Mohammadreza Khoshbin
Curriculum Vitae

Contact Information

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Research Interests

I am interested in expanding the depth and breadth of my knowledge and experience in the field of solid mechanics and micromechanics of materials. I am particularly interested in the following subjects:

- Applications of Machine Learning Methods in Mechanical Engineering
- Data Generation and Synthetic Datasets in Mechanical Engineering
- Damage Initiation and Propagation
- Dual- and Multi-Phase Steels
- Voxel-Based Modeling of Microstructures

Education

PhD Candidate of Mechanical Engineering, Design of Solids 2019 – present
Shahid Rajaee Teacher Training University, Tehran, Iran
Supervisors: Professors Ali Pourkamali Anaraki and Javad Kadkhodapour
Thesis title: Creation of a Data Pipeline from Multi-Disciplinary Simulations for use in Fatigue Life Estimation of Multi-Phase Steels by Machine Learning Algorithms

M.Sc. in Mechanical Engineering, Applied Design 2017 – 2019
Shahid Rajaee Teacher Training University, Tehran, Iran
Supervisors: Professors Ali Pourkamali Anaraki and Javad Kadkhodapour
Thesis title: Micromechanical Investigation of Damage and Low Cycle Fatigue Properties in Dual-Phase Steel

Research Highlights:

- Designed and performed experimental interrupted fatigue tests coupled with scanning electron microscopy on commercial DP600 steel to observe failure mechanisms during fatigue loading.
- Proposed a model for initiation, propagation, and coalescence of damage in fatigue loading of dual-phase steels.
- Extended my framework for approximating material behavior in the dislocation-rich interface between the ferrite and martensite phase of dual-phase steels.
- Applied the said model for micromechanical finite element simulation of tensile and fatigue loading of DP600 commercial steel.

B.Sc. in Mechanical Engineering, Design of Solids 2013 – 2017
Shahid Rajaee Teacher Training University, Tehran, Iran
Project Title: Investigation of the Effect of Damage in the Interphase of the DP980 Steel

Main achievements:

- Was selected for a national scholarship combining a B.Sc. in mechanical engineering and a teacher-training program.
- Earned qualifications required to be awarded tenure as a technical teacher based on understanding of educational techniques and relevant subject matter.
- Volunteered as a laboratory technician and undergraduate researcher in the *Laboratory for Micromechanics and Biomechanics* for 6 semesters.
- Introduced a framework for approximating material behavior in the dislocation-rich interface between the ferrite and martensite phases of dual-phase steels and presented the results at the *25th Annual Conference on Mechanical Engineering*, Tehran, Iran.
- As the director of the Student Scientific Society of Nanotechnology, lead a team of 5 students to host a low-budget, volunteer-based seminar in the university as part of *Iran Nanotechnology Initiative Council*'s efforts to promote nanotechnology at the university level.

Professional Experience

Shahid Rajaee Teacher Training University, Tehran, Iran

Researcher Dec 2013 – present

Laboratory for Micromechanics and Biomechanics

I currently conduct research under supervision of Professors Ali Pourkamali Anaraki and Javad Kadkhodapour. Some of my past research activities are:

- Investigated fatigue life of notched dual-phase steel specimens using interrupted in-situ testing.
- Investigated the effect of modeling gradient ferrite-martensite interphase on accuracy of FEA in the RVE framework.
- Developed and maintained the *PyAuxetic* Abaqus plugin for automatic modeling, analysis, and post-processing of auxetic metamaterials.
- Developed and maintained the free and open source VCAMS software for voxel-based modeling of complex structures. Refer to the Open Source Contributions section for more details.

Teaching Assistant

Advanced Numerical Analysis (Graduate Level) Fall 2022

This was a graduate level course taught by Dr. Arash Mohammadi. I:

- Designed a syllabus for the hands-on part of the course.
- Taught basic programming concepts and methods and MATLAB to the graduate students to ensure a common baseline.
- Implemented the numerical algorithms in MATLAB using the live coding teaching method.
- Was responsible for assessment and grading the student projects which was half of the course grade.

Micro- and Nano-Mechanics of Materials (Graduate Level) Spring 2021

This was a graduate level course taught to MSc and PhD students by Dr. Javad Kadkhodapour. I:

- Designed a syllabus for the hands-on part of the course.
- Taught programming concepts and the Python language to the graduate students.
- Taught the use of Abaqus' Python API for automating pre- and post-processing of FE analyses.
- Introduced the use and creation of Abaqus plugins.
- Designed and graded student projects.

