

Jeremy Binagia

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ABOUT ME

Engineer with an expertise in computational science interested in solving complex problems using applied mathematics, modeling and numerical simulation, and machine learning

EDUCATION

Stanford University , Ph.D. in Chemical Engineering (4.068 GPA)	Expected 2021
Stanford University , M.S. in Chemical Engineering (4.068 GPA)	2019
The University of Texas at Austin , B.S. in Chemical Engineering with Highest Honors (4.00 GPA)	2016

RESEARCH EXPERIENCE

Graduate Researcher, Advisor: Prof. Eric S.G. Shaqfeh, Stanford University 2016 – Present

- Designs and writes algorithms from scratch in Fortran to simulate systems involving fluid-structure interaction
- Created first fully resolved 3D simulation of microorganisms swimming in complex fluids
- Collaborates with others to design, test, and enhance the research group's massively parallel multiphysics flow solver
- Visualizes and analyzes large datasets from computational fluid dynamics simulations using Python, Matlab, and Tecplot

High-Energy-Density Physics Intern, Mentor: Dr. Luc Peterson, Lawrence Livermore National Laboratory 2020

- Developed a method to infer material microstructure from SEM images for use in radiation hydrodynamics simulations
- Conducted simulations to study microstructure-seeded hydrodynamic instabilities in National Ignition Facility experiments

Undergraduate Researcher, Advisor: Prof. Roger T. Bonnecaze, The University of Texas at Austin 2015 – 2016

- Prototyped nano-patterning via selective reduction of a thin metal oxide film through COMSOL simulations
- Utilized molecular simulations to compute rheological properties of soft particle glasses modeled as Herschel-Bulkley fluids

Undergraduate Researcher, Advisor: Prof. Doraiswami Ramkrishna, Purdue University 2014

- Modeled the signaling molecule network that populations of bacteria use to regulate the transfer of antibiotic resistance
- Simulated stochastic chemical systems via a parallel tau-leaping algorithm

Undergraduate Researcher, Advisor: Prof. Nicholas A. Peppas, The University of Texas at Austin 2013 – 2014

- Developed and synthesized pH-responsive polymer systems for oral drug delivery
- Characterized polymeric hydrogels via dynamic & equilibrium swelling, loading & release, and titration studies

PUBLICATIONS

1. Housiadas, K. D., **Binagia, J. P.**, & Shaqfeh, E. S. G. Squirmlers with Swirl in Viscoelastic Fluids at Low Weissenberg Number. *Journal of Fluid Mechanics*, accepted.
2. **Binagia, J. P.**, Phoa, A., Housiadas, K. D. & Shaqfeh, E. S. G. Swimming with swirl in a viscoelastic fluid. *Journal of Fluid Mechanics* (2020).
3. Bonnecaze, R., Chopra, M., Chopra, S., **Binagia, J.**, Ekerdt, J., & Edmondson, B. Patterning metal regions on metal oxide films/metal films by selective reduction/oxidation using localized thermal heating (2020). U.S. Patent App. No. 16/467,927.
4. **Binagia, J. P.***, Guido, C. J.*, Shaqfeh, E. S. G. Three-Dimensional Simulations of Undulatory and Amoeboid Swimmers in Viscoelastic Fluids. *Soft Matter* (2019).
5. Shu, C.-C., Tran, V., **Binagia, J.**, Ramkrishna, D. On Speeding up Stochastic Simulations by Parallelization of Random Number Generation. *Chemical Engineering Science* (2015).

