Soumya Shouvik Bhattacharjee

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Education

University of Texas at El Paso (UTEP) — *August 2025*, *Texas, United States*
Master of Science (M.Sc.) in Mechanical Engineering — *CGPA: 4.00 / 4.00*

Bangladesh University of Engineering and Technology (BUET) — *May 2022*, *Dhaka, Bangladesh*
Bachelor of Science (B.Sc.) in Mechanical Engineering — *CGPA: 3.73 / 4.00*, *US Equivalence: 3.84 / 4.00*

- University Merit Scholarship
- Dean's List Award

Technical and Software Skills

- Expertise in **Python**, for building solvers from scratch, debugging and optimization
- Experience in building **Multiphysics** Models.
- Working experience in **Mesoscale Modelling** and Lattice Boltzmann Method.
- Working experience in **Finite Element Method** using opensource program FEniCS. Can adapt to any commercial software
- Working experience in using **Google JAX**, Taichi for GPU assisted high performance computing
- Proficient in **3D modelling** and Rapid-Prototyping. **Certified SOLIDWORKS Expert (CSWE)**
- Working knowledge of implementing **Machine Learning** algorithms in engineering problems
- Learning Experience on **Operator Learning**, i.e. Fourier Neural Operator and Transfer Learning
- Basic knowledge on **statistical analysis**. Proficient in using Minitab
- Basic knowledge on **control engineering** design using Simulink

Research Interest

- Micro and Nano Engineering
- