)
- **Key Courses:** Structural Analysis, Mechanics of Materials, Numerical Methods, Programming
- **Senior Project:** Design and Analysis of a Multi-Story Building

Publications

Journal Papers

The Impact of Data Splitting Methods on Machine Learning Models: A Case Study in Predicting the Concrete Workability, *Machine Learning for Computational Science and Engineering, 2025*

DOI: 10.1007/s44379-025-00021-3

- A structured evaluation framework for assessing concrete workability in a more efficient and sustainable manner.
- Consistency in data splitting to ensure reliable and reproducible model assessment.
- Nested cross-validation to minimize sampling effects and improve evaluation robustness.
- Deep neural networks (DNNs) for enhancing accuracy in predicting concrete properties from imbalanced datasets.
- Multi-output DNNs and transfer learning to exploit shared property correlations for better flow prediction.

Finite Element Solution of Coupled Multiphysics Reaction-Diffusion Equations for Fracture Healing in Hard Biological Tissues, *Computers in Biology and Medicine, 2024*

DOI: 10.1016/j.compbiomed.2024.108829

- Finite element solution of the reaction-diffusion equations governing fracture healing in hard tissues.
- Weak formulation to enhance stability for complex domains, coarser meshes, and accurate boundary conditions.
- Captures various stages of fracture healing, e.g., soft and hard callus formation, and endochondral ossification.
- Predictions demonstrate coherence with available reference experimental and numerical data.

Conference Papers

3D Multiscale Topology Optimization for Conceptual Design of a Quadrotor Aerial Taxi, *The 33th Annual International Conference of Iranian Society of Mechanical Engineers, 2025*

DOI: 10.1234/isme.2025.12345

- Developed a computational framework for 3D concurrent topology optimization of multiscale composite structures.
- Combined modified SIMP method with asymptotic homogenization for effective material properties.
- Implemented 3D eight-node hexahedral elements at both macro and micro scales.
- Achieved optimal combination of lightness, strength and mechanical stability for aerial taxi design.
- Demonstrated significant impact of asymptotic homogenization in composite design accuracy.

Inverse Design of New Mechanical Metamaterial for Base Isolator, *The 33th Annual International Conference of Iranian Society of Mechanical Engineers, 2025*

DOI: 10.1234/isme.2025.4321

- Developed topology optimization framework for mechanical metamaterials with high bulk-to-shear modulus ratio.
- Introduced novel filtering function maintaining connectivity and symmetry in optimization.
- Implemented 3D inverse homogenization framework with energy-based property computation.
- Achieved optimal metamaterial design for seismic base isolation applications.
- Demonstrated rational design approach for metamaterials with tunable elastic properties.

Book Chapter

Biomechanics of Hard Tissues (Chapter 6) in *Multiscale Biomechanics*, Ed. S. Mohammadi, *Wiley, 2023*

DOI: 10.1002/9781119033714.ch6

- Analysis of macro and micro structures in hard tissue architecture.
- Implementation of numerical simulations.
- Investigation of healing processes through governing equations and numerical methods.

Technical Expertise

Programming Languages: Python, MATLAB, C/C++, Fortran, Julia, etc.

Machine Learning & AI: PyTorch, TensorFlow, Keras, Gymnasium, PyTorch Geometric, etc.

Scientific Computing: NumPy, SciPy, Pandas, Matplotlib, Jupyter

Engineering Software: Abaqus (FEA), ANSYS, COMSOL, Mathematica, FEniCS, FreeFEM, OpenFOAM

Development Tools: Git, GitHub, Linux/Windows, LaTeX, VS Code, Docker, CMake, Make, Shell Scripting

High-Performance Computing: Parallel Computing, MPI, OpenMP, CUDA, GPU Programming

Research Experience

University of Tehran - HPC Lab
Graduate Research Assistant 2021 - Present

- Computational Biomechanics:
  - Developed a novel FEM framework for tissue vascularization simulation
  - Solved coupled reaction-diffusion equations numerically
- Machine Learning in Engineering:
  - Led comparative analysis of ML methods for engineering datasets
  - Developed deep learning models for material property prediction
  - Implemented reinforcement learning for structural optimization
- Multiscale Modeling & Optimization:
  - Improved homogenization methods for composite materials
  - Developed topology optimization algorithms for lightweight structures
  - Created inverse design methods for mechanical metamaterials

Graduate Research Projects
University of Tehran 2019 - 2022

- Advanced Computational Methods:
  - Implemented adaptive FEM solvers in MATLAB and Python
  - Developed meshless methods for complex geometries
  - Created parallel computing algorithms for large-scale simulations
- Materials Science Applications:
  - Applied multiscale modeling to composite materials
  - Developed micromechanics models for material behavior
  - Implemented statistical mechanics approaches for material properties

Teaching Experience

Engineering Mathematics *2022 – 2024*
University of Tehran Teaching Assistant

Finite Element Methods *2023 – 2024*
University of Tehran Teaching Assistant

Mechanics of Material II *2021 – 2022*
Shahid Beheshti University Teaching Assistant

References

Prof. Soheil Mohammadi
Full Professor, M.Sc. Supervisor
University of Tehran
smoham@ut.ac.ir

Dr. Houshang Dolatshahi
Associate Professor
University of Tehran
mdolat@ut.ac.ir