TEACHING EXPERIENCE

Teaching Assistant: Applied Mathematics in the Chemical and Biological Sciences, Stanford University 2017 – 2018

- Planned and led weekly recitation sessions, gave assignment feedback, and provided final project guidance to 30+ students
- Designed novel homework problems and transitioned the course to a flipped classroom setup
- Received a median and mean score of 5/5 and 4.6/5 respectively for Fall 2018 student course evaluations

Tutor: Transport Phenomena, The University of Texas at Austin 2015 – 2016

- Aided 50+ students on weekly problem sets, developing their physical intuition for problem solving

* These authors contributed equally

MACHINE LEARNING PROJECTS

Teaching Microswimmers How to Navigate via Reinforcement Learning (<https://github.com/jbinagia/cme216-final-project>) 2020

- Trained active particles to navigate a complex flow field through reinforcement learning (Q-learning, expected SARSA)

Parallel Neural Network Training using Multiple GPUs (<https://github.com/jbinagia/cme213-final-project>) 2020

- Designed and implemented a parallel algorithm to accelerate neural network training on multiple GPUs via CUDA and MPI

Analyzing and Predicting Treatment Effects for Schizophrenia Patients (github.com/jbinagia/stats202-final-project) 2019

- Developed and evaluated hypothesis tests in R to assess statistical significance of an administered drug
- Used unsupervised learning methods including clustering and principal component analysis (PCA) to define patient groups
- Placed 4th out of 44 teams in a Kaggle competition for forecasting future severity of schizophrenia symptoms
- Created a classifier to predict the probability of a patient diagnoses being erroneous (placed in top 28% of competition)

Efficient Sampling of Equilibrium States Using Artificial Neural Networks (github.com/jbinagia/CS-230-Final-Project) 2019

- Implemented a deep neural network in PyTorch that learns simple latent space descriptions of molecular configurations

INDUSTRY EXPERIENCE

Process Engineering Intern, Valero Energy, Port Arthur, TX 2015

- Troubleshoot steam header inlet of washwater injection drum to ensure adequate drum pressure when feed nitrogen levels are elevated. Created and optimized operator pressure safety valve car-seal rounds.

SKILLS

<i>Languages</i>	<i>Experienced:</i>	Python, MATLAB, Fortran
	<i>Familiar:</i>	C++, Lua, R
<i>Software</i>	<i>Experienced:</i>	Linux, Git, Pandas, NumPy, MPI, CUDA, Tecplot
	<i>Familiar:</i>	COMSOL, PyTorch, TensorFlow, Keras, OpenMP
<i>Theory</i>		Fluid mechanics, Parallel computing, Finite element analysis, Data mining, Deep learning

AWARDS & HONORS

National Science Foundation (NSF) Graduate Research Fellowship (fund 3 years, valued at \$140,000)	2016 – 2019
Stanford Blueprint Datathon Finalist (annual hackathon focused on big data)	2019
National Defense Science & Engineering Graduate (NDSEG) Fellowship Awardee (5 - 10% acceptance rate)	2016
Undergraduate Research Fellowship Awardee (Spring 2014 and 2016)	2016
Welch Foundation Scholarship (20 of 700 applicants receive this award annually)	2012 – 2016
Hutchinson International Scholarship (allows first-generation students to study abroad)	2012 – 2016
Eagle Scout, Boy Scout Troop 75 – Port Arthur, TX	2012

LEADERSHIP & COMMUNITY SERVICE

Program Coordinator , Science Teaching Through Art (STAR)	2019 – 2020
Instructor , Stanford Prison Education Project	2019
Member , Stanford CHEMENG Faculty Search Committee	2019
Member , Stanford CHEMENG PhD Recruitment Committee	2018
Vice President Internal , Engineering Chamber Orchestra	2014 – 2015
Treasurer , Omega Chi Epsilon (OXE) Chemical Engineering Honor Society	2014 – 2015

PRESENTATIONS

- Binagia, J. P.**, Phoa, A., Housiadis, K., & Shaqfeh, E. S. G. "How Azimuthal Swirl Impacts Swimming Kinematics in a Viscoelastic Fluid," 72nd Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics, Seattle, WA (2019, Nov). Oral presentation.
- Binagia, J. P.**, Guido, C. J., & Shaqfeh, E. S. G. "Simulating the Swimming Motion of *C. elegans* and Amoeboids in Viscoelastic Fluids via the Immersed Boundary Method," SIAM Conference on Computational Science and Engineering (CSE19), Spokane, WA (2019, Feb). Oral presentation.