

# Ronak Shoghi

## CONTACT

### Phone

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### Email

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## SKILLS

### Machine Learning & AI

Supervised Machine Learning  
Classification, Regression  
Physics-Informed Neural Networks  
Active Learning

### Computational Mechanics

FEM  
Crystal Plasticity  
Constitutive Modeling  
Micromechanical Modeling

### Programming & Software

Python  
(NumPy, SciPy, scikit-learn, PyTorch)  
MATLAB / C++ / Abaqus / ProCast

### Open Science & Data

FAIR Data  
Reproducible Research Pipelines

### Personal

Science Communication  
Project management  
Team Collaboration & Leadership  
Creativity in Problem-Solving

### [ORCID](#)

### [Google Scholar](#)

### [GitHub](#)

## EDUCATION

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2021 - 2025

Ruhr-Universität Bochum, Germany

### Ph.D. Candidate Mechanical Engineering

Thesis Topic: Data-Oriented Modeling of Microstructure and Mechanical Properties of Polycrystalline Metals. Grade: Summa Cum Laude

2018 - 2021

Technische Universität Darmstadt, Germany

### M.Sc. Materials Science

Thesis Topic: Parametrization and application of a data science-based crack growth model under creep-fatigue conditions for Inconel 718 superalloy. Grade: 1.46

2012 - 2017

Iran University of Science and Technology, Iran

### B.Sc. Materials Engineering

Thesis Topic: Investigating the effect of cooling rate on solidification parameters and heat transfer in Al-10Si-3.5Cu-Mg alloy. Grade: 16.69/20

## PROFESSIONAL EXPERIENCE

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2026 - Present

Research Group Leader

### Interdisciplinary Centre for Advanced Materials Simulation, Ruhr-Universität Bochum, Germany

Leading the Data-Oriented Materials Modeling group, focusing on FAIR data infrastructures, micromechanical simulations, and machine-learning-based prediction of mechanical material behavior.

2021 - 2025

Research Assistant

### Interdisciplinary Centre for Advanced Materials Simulation, Ruhr-Universität Bochum, Germany

Extensive experience in Python programming, machine learning, and finite element analysis for data-oriented constitutive modeling

Sep - Dec, 2024

Research Fellow (Visiting Researcher)

### Cornell University, USA

Conducted research on Physics-Informed Neural Networks, Collaborated with experts in computational mechanics and AI to explore advanced data-driven approaches for material modeling.

2019 - 2020

Working Student

### Continental Automotive GmbH, Germany

Programming using C++ for tool development and testing, creating user-friendly interfaces, analyzing software metrics, and debugging code to ensure quality, stability, and reliability.

2018 - 2020

Student Research Assistant

### Institute for Energy Systems & Technology, Technische Universität Darmstadt, Germany

Simulation of combustion systems using MATLAB, measurement and data analysis using TGA and FTIR

# TEACHING & SUPERVISION

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2022 - Present

Ruhr-Universität Bochum, Germany

- Materials Modeling Lab (M.Sc. course)
- Microstructure and Mechanical Properties (M.Sc. course)
- Fundamental Materials Physics (M.Sc. course)
- Supervision of M.Sc. student projects, including model development, data analysis, and scientific writing.

## OPEN SCIENCE, RESEARCH SOFTWARE & DATA

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Contributor: pyLabFEA (Python finite-element toolkit) — GitHub

- <https://github.com/AHartmaier/pyLabFEA>

Contributor: Kanapy (microstructure generation and analysis in Python) — GitHub

- <https://github.com/AHartmaier/Kanapy>

Developer: MetadataSchema — FAIR-compliant metadata schema for automated extraction and storage of microstructure-sensitive mechanical data — GitHub & Zenodo

- <https://github.com/Ronakshoghi/MetadataSchema>
- <https://doi.org/10.5281/zenodo.15040492>

## PUBLICATIONS

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- [Shoghi, R.](#), Hartmaier, A. (2026)  
*A machine learning-based constitutive model incorporating history-dependent features for cyclic plasticity.*  
Computer Methods in Applied Mechanics and Engineering, 448, 118524.  
Scientific contribution: Developed a classification-based ML framework capturing isotropic, kinematic, and mixed hardening in cyclic plasticity.
- [Shoghi, R.](#), Hartmaier, A. (2025)  
*A workflow-centric approach to generating FAIR data objects for computationally generated microstructure-sensitive mechanical data.*  
Advanced Engineering Materials, 2024/2025, Article 2401876.  
Scientific contribution: Designed a workflow-centric metadata schema enabling FAIR, reusable data objects for computational materials mechanics.
- [Shoghi, R.](#), Morand, L., Helm, D., Hartmaier, A. (2024)  
*Optimizing machine learning yield functions using query-by-committee for support vector classification with a dynamic stopping criterion.*  
Computational Mechanics, vol. 74, no. 2, pp. 447–466.  
Scientific contribution: Developed an active learning framework for optimal data selection in high-dimensional stress space, enabling data-efficient and robust ML yield functions.
- [Shoghi, R.](#), Hartmaier, A. (2024)  
*A machine learning constitutive model for plasticity and strain hardening of polycrystalline metals based on data from micromechanical simulations.*  
Machine Learning: Science and Technology, vol. 5, no. 2, p. 25008.  
Scientific contribution: Introduced a unified SVC-based yield function capturing initial yielding and strain hardening directly from CPFEM data.
- [Shoghi, R.](#), Hartmaier, A. (2022)  
*Optimal data-generation strategy for machine learning yield functions in anisotropic plasticity.*  
Frontiers in Materials, 9:868248.  
Scientific contribution: Proposed an optimal stress-space sampling strategy reducing computational cost while preserving model accuracy. Associated open-source implementation available.

## SELECTED CONFERENCES

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- Shoghi, R., Hartmaier, A.  
*A Machine Learning-Based Constitutive Model Incorporating History-Dependent Features for Cyclic Loading Scenarios*  
EUROMECH COLLOQUIUM 656, May 2025, Gothenburg, Sweden.
- Shoghi, R., Hartmaier, A.  
*A Microstructure-Sensitive Machine Learning Model for Plasticity and Strain Hardening in Polycrystalline Metals*  
MSE 2024 Materials Science and Engineering Congress and Exhibition, TU Darmstadt, Germany, Sept. 25, 2024
- Shoghi, R., Hartmaier, A.  
*A Machine Learning-Based Constitutive Modeling of Plastic Behavior in Polycrystalline Materials Using Crystal Plasticity Simulations Including Strain Hardening*  
MRS Fall Meeting & Exhibition, Boston, USA, Dec. 1, 2023.
- Shoghi, R., Hartmaier, A.  
*Developing a Microstructure-Sensitive Machine Learning Yield Function and Strain Hardening Model*  
SEECM Conference: 5th South-East European Conference on Computational Mechanics, Vrnjačka Banja, Serbia, July 5, 2023.
- Shoghi, R., Schmidt, J., Hartmaier, A.  
*Data-Oriented Constitutive Models for Polycrystalline Metals," 9th GAMM AG Data Workshop, Stuttgart, Germany, Mar. 20, 2023.*

## PEER REVIEW

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- European Journal of Mechanics
- International Journal of Solids and Structures
- Scientific Data
- Machine Learning Science and Technology

## MEMBERSHIPS

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- Deutsche Gesellschaft für Materialkunde (DGM)
- German Association for Computational Mechanics (GACM)
- Gesellschaft für Angewandte Mathematik und Mechanik (GAMM)