Continuum Mechanics (Graduate Level) Fall 2020

Finite Element Analysis (Undergraduate Level) Spring 2020

These courses were taught by Professor Ali Pourkamali Anaraki. I prepared slides based on the standard syllabus and helped with grading.

Mechanical Vibrations (Undergraduate Level) Fall 2017

This was an undergraduate level course taught by Dr. Majid Shahgholi. I taught basic programming concepts and MATLAB to the students so they could solve equations in the field of mechanical vibrations.

Laboratory Technician Jan 2015 – Jan 2017

Intern Summer 2015

Laboratory for Micromechanics and Biomechanics

Provided the following services on a volunteer basis:

- Maintained and managed the laboratory's computational resources.
- Provided intensive training and troubleshooting for Abaqus, MATLAB, EndNote, and Mendeley software packages.
- Trained members in use of FDM 3D printers and related design and software skills.

Ministry of Education, Iran

Technical Teacher of Auto Mechanics

Alaghemandan Vocational High School, Rasht, Iran Sep 2024 – present

Two-Year Sabbatical

Sep 2021 – Sep 2022

Shahid Khodadadi Technical High School, Bandar-e-Anzali, Iran Feb 2017 – Sep 2021
My main responsibilities include:

- Promoting a fun, relaxed, and supportive learning environment for imparting theoretical and practical knowledge to my students so they can start their careers in various industries, particularly the automotive repair and maintenance industry.
- Adapting and implementing curricula within the scope of national and local protocols to meet the needs of each individual classroom.
- Providing counseling to students based on their individual needs or, if appropriate, referring them to professional counselors.
- Managing student behavior and resolving possible conflicts.
- Developing and administering specific assignments and assessments to judge students' competency levels and providing appropriate feedback.

Head of the Educational Department of Auto Mechanics Sep 2021 – Sep 2022
District Educational Office 2 of Rasht, Guilan
I was appointed to this leadership position which added the following to my regular teaching responsibilities:

- Supervision and evaluation of the education provided to around 800 students across three schools and 12 workshops.
- Evaluation of the in-person and online teaching activities of the department's 20 teachers and technicians.
- Providing professional development courses to the department members.
- Mentoring and knowledge transfer to early-career teachers joining any of the educational departments of auto mechanics in the province of Guilan, Iran.
- Various tasks to ensure smooth operation of the department. These included ombudsmanship, organizational diplomacy, and providing consultations to various officials in any level of the Ministry of Education's management hierarchy.

Teacher in Training Jan 2013 – Jan 2017
Student Teacher Oct 2016 – Dec 2016
Shahid Rajaee Teacher Training University, Tehran, Iran
As part of a national scholarship, I:

- Completed a teacher training course parallel to a B.Sc. in mechanical engineering and became qualified as a technical teacher.
- Completed two semester-long teaching internships.
- Was awarded tenure at the end of studies.

Open Source Contributions

As a researcher, I strive to make my research code accessible as open-source software. This not only enhances the quality of the research but also facilitates reproducibility. Additionally, I contribute to bug fixes and documentation in the projects and libraries that I frequently utilize to aid in their development.
My repositories can be found on GitHub under the username mkhoshbin1.
Some of the projects that I have contributed to are listed below:

- **VCAMS: A Program and Python Library for Voxel-Based Computer-Aided Modeling of Complex Structures**
  Role: Author, Maintainer
  A library with a GUI for rapid creation of large and complex finite element models. Uses NumPy, scikit-image, Matplotlib, PyQt5, and Sphinx.
  Published under AGPLv3 on GitHub and available on PyPI.

- **pyAuxetic**
  Role: Author, Maintainer
  An Abaqus™ plugin and Python library for automatic modeling, analysis, and post-processing of auxetic materials. It was written using Abaqus' Python Scripting Interface and the GUI was created using the FOX GUI Toolkit. It also takes full advantage of the said API's parametric modeling capabilities to create the

structures.
Published under AGPLv3 on GitHub.

- **pyinstaller-versionfile**
  Role: Contributor
  A Python module that helps with creating version-info files for PyInstaller. I helped with improving the documentation.

