# Moslem Moradi, PhD

## SUMMARY

Soft matter physicist with more than 5+ years professional of experience in fields of active matter, fluid dynamics, and buoyancy-driven micro-hydrodynamics with proven record of publications. I have developed continuum model to explain mechanical properties of cell cytoskeleton. Experienced in fluid-structure interactions and lattice Boltzmann and immersed boundary simulations of elastic micro-structures in reaction-convection-diffusion systems.

## EXPERIENCE

### POSTDOCTORAL RESEARCHER

Jan 2023 – present
University of Pittsburgh, Department of Chemical Engineering, Pittsburgh, PA, USA. (PI: Professor Anna C. Balazs)

- Integrating fluid flow, chemistry, and mechanics to generate spontaneous patterns in elastic microstructures.
- Self-oscillation of elastic posts with reaction-convection flows in microchambers.
- Motion of elastic enzyme-coated sheet in reactive solutions.

### POSTDOCTORAL RESEARCHER

Oct 2018- Dec 2022
University of North Carolina at Chapel Hill, Department of Applied Physical Sciences, Chapel Hill, NC, USA. (PI: Dr. Ehssan Nazockdast)

- Led an investigation on how cell nucleus can act as a micro-rheological probe to study rheology of cell cytoskeleton.
- Developed continuum poro-viscoelastic model that could explain different relaxation times observed in AFM experiments.
- Analytical study of motion of filament on fluid spherical membranes.
- Involved in HOOMD-Blue simulation project to study phase behavior and surface tension in active Brownian particles.

### FACULY/INSTRUCTOR

Aug 2005 – Mar 2016
University of Zanjan, IASBS, Mahan Institute, Iran.

Teaching basic physics graduate and undergraduate courses: General physics, Quantum mechanics, Electromagnetism, Mathematical physics, Thermodynamics and Statistical mechanics; Includes research/consulting projects.

### ACADEMIC PROJECTS

- Rheology of a dilute suspension of active particles (PhD Thesis)
- Force between two charged conducting spheres (MS Project)
- Vortex dynamics (BS Project)

## CONTACT

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LinkedIn
Google Scholar
GitHub
Pittsburgh, PA, USA

## ABOUT ME

I am passionate about seeking answers to "wh" questions in physical sciences. I enjoy solving analytical/ computational problems in fluid dynamics and teaching/learning physical sciences.

## EDUCATION

- PhD Physics, University of Zanjan, Zanjan, Iran. 2015.
- MS. Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran. 2005.
- BS. Physics, Iran University of Science and Technology, Tehran, Iran. 2001.

## SKILLS

Python, Matlab, R, Mathematica, Scikit-learn, Computational Fluid Dynamics, Suspension Rheology, COMSOL MultiPhysics, Cell Mechanics, Lattice-Boltzmann-Immersed-Boundary Method, Complex Fluids, Reaction-converction-diffusion,

Active Matter, PDEs, Statistics, Data Analysis, Research, Independent Thinking, Teamwork.

## SHORT LIST OF PUBLICATIONS

- **Moradi M.**, Shklyaev O.E., and Balazs A.C., Controlling the dynamic behavior of micro-posts in solution via diffusion-convection, *Langmuir*, 2025, 41, 10.
- **Moradi M.**, Shklyaev, O.E., Shi W., and Balazs A.C., Fluid-mediated communication among flexible micro-posts in chemically active solution, *Materials Horizons*, 2024, 11, 6326.
- **Moradi M.**, Shi W., and Nazockdast E., A reciprocal theorem for biphasic materials, *Journal of Fluid Mechanics*, 2024, 997.
- **Moradi M.**, Shklyaev O.E., and Balazs A.C., Integrating fluid flow, chemistry, and mechanics to drive spontaneous formation of 3D patterns in anchored microstructures, *PNAS*, 2024, 121.
- Shi W., **Moradi M.**, and Nazockdast E., The drag of a filament moving in supported spherical bilayer, *Journal of Fluid Mechanics*, 2024, 979.
- **Moradi M.**, Shi W., and Nazockdast E., General solutions of linear poro-viscoelastic materials in spherical coordinates, *Journal of Fluid Mechanics*, 2022, 946.
- **Moradi M.**, Nazockdast E., Cell nucleus as a micro-rheological probe to study the rheology of cytoskeleton, *Biophysical Journal*, 2021, 120.
- Lauersdorf N., Kolb T., **Moradi M.**, Nazockdast E., and Klotsa D., Phase behavior and surface tension of soft active Brownian particles, *Soft Matter*, 2021, 26.
- **Moradi M.**, Najafi A., Rheological properties of a dilute suspension of self-propelled particles, *EuroPhysics Letters*, 2015, 109.

## SHORT LIST OF CONFERENCES/PRESENTATIONS

- **Poster**, MRS Fall Meeting, Boston, 2023, Chemically activated mechanical patterns in array of elastic micro-posts.
- **Talk**, APS, DFD, Indianapolis, 2022, Reciprocal theorem for linear poro-viscoelastic materials.
- **Talk**, AIChE, Boston, 2021, General solutions for poro-elastic equations with shear stress.
- **Talk**, Society of Rheology, Raleigh, 2019, Cell nucleus as a micro-rheological probe.

## ACADEMIC COMMUNITY SERVICES

- **Journal Reviewer**, Physical Review Letters, Physical Review E, Journal of Fluid Mechanics, Physical Review Fluids.
- **Science Education**, UNC Science Expo, 2019; Preparing family friendly fun experiments on fluid mechanics.

## WORKSHOPS

- CRC Bioinformatics workshop at University of Pittsburgh, 2025
  1. 10X single cell techniques; Cellranger
  2. Single cell data analysis using Seurat
  3. Trajectory-inference methods
  4. Gene regulatory network analysis

- Machine learning with MATLAB
- Data analysis using Mathematica

## MEDIA MENTIONS

- Nosy chemistry: Swanson school of engineering
- Research team designs small-scale 'chemical nose': Phys.org

## REFERENCES


- **Ehssan Nazockdast**, Assistance Professor, Department of Applied Physical Sciences, University of North Carolina at Chapel Hill, NC, USA. ehssan@email.unc.edu

- **Anna Balazs**, Distinguished Professor, Department of Chemical Engineering, University of Pittsburgh, PA, USA. balazs@pitt.edu

- **Daphne Klotsa**, Associate Professor, Department of Applied Physical Sciences, University of North Carolina at Chapel Hill, NC, USA. dklotsa@email.unc.edu

- **Ali Najafi**, Associate Professor of Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran. najafi@iasbs.ac.ir