

AMIR NAZEMI

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OBJECTIVE

Ph.D. candidate in Mechanical Engineering and Scientific Computing at University of Michigan specializing in computational mechanics and scientific computing, awarded 1st place in AIAA engine design competition, seeking an internship to apply my expertise in FEM, DEM, and MPM simulations, as well as scientific machine learning techniques (e.g., PINNs), to tackle complex engineering problems.

EDUCATION

University of Michigan, Ann Arbor, MI August 2023 – Present

Ph.D. Candidate in Mechanical Engineering and Scientific Computing. GPA: 4.0 / 4.0

Research: Computational modeling of intrusion and interaction of deformable bodies in granular media using DEM and FEM.

The University of British Columbia, Canada January 2023

M.A.Sc. in Mechanical Engineering. GPA: 94.8 / 100

Research: Multi-scale modeling of fiber-reinforced composites using MPM and FEM.

Sharif University of Technology, Iran August 2020

B.Sc. in Mechanical and Aerospace Engineering. GPA: 4.0 / 4.0 , Ranked **3rd** in Aerospace Engineering

Research: Studying the effect of slippage on free vibration and aeroelastic instability of sandwich beams.

WORK & RESEARCH EXPERIENCE

University of Michigan August 2023 – Present

Graduate Student Instructor and Research Assistant

Ann Arbor, MI

- Developed a high-fidelity DEM-based simulation framework for analysis of locomotion in granular materials.
- Integrated DEM and FEM approaches for modeling intrusion of deformable bodies in granular material.
- Implemented parallelized algorithms for large-scale granular mechanics problems with non-spherical particles.
- Presented lectures for Finite Element Method course and provided instruction on the theory and programming of projects and assignments to the graduate and undergraduate students.

University of British Columbia January 2021 – August 2023

Graduate Research and Teaching Assistant

Canada

- Utilized MPM-based multi-scale simulations for textile composites forming processes, published in *Composites Part A*.
- Developed a Fortran subroutine for woven fabrics constitutive model in ABAQUS.
- Programmed Python scripts for numerical modeling of hemisphere forming process in ABAQUS.
- Managed and led groups of students for their course projects, led and trained other TAs as Head TA, provided instruction on the theory of tutorials and lab procedures to the students in several engineering courses.

NIEDNER INC. December 2021 - June 2022

MITACS Research Intern

Coaticook, Canada

- Experimentally characterized mechanical properties of 3D woven fabric composite hydraulic tubes.
- Utilized numerical analysis of buckling-driven in-situ instabilities using the FEM and MPM.

PROJECT EXPERIENCE

University of Michigan Ann Arbor, MI

Parallelized Object-Oriented Framework for Monte Carlo and Molecular Dynamics Simulations August - December 2024

- Designed and implemented an object-oriented Monte Carlo (MCMC) simulation framework for modeling molecular systems.
- Conducted parallel performance analysis of MD simulations performed using LAMMPS.
- Developed parallelized MCMC simulations using OpenMP and MPI, achieving a comparable efficiency to LAMMPS efficiency using up to 72 cores.

Machine Learning Application in Solving Partial Differential Equations August - December 2023

- Developed and implemented neural network models to solve PDEs, focusing on integrating uniquely designed cost functions to enforce boundary conditions and physical laws.
- Analyzed the effectiveness of ML approaches compared to conventional FEM solutions, highlighting potential advantages in computational efficiency and adaptability.
- Conducted experiments to compare the performance of machine learning-based solvers with classical methods like finite difference and finite element methods, showing reduced computational complexity compared to traditional numerical methods.

- Utilized TensorFlow 2 to train neural networks, integrating governing physical laws into deep learning models.
- Developed a PINN model to solve heat conduction problems in 1D steady-state, transient, and 2D transient systems.
- Achieved 93.2 % accuracy in predicting the thermal diffusivity coefficient of an unknown material through physics discovery.

SELECTED PUBLICATIONS

Nazemi, A., & Xiao, H. (2025). "Understanding the Propulsion of a Scallop-like Swimmer in Granular Media." manuscript in preparation for *Journal of Fluid Mechanics*.

Nazemi, A., & Milani, A. (2025). "Emerging Fast Simulations using Material Point Method." *Advanced Structural Textile Composites Forming* (pp. 419-445). Woodhead Publishing.

Nazemi, A., & Milani, A. (2024). "A comparative study of emerging material point method and FEM for forming simulation of textile reinforcements." *Composites Part A: Applied Science and Manufacturing*, 108284.

Ramezankhani, M., **Nazemi, A.**, Narayan, A., Voggenreiter, H., Harandi, M., Seethaler, R., & Milani, A. (2022). "A Data-driven Multi-fidelity Physics-informed Learning Framework for Smart Manufacturing: A Composites Processing Case Study." 2022 5th IEEE International Conference on Industrial Cyber-Physical Systems (ICPS). Coventry, United Kingdom. pp. 01-07.

Margoto, O. H., **Nazemi, A.**, Abdin, Y., & Milani, A. (2024). "On Drapability and Characterization of Flax Fabric Reinforcements." SAMPE Conference Proceedings. Long Beach, CA, May 20-23, 2024. *Society for the Advancement of Material and Process Engineering – North America*.

LEADERSHIP EXPERIENCE

Iranian Graduate Student Association, University of Michigan
President

September 2024 - Present
Ann Arbor, MI

- Leading the organization in planning cultural, academic, and networking events for Iranian graduate students.
- Managing funding applications, budget allocation, and collaborations with university departments and colleges.

Mechanical Engineering Graduate Council (MEGC), University of Michigan
Officer

January 2024 - Present
Ann Arbor, MI

- Mentoring two junior PhD students in their first semester, providing guidance on coursework, research expectations, and academic resources.
- Assisting in organizing social and mentorship events to support graduate students in the Mechanical Engineering department.
- Facilitating networking opportunities between new and senior graduate students to enhance academic and professional development.

Composites Research Network, The University of British Columbia
Graduate Mentor

September 2021 - August 2023
BC, Canada

- Mentored an undergraduate student, a visiting scholar, three master's students, and a PhD student.
- Trained and supervised them on performing experimental tests using Instron dual column load frame, Instron droptower impact system, thermal conductivity tester, and friction/peel tester.
- Trained and supervised them on material preparation and characterization of fiber-reinforced composites, and analysis of the characterization results.
- Trained and supervised them on running finite element simulations using ABAQUS.

HONORS & AWARDS

Rackham Graduate Student Research Grant, University of Michigan.

June 2024

MITACS Accelerate Award, University of British Columbia.

August 2022

UBC Graduate Fellowship, University of British Columbia.

November 2021

1st Place of American Institute of Aeronautics and Astronautics Engine Design Competition.

September 2018 – August 2019

SKILLS

Computational Methods: Finite Element Method (FEM), Discrete Element Method (DEM), Material Point Method (MPM)

Programming: Python, C++, Fortran, C#

Simulation Tools: ABAQUS, ANSYS, LAMMPS, MercuryDPM

Machine Learning: TensorFlow, Scikit-Learn

High-Performance Computing: OpenMP, MPI