

Prathamesh Kulkarni

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EDUCATION

Ph.D. in Chemical and Biomolecular Engineering, GPA: 3.95/4.00

Rice University

Fall 2019 – Present

Houston, TX

B.Tech. Chemical Engineering, CPI: 8.10/10.00

Indian Institute of Technology (IIT) Bombay

2019

Mumbai, India

SKILLS

Professional Summary: Trained chemical engineer and a team player with **5+ years of experience** in computational modeling using thermodynamics, biological physics, soft matter rheology, and chemical reaction engineering principles

Programming: C++, Python, Bash, High Performance Computing (SLURM) for remote parallel processing

Physics-based and Soft Matter Modeling: Coarse-grained simulations using lattice-based geometry and off-lattice models to predict strain-stiffening, stress-relaxation, failure of tissues, soft elastic materials

Chemical Engineering & ODE/PDE Modeling: Monte-Carlo techniques, Stochastic processes, Brownian dynamics for particle-based simulations like gas-liquid phase equilibria, Differential equations (ODE/PDE) for modeling flow/fluid mechanics and thermodynamics, chemical kinetics for reaction engineering modeling

Publishing: L^AT_EX, Microsoft Office, Inkscape, Data Visualization with Python (Matplotlib) and MATLAB

RESEARCH EXPERIENCE

PhD Candidate, Rice University

Houston Texas

Advisors: [Dr. Frederick MacKintosh](#) and [Dr. Anatoly Kolomeisky](#)

Spring 2020 – Present

- Gained hands-on expertise in coarse-grained modeling of soft crosslinked biopolymers using triangular-lattice fiber-network simulations (C++), stress/strain, rheological analysis—to study material mechanical stress response
- Built a generalized spring-network model that integrates filament fragmentation, revealing how stress-relaxation profiles can help tuning of bio-inspired materials and engineering tissues
- Simulated interpenetrating networks of polymers with vastly contrasting mechanical properties, showing how crosstalk shifts material stiffening under strain - insights for tougher composite biomaterial design
- Extending the computational framework to capture filament breakage in composite network - showing how cascading failures in composite biomaterials shift the dominant response across regimes (ongoing)
- Executed large-scale parallel C++ simulations through Bash scripts on SLURM-managed High Performance Computing clusters, along with MATLAB post-processing and publication-quality figures/simulation movies

Summer Research Intern, National Tsing Hua University

Taiwan

Advisor: [Prof. Zung-Hang Wei](#), NanoEngineering and MicroSystems

May 2018 – Jul 2018

- Conducted literature survey for various methods of extracting contact angle of droplets on a surface
- Built mathematical models using LabVIEW for tracing contours of droplets from the droplet images

Undergraduate Research Assistant, Indian Institute of Technology Bombay

Mumbai, India

Advisor: [Dr. Supreet Saini](#), Department of Chemical Engineering

Dec 2017 – Feb 2018

- Performed stochastic simulations for bacterial population under stochastic signal detection, tracking how cost/benefit trade-offs and response accuracy shape population fitness when conditioning is allowed
- Formulated non-linear optimization of cell growth, degradation, and kinetic parameters using differential equations for different signals to identify regimes where conditioning outperforms default responses in bacterial population

ACADEMIC PROJECTS

Phase Equilibria using Gibbs Ensemble Monte Carlo

Houston, TX

Advisor: [Dr. Walter Chapman](#), Rice University

Fall 2019

- Applied thermodynamic modeling principles and Gibbs-Ensemble Monte Carlo method—combining particle displacements, volume changes, and particle exchanges—to predict gas-liquid equilibrium for a model fluid
- Performed Monte Carlo simulations to determine phase separation and density profiles near critical points with literature comparison - crucial for oil/gas, chemical, and pharmaceutical process design.

