Technical & Academic Projects

Design of a Chloroform Plant *Jan '24 - Apr '24*
B. Tech Design Project | *Guide: Prof. R. Thaokar & Prof. S. Roy, IIT Bombay* *Report*

- Drafted a 100+ page engineering design proposal for the industrial installation of a plant with 60K TPY capacity and 99.5% purity with complete process flow diagrams and process simulations
- Performed a detailed design of a multi-tubular reactor for high-pressure thermal chlorination reactions including optimization of stiff reaction kinetic parameters in Python

Polymer Stretching in Batchelor-Kriachnan Flows *Jan '24 - Apr '24*
Stochastic & Turbulent Transport | *Guide: Prof. Jason Picardo, IIT Bombay* *Report*

- Simulated the **Fokker-Planck** equation to obtain the p.d.f of the length of a dumbbell model of a polymer in a Batchelor-Kriachnan flow at various values of the Weissenberg number
- Investigated how the flow-induced stretching causes mechanical **scission of polymers** and observed the exponential decay of the fraction of unbroken polymers

Spatio-Temporal Analysis of COVID-19 Genomic Sequence Similarity *Jan '24 - Apr '24*
Intro to Genomics | *Guide: Prof. Sarika Mehra, IIT Bombay* *Report*

- Utilized genome sequences from different countries at different times deposited in NCBI and performed MAFFT alignment to identify mutations and calculate the simalirity scores
- Performed **k-means** clustering on Python to observe time and location-specific similarities

Granular Flow on an Inclined Plane *Jan '23 - Apr '23*
Granular Mechanics | *Guide: Prof. Devang Khakhar, IIT Bombay* *Presentation*

- Utilized **LAMMPS** to simulate the flow of powdered material down an inclined plane
- Varied the particle-size ratios and plane inclination to study their effects on segregation

Identifying Materials Genes of Heterogeneous Catalysts *Jan '23 - Apr '23*
Chemical Reaction Engineering II | *Guide: Prof. A. K. Suresh, IIT Bombay* *Report*

- Critically reviewed and presented the Foppa et al. (2021) article detailing the computational and experimental procedure to identify key parameters determining catalyst performance

Bénard-Marangoni Film Instabilities *Aug '22 - Nov '22*
Advanced Transport Phenomena | *Guide: Prof. Jason Picardo, IIT Bombay* *Report*

- Reviewed **Rayleigh-Taylor** and **Bénard–Marangoni** instabilities in a liquid film, derived the stability criteria and used Python to simulate its time-varying state on perturbation

CFD Simulation of Flow in a Centrifugal Pump *May '22 - Jul '22*
Learning Project | *Guide: Prof. Devang Khakhar, IIT Bombay*

- Designed a FreeCAD model, performed meshing using Salome and simulated both steady state and transient incompressible flow in **OpenFOAM**
- Varied the number of vanes in the impeller to ascertain the effect on output pressure

Flow Patterns in Draining of a Tank *Jan '22 - Apr '22*
Process Fluid Mechanics | *Guide: Prof. Devang Khakhar, IIT Bombay* *Report*

- Verified **Torricelli's theorem** of efflux velocity by changing the height and area of the orifice
- Contrasted laminar and turbulent flow using OpenFOAM's icoFoam and pisoFoam solvers

Cooling of Thermal Hotspots on GPU Chips *Jan '22 - Apr '22*
Heat Transfer | *Guide: Prof. P. Sunthar, IIT Bombay* *Report*

- Worked in a team of **8** to dilute heat fluxes from GPU chips using thermo-acoustic cooling
- Reduced hardware and energy costs by **10x** and used OpenFOAM to demonstrate the achievement of **20x** greater cooling power than conventional methods