

# Jeremy Binagia

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## ABOUT ME

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

## EDUCATION

<b>Stanford University</b> , Ph.D. in Chemical Engineering (4.068 GPA)	Expected 2021
<b>Stanford University</b> , M.S. in Chemical Engineering (4.068 GPA)	2019
<b>The University of Texas at Austin</b> , 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 image processing workflow to infer material microstructure from SEM images for use in multiphysics simulations
- Conducted radiation hydrodynamics simulations to assess the impact of microstructure on seeding fluid instabilities at NIF

**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

## 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

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

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

**Analyzing and Predicting Treatment Effects for Schizophrenia Patients** ([github.com/jbinagia/stats202-final-project](https://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 4<sup>th</sup> 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)

## SKILLS

*Languages (experienced & familiar):* Python, MATLAB, Fortran, C++, Lua, R

*Software (experienced & familiar):* Linux, Git, Pandas, NumPy, MPI, CUDA, COMSOL, PyTorch, TensorFlow, Keras, OpenMP

*Theory* Fluid mechanics, Transport phenomena, Parallel computing, Data mining, Deep learning

## PUBLICATIONS

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1. Housiadas, K. D., **Binagia, J. P.**, & Shaqfeh, E. S. G. Squirmer 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

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**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

## INDUSTRY EXPERIENCE

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**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.

## AWARDS & HONORS

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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

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**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

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**Binagia, J. P.**, & Shaqfeh, E. S. G. "Swimming with Swirl in a Viscoelastic Fluid," 2020 AIChE (the American Institute of Chemical Engineers) Virtual Annual Meeting (2020, Nov). Abstract accepted for oral presentation.  
**Binagia, J. P.**, & Shaqfeh, E. S. G. "Swimming with Swirl in a Viscoelastic Fluid," Virtual Technical Meeting 2020 of the Society of Engineering Science (2020, Sep). Oral presentation.  
**Binagia, J. P.**, Phoa, A., Housiadas, 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.

\* These authors contributed equally