Transient exposure of protein binding DNA sites in the nucleosome

Mumbai, India

Advisor: [Dr. Ranjeeth Padinhateeri](#), Biosciences and Bioengineering, Indian Institute of Technology Bombay

Spring 2018

- Developed bead-spring Brownian-dynamics simulations for DNA-histone nucleosomes, implementing Langevin integration with Morse and electrostatic potentials to simulate spontaneous partial unwrapping
- Presented simulation methodology and preliminary findings as part of project for a graduate-level course that focused on computational biology modeling

PUBLICATIONS

Kulkarni, P., Kolomeisky, A. B., MacKintosh, F. C., Stress relaxation in spring networks via force-dependent stochastic severing (In preparation)

Kulkarni, P., Gupta, S., Kolomeisky, A. B., MacKintosh, F. C., Effects of crosstalk on strain-stiffening in spring and rope-like composite double network systems (In preparation)

POSTER AND ORAL PRESENTATION

Presented a poster on Stress relaxation in spring networks via force-dependent stochastic severing at the Smalley Curl Institute Colloquium 2024 (Best poster)

Presented a talk on Mechanics of composite networks with rope-like filaments at the Global Summit (March Meeting) of the American Physical Society 2025: [talk abstract link](#)

LEADERSHIP AND OUTREACH

Outreach Chair — Rice University

ChBE Graduate Student Association (ChBE GSA)

Houston Texas

Jun 2020 – Jun 2021

- Acted as a liaison between ChBE GSA, AICHE, and ChBE Alumni committee and helped organize career fair preparation events such as Resume review, Mock Interviews, Fishbowl interview, and Career Panel for students

Treasurer — Rice University

ChBE Graduate Student Association (ChBE GSA)

Houston Texas

Jun 2020 – Jun 2021

- Managed the budget of ChBE GSA and applied for grants to support social events virtually for graduate student engagement and morale during the pandemic

Events Manager, Indian Institute of Technology Bombay

AZeotropy - Chemical Engineering Symposium

Mumbai, India

Apr 2017 – March 2018

- Coordinated a 2-tier team to conceptualize and execute 20+ events—lectures, panel discussions, exhibitions, and fireside chats—in partnership with industry and academic leaders, drawing over 2000 attendees
- Organized hands-on workshops on engineering simulation software (ASPEN, ANSYS, COMSOL, MATLAB) - creating educational opportunities for students to learn modeling outside of the curriculum

TEACHING EXPERIENCE

Teaching Assistant for Fluid Mechanics and Transport Phenomena CHBE 501

Fall 2021, 2022

Teaching Assistant for Computational Methods in Chemical Engineering

Spring 2020

Teaching Assistant for Thermodynamics I, ChBE 411

Spring 2023

- Held office hours weekly to guide students and clarify concepts outside of class, and graded assignments for first-year 30+ graduate students and programming assignments for undergraduate students

INDUSTRIAL TRAINING

Modeling and Simulation of Catalytic Converter

Instructor: [Harsh Vinjamoor](#), Manager R&D SEDEMAC Mechatronics

Pune, India

May 2017 – Jul 2017

- Analyzed the chemical reaction kinetics involved in catalytic converter and simulated surface reactions using Python via Cantera as a third-party library for reactor modeling
- Studied and attempted to reflect behavior of outlet gas concentrations profiles with introduction of steps changes in air-to-fuel ratio at the inlet of catalytic converter - valuable understanding to design emission control strategies

AWARDS & ACHIEVEMENTS

Recipient of Graduate Student Travel Grant award by Rice Engineering Alumni (REA)

Spring 2025

Recipient of Platinum Poster Award at the Smalley Curl Institute Colloquium

Summer 2024

Honored with Undergraduate Research Award for exemplary contribution to research

2018

Awarded Department Color for exceptional contribution to the chemical engineering symposium activities

2018

RELEVANT COURSEWORK

Chemical Engineering, Computational Biology, and Modeling: Fluids and Transport Phenomena, Statistical Mechanics, Advanced Numerical Methods, Modeling Biological Systems and Processes, Physicochemical Hydrodynamics, Bioprocess Principles