Arkava Ganguly

Ph.D. Candidate, Department of Chemical and Biological Engineering, University of Colorado Boulder

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Skills

- Experienced in continuum scale modeling and solving systems of partial differential equations.
- Analytical techniques to solve coupled diffusion-convection-reaction equations. Numerical techniques include finite difference, finite element, and finite volume methods.
- Simulation software and solvers: SolidWorks, COMSOL, Basilisk C flow solver, RStudio, GNUPlot.
- Programming Languages: Matlab, Python, C, Julia, FORTRAN.
- Machine Learning: Optimization using Genetic Algorithm, ML classification and clustering techniques.
- Experimental techniques: particle image velocimetry; soft lithographic techniques - spin coating, dip coating; thermal evaporation for metal coating; goniometry.

Work and Research Experience

Graduate Research Assistant, ChBE Department, University of Colorado Boulder *08/2021-present*

- Investigating how particle shape, surface heterogeneities, and interfacial interactions influence the motion of colloidal particles and droplets in complex, confined environments for biomedical or environmental remediation applications.
- Utilized analytical and numerical tools to predict particle trajectories, solute dynamics, and interactions. Collaborated with experimental groups to provide mechanistic insight and design better experiments. Ability to perform simple benchtop experiments.
- Ongoing doctoral work and scientific contributions have led to multiple journal publications, contributed and invited conference presentations, as well as research awards and fellowships.

Junior Research Fellow, Process Development, National Chemical Laboratory, India *11/2020-05/2021*

- Investigate how non-protein encoding variations in human genomic sequences can contribute to diseases in specific organs.
- Developed statistical models to analyze large-scale genomic data, identifying repeating patterns correlated with tissue-specific defects and birth defects in the brain and heart.
- The work served as a proof-of-concept and foundation for the development of a larger framework currently under development, aiming to analyze the entire human genome and correlate mutations with a broad spectrum of physiological defects.

Junior Research Fellow, Green Solvent Laboratory, IIT Guwahati *04-10/2020*

- Current research focuses on developing cost-effective alternatives, like liquid-liquid phase splitting, to separate highly carcinogenic cyclic-diethers from industrial effluent streams, due to limitations of traditional separation methods like distillation. However, their LL-phase behavior is poorly understood.
- We utilized nature-inspired optimization algorithms to determine binary interaction parameters for NRTL and UNIQUAC models, achieving high quantitative accuracy. Developed a Genetic Algorithm-based UNIQUAC model incorporating Pitzer-Debye-Hückel contributions for resolving ionic liquid system equilibria.
- Our work led to an increase in accuracy from 1.22% to 0.05% absolute error in LLE prediction for general cyclic di-ether systems. Further, for ionic liquids, our PDH refinement of the UNIQUAC model leads to a 33% increase in prediction accuracy for higher ionic liquid concentrations.

Engineering Trainee, Syngas Technology Development, Haldor Topsoe *05-07/2019*

- Optimized the enrichment oxygen level to minimize fuel flow rate and energy consumption in proprietary SMR technology.
- Gained experience in developing plant-scale process flow sheets, understanding and retrofitting oxygen enrichment technologies, and conducting techno-economic analysis.

- Achieved a 56.8% reduction in fuel consumption as a result of the optimization efforts.

Project Consultant, BHAVINI, Department of Atomic Energy, India *12/2018-01/2019*

- Conducted root cause analysis on a pump failure in a prototype fast breeder reactor's secondary cooling circuit.
- Analyzed flow and electromagnetic instabilities in an operational annular linear induction pump using CFD simulations and magnetohydrodynamic simulations. Presented detailed findings in a technical report, identifying mechanical design flaws and suggesting modifications.
- Provided insights into the pump failure, highlighted mechanical design flaws, and proposed modifications to suppress electromagnetic instabilities and reduce flow instabilities by 20%.

Summer Research Intern, Instability and Soft Patterning Laboratory, IIT Kharagpur *05-07/2018*

- Investigated variations in surface wetting with secondary wrinkle formation via metal deposition on bio-mimetic pre-patterned substrates.
- Utilized soft lithographic techniques, conducted thermal metal evaporation, employed goniometry for surface wettability measurements, and gained exposure to surface characterization techniques - Scanning Electron Microscopy, and Atomic Force Microscopy.
- Acquired practical experience in understanding surface properties and their alterations with changes in surface morphology.

Education

Ph.D. in Chemical Engineering, University of Colorado Boulder *2021-present*
M.S. in Chemical Engineering, University of Colorado Boulder *2021-2023*
B.E. in Chemical Engineering, Jadavpur University *2016-2020*

Honors and Awards

Teets Family Endowed Graduate Fellowship in Nano-technology, University of Colorado Boulder *2023*
Workshop Fellowship, Isaac Newton Institute for Mathematical Sciences *2023*
Mukhopadhyay Graduate Research Fellowship, University of Colorado Boulder *2022*
ChBE First Year Graduate Fellowship, University of Colorado Boulder *2021*
H.L. Roy Memorial Gold Medal, Jadavpur University *2020*

First-authored Journal Publications (* denotes equal contribution)

Full list at Google Scholar

1. **Ganguly, A.**, Roychowdhury, S., & Gupta, A. (2024). Unified mobility expressions for externally driven and self-phoretic propulsion of particles. Journal of Fluid Mechanics, 994, A2. [Link]
2. **Ganguly, A.**, Alessio, B.M., & Gupta, A. (2023), Diffusiophoresis: a novel transport mechanism - fundamentals, applications, and future opportunities. Front. Sens. 4:1322906. [Link]
3. **Ganguly, A.**, & Gupta, A. (2023). Going in circles: Slender body analysis of a self-propelling bent rod. Physical Review Fluids, 8(1), 014103. [Link]
4. **Ganguly, A.***, Bairagya, P.*, Banerjee, T., & Kundu, D. (2022). Application of nature-inspired algorithms with generalized Pitzer-Debye-Hückel (PDH) refinement for liquid-liquid equilibria (LLE) correlation in cyclic di-ether systems. AIChE Journal, 68(2), e17434. [Link]

Teaching and Mentorship Experience

- **Advanced Teaching Assistant**: Statistical Thermodynamics, Class strength: 27 *Fall 2023.*
  Helped prepare and grade assignments, and exams along with holding office hours every week. Prepared and delivered two lectures on Monte Carlo Algorithms, and Interfacial Phenomena.
- **Teaching Assistant**: Chemical Engineering Fluid Mechanics, Class strength: 86 *Spring 2022.*
  Helped prepare homework assignments, set grading rubrics, held office hours, and graded exams.
- **Mentorship:** Research mentor to two undergraduate students. Peer mentor to three graduate students.
- **Service:** Reviewer in Journal of Colloid and Interface Science; Member of the Graduate Leadership Committee at CU Boulder.