Teaching

Workshops

- *How Can We Introduce Our School Using a Short Animation?*, Educational Department of Auto Mechanics, District Educational Office 2 of Rasht, Guilan, Iran, March 2022.
- *Classroom Management, Student Interaction, and Teaching in Auto Mechanics School Workshops*, Taught to early-career teachers, Provincial Educational Department of Auto Mechanics, Provincial Educational Office of Guilan, Iran, February 2022.
- *Investigation of the Prevalent Problems in Auto Mechanics School Workshops*, Educational Department of Auto Mechanics, District Educational Office 2 of Rasht, Guilan, Iran, December 2021.

Journal Publications

[1] A. Cheloee Darabi, S. Rastgordani, M. Khoshbin, V. Guski, and S. Schmauder, "Hybrid data-driven deep learning framework for material mechanical properties prediction with the focus on dual-phase steel microstructures," *Materials*, vol. 16, no. 1, 447, Jan. 2023. DOI: 10.3390/ma16010447.

[2] A. Cheloee Darabi, J. Kadkhodapour, A. Pourkamali Anaraki, M. Khoshbin, A. Alaie, and S. Schmauder, "Micromechanical modeling of damage mechanisms in dual-phase steel under different stress states," *Engineering Fracture Mechanics*, vol. 243, 107520, Feb. 2021. DOI: 10.1016/j.engfracmech.2020.107520.

[3] S. Rastgordani, A. Ch Darabi, J. Kadkhodapour, S. Hamzeloo, M. Khoshbin, S. Schmauder, and J. Mola, "Damage characterization of heat-treated titanium bio-alloy (ti–6al–4v) based on micromechanical modeling," *Surface Topography: Metrology and Properties*, vol. 8, no. 4, 045016, Oct. 2020. DOI: 10.1088/2051-672x/abc0f8.

Conference Publications

[4] M. Khoshbin, A. Cheloee Darabi, J. Kadkhodapour, and A. Pourkamali Anaraki, "Application of the free and open source vcams package in modeling triply-periodic minimal surfaces," in *The 6th National Conference on Computational and Experimental Mechanics*, (Shahid Rajaee University, Tehran, Iran), Jun. 13, 2024.

[5] M. Khoshbin, A. Cheloee Darabi, J. Kadkhodapour, and A. Pourkamali Anaraki, "VCAMS: A software package for voxel-based computer-aided modeling of complex structures," in *The 31th Annual International Conference of Iranian Society of Mechanical Engineers*, (Shahid Beheshti University, Tehran, Iran), May 9–11, 2023.

[6] M. Khoshbin, A. Cheloee Darabi, J. Kadkhodapour, A. Pourkamali Anaraki, and S. Schmauder, "The effect of interpolation functions in numerical simulation of interphase in dual-phase steels," in *29th International Workshop on Computational Mechanics of Materials (IWCMM29)*, (University of Zagreb, Dubrovnik, Croatia), Sep. 15–18, 2019.

[7] M. Khoshbin, A. Cheloee Darabi, J. Kadkhodapour, A. Pourkamali Anaraki, and S. Schmauder, "Numerical determination of optimal interphase thickness in dual-phase steels," in *The 27th Annual International Conference of Iranian Society of Mechanical Engineers*, (Tarbiat Modares University, Tehran, Iran), Apr. 30–May 2, 2019, p. 66.

[8] M. Khoshbin, A. Cheloee Darabi, S. Rastgordani, J. Kadkhodapour, A. Pourkamali Anaraki, and S. Schmauder, "The effect of interphase in micromechanical modeling of dual-phase steel," in *25th Annual International Conference on Mechanical Engineering*, (Tarbiat Modares University, Tehran, Iran), May 2–4, 2017, pp. 121–122.

Patents

[9] M. Khoshbin, "Teaching aid for practical teaching of measurement using vernier caliper," IR Patent No. 98632, May 21, 2019.

Skills

Language Skills

Farsi	Native
English	CEFR Level: C2 IELTS Score: 8.5

Technical Skills

CAD/CAE Software

Abaqus	(Advanced)
CATIA	(Beginner)
SolidWorks	(Beginner)

Programming/Scripting Languages

Python	(Advanced)
Abaqus' Python Scripting Interface	(Expert)
MATLAB	(Advanced)
Windows PowerShell/Batch	(Intermediate)
C/C++	(Beginner)

Other Programming Libraries/Tools

NumPy, PyQt5, Matplotlib, Sphinx, MATLAB Image Processing Toolbox, MATLAB GUI Development, Git, SVN.

Other Technical Skills

Adobe Photoshop, Camtasia, Hugo, MS Office Suite, LaTeX, Zotero, WordPress.