Siamak Mirfendereski, Ph.D.

Professional Summary

Engineer & computational scientist specializing in fluid mechanics, multiphysics simulation, electrokinetics, and complex fluids (rheology). 10+ years bridging computational modeling (CFD, particle-simulation, Stokesian Dynamics), experimentation to deliver solutions in energy, materials, and bio/medtech. Skilled in HPC workflows, high-fidelity advanced solver development (Fortran/MATLAB/Phyton), and multiphase modeling. Proven record of publications in *Matter (Cell Press)*, *PNAS, JFM,* and *Soft Matter* with leadership in cross-disciplinary research teams; 11 first-author papers (15 total), 112+ citations, h-index 5 and 45+ conference presentations and invited talk.

Education

- **Ph.D.**, Mechanical Engineering – Fluid Mechanics, University of Nebraska–Lincoln (2017–2022)
- **M.Sc.**, Mechanical Engineering – Energy Conversion, Amirkabir University of Technology (2010–2013)
- **B.Sc.**, Mechanical Engineering, Isfahan University of Technology (2005–2010)

Core Skills

- **Modeling & Simulation**: CFD, Stokesian Dynamics, Multiphysics simulations, multiphase flow, FSI, Immersed Boundary Method (IBM), reaction-diffusion modeling, Ionic transport.
- **Programming**: Fortran, MATLAB, Phyton, C++, Unix Shell | HPC: Slurm, MPI, Git/GitHub
- **Software**: ANSYS (CFX, Fluent), COMSOL, ABAQUS, SolidWorks, Inventor
- **Experimental**: PIV, microfluidics, capillary flow imaging, thermofluidic experiments
- **Optimization/ML**: Gradient-based & genetic algorithms; data analysis/visualization
- **Leadership**: Project leadership, mentoring, collaboration, technical communication

Professional Experience

Postdoctoral Research Associate – Chemical & Biological Engineering
University of Colorado Boulder | 2024–present

- Developed multiphysics solvers coupling multi-ion transport, diffusiophoresis, and flow; reproduced exclusion-zone formation & instability observations.
- Modeled nanoparticle transport in porous media under electric fields (with Prof. Daniel K. Schwartz).
- Developed fast Eulerian–Lagrangian chemotaxis/diffusiophoresis codes for biologically inspired patterning.
- Mentored/advised students and co-wrote funding proposals.

Postdoctoral Research Associate – Mechanical & Materials Engineering
University of Nebraska–Lincoln | 2023–2024

- Created Stokesian Dynamics & DNS solvers for dense suspensions and turbulent flows.
- Explored superhydrophobic drag reduction and active rheology control in smart fluids.

Graduate Research Assistant – Mechanical & Materials Engineering
University of Nebraska–Lincoln | 2017–2022

- Developed in-house Stokesian Dynamics & CFD solvers in Fortran for electrokinetics-driven dense suspensions under flow & turbulent DNS. Developed IBM+DNS simulation for pulsatile blood flow in stenotic arteries.

- Proposed active rheology control for conductive suspensions.
- Collaborated on electroporation/drug-delivery modeling; conducted SPIV & HPC runs.

Mechanical Engineering Consultant (Self-Employed)
2015–2017

- Designed and modeled mechanical systems from concept through prototyping/testing.
- Delivered simulation-driven solutions under tight industrial timelines.

R&D Engineer – ARAMICO Co.
2012–2014

- Optimized hydropower turbine performance using ANSYS CFX.
- Fully designed customized skip-elevator unit for an industrial plant. Engineering mechanical components.

Selected Achievements

- Outstanding Postdoc of the Year – Honorable Mention (2025)
- Outstanding Doctoral Dissertation Award (2023)
- Outstanding Graduate Research Assistant Fellowship, (2022)
- Milton E. Mohr Fellowship (2020–2021)

Leadership & Service

- Vice President, Postdoctoral Association, CU Boulder (2024, 2025)
- Session Chair, APS Division of Fluid Dynamics Conference (2024)
- Journal Reviewer: Journal of Fluid Mechanics, ASME, ASABE Journal (2022 – 2025)
- Session Chair, APS-DFD (2024); Vice President, CU Boulder Postdoctoral Association (2024–2025)

Selected Publications

- Mirfendereski, Gupta. Imperfect Turing patterns: diffusiophoretic assembly of hard spheres via reaction-diffusion instabilities. Matter (2025).
- Shi, Mirfendereski, Gupta, Schwartz. Electrokinetic nanoparticle transport in an interconnected porous environment. PNAS (in press).
- Mirfendereski, Park. Rheology of dense suspensions of ideally conductive particles in an electric field. J. Fluid Mech. 977 (2023) A35.
- Mirfendereski, Park. Multiscale electric-field-induced structural formations in non-colloidal suspensions. Soft Matter 18 (2022) 6916–6926.
- Mirfendereski, Park, Direct numerical simulation of a pulsatile flow in a stenotic channel using immersed boundary method. *Eng. Rep.* 4(1) (2022).
- Hosseini, Mirfendereski, Park. Two-dimensional dynamics of dense suspensions of ideally polarizable particles. Phys. Rev. E 111(4), 045104 (2025).
- Brooks et al., incl. Mirfendereski. Transepithelial electrical impedance increase following porous substrate electroporation. Small (2024).

Professional Affiliations

APS | SOR | ACS | AIChE | ASME