Amir Saadat, PhD

Postdoctoral Scholar
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Profile

Multi-disciplinary scientist with 10+ years of experience in simulation, modeling, and experimental investigations in biophysics, soft matter, and nanocomposites. I have conducted multi-scale numerical simulations to validate different experiments, namely automatic cell microscopy, single DNA visualization, and extensional rheology. I have extensively collaborated with biochemists, medical doctors, and microfluidic experts. Currently investigating variability of cell biomechanics and biochemistry in chronic fatigue syndrome (CFS) disease.

Selected Skills

- Computational and statistical modeling of physical systems

  - Molecular-level (Monte Carlo, stochastic differential equations)

  - Continuum-level (finite-element, finite-volume)

- Optical microscopy, LED lighting

- Image analysis (bioengineering applications)

- Microfluidic devices (bioengineering applications)

- Familiar with spectroscopy and scattering techniques

- Statistical analysis: descriptive, inferential

- Rheology, polymer and nano-composite processing

Skill	Level
MATLAB	●●●●●
Python	●●●○○
Fortran, C/C++	●●●●●
MPI, OpenMP, CUDA	●●●●●
Rheometry, LVE, LAOS	●●●●●
Extrusion, Injection molding	●●●●◐
Dynamic light scattering (DLS)	●●●○○
ANSYS Fluent & POLYFLOW	●●●●○
OpenFOAM & ParaView	●◐○○○

Experiences

Postdoctoral Scholar — Stanford, CA
- Designed a biomedical assay experiment to validate red blood cell models
- Studied physiological variability of blood cell biochemistry and biomechanics
- Characterized cell stiffness using multi-physics simulation and microfluidic experiments — 2016 - present
- Studied large-scale dynamics of red blood cell suspension in micro-vasculature
- Developed automatic image analysis tools for cells inside a micro-channel using MATLAB/Python
- Investigated zeta potential and mobility of red blood cells using dynamic light scattering (DLS)

Graduate Research Assistant, Eastman Chemical Fellow — Knoxville, TN
- Simulated/validated single DNA visualization experiments with stochastic modeling — 2011 - 2016
- Modeled extensional rheology of polystyrene solutions using statistical simulations
- Developed Brownian dynamics simulation package "BDpack" (http://amir-saadat.github.io/BDpack/)
- Developed parallelized codes using CUDA, MPI, OpenMP

Polymer Rheology Lab Coordinator — Tehran, Iran
- Mentored/supervised three undergrad students to conduct viscoelastic and processing experiments — 2007 - 2010
- Studied die swell and rheology of nanocomposites theoretically and experimentally

Honors and Awards

Aug 2018-present	Open Medicine Foundation (OMF) Postdoc Scholarship
Apr 2019-Apr 2020	Allocation of NSF's XSEDE computational resources (equal to ~$40,000)
Feb 2017-Aug 2018	Army High-Performance-Computing Research Center Postdoc Scholarship
July 2017	NVIDIA-Stanford ICME grant for leveraging GPU computing ($50,000)
Feb 2014-Aug 2016	Eastman graduate student fellowship from Eastman Chemical Company
2006-2009	Top (1st rank) and honor student during M.Sc. in Amirkabir University

Education/Professional Training

Stanford University Stanford, CA
Postdoc in Chemical Engineering 2016 - present
Advisor: Eric S. G. Shaqfeh
Research title: Design of diagnostic devices via simulation and microfluidic experiments

University of Tennessee Knoxville, TN
Ph.D. and M.Sc. in Chemical and Biomolecular Engineering, GPA:4.0 2011 - 2016
Ph.D. minor in Computational Science (Program chair: Jack Dongarra) 2015
Advisor: Bamin Khomami
Dissertation title: Large scale Brownian dynamics simulation of polymeric solutions

Amirkabir University of Technology Tehran, Iran
M.Sc. and B.Sc. in Polymer Engineering 2003 - 2009

Publications

1. Amir Saadat*, Diego A. Huyke*, Diego I. Oyarzun*, Ingrid H. Ovreeide, Paulina V. Escobar, Eric S. G. Shaqfeh, Juan G. Santiago "High-throughput Measurement of an Individual's Red Blood Cell Shear Modulus Distribution", under review in *PNAS*.

2. Amir Saadat, Chris J. Guido, Eric S. G. Shaqfeh, "Effect of Cytoplasmic Viscosity on Red Blood Cell Migration in Small Arteriole-level Confinements", under review in *Phys. Rev. Fluids*. Presently available as *bioarxiv*.

3. Amir Saadat*, Chris J. Guido*, Gianluca Iaccarino, Eric S. G. Shaqfeh, "Immersed-Finite-Element Method for Deformable Particle Suspensions in Viscous and Viscoelastic Media", *Phys. Rev. E*, **2018**, 98, 063316.

4. Danielle J. Mai*, Amir Saadat*, Bamin Khomami, Charles M. Schroeder, "Stretching Dynamics of Single Comb Polymers in Extensional Flow", *Macromolecules*, **2018**, 51, 1507.

5. Tiras Y. Lin*, Amir Saadat*, Amit Kushwaha, Eric S. G. Shaqfeh "Effect of Length on the Dynamics of Wall Tethered Polymers in Shear Flow", *Macromolecules*, **2017**, 51, 254.

6. Amir Saadat, Bamin Khomami, "Letter to the Editor: BDpack, an Open Source Parallel Brownian Dynamics Simulation Package", *J. Rheol.*, **2017**, 61, 147-149.

7. Amir Saadat, Bamin Khomami, "A New Bead-Spring Model for Simulation of Semi-Flexible Macromolecules", *J. Chem. Phys.*, **2016**, 145, 204902.

8. Amir Saadat, Bamin Khomami, "Matrix-Free Brownian Dynamics Simulation Technique for Semidilute Polymeric Solutions", *Phys. Rev. E*, **2015**, 92, 033307.

9. Amir Saadat, Bamin Khomami, "Molecular Based Prediction of the Extensional Rheology of High Molecular Weight Polystyrene Dilute Solutions: A High-Fidelity Brownian Dynamics Approach", *J. Rheol.*, **2015**, 59, 1507-1525.

10. Amir Saadat, Bamin Khomami, "Computationally Efficient Algorithms for Incorporation of Hydrodynamic and Excluded Volume Interactions in Brownian Dynamics Simulations: A Comparative Study of the Krylov Subspace and Chebyshev Based Techniques", *J. Chem. Phys.*, **2014**, 140, 184903.

11. Amir Saadat, Hossein Nazockdast, Fatemeh Sepehr, Milad Mehranpour, "Viscoelastic Modeling of Extrudate Swell of Acrylonitrile-Butadiene-Styrene/Clay Nanocomposite", *Appl. Rheol.*, **2013**, 23, 12131.

12. Amir Saadat, Hossein Nazockdast, Fatemeh Sepehr, Milad Mehranpour, "Linear and Nonlinear Melt Rheology and Extrudate Swell of Acrylonitrile-Butadiene-Styrene and Organoclay-Filled Acrylonitrile-Butadiene-Styrene Nanocomposite", *Polym. Eng. & Sci.*, **2010**, 50, 2340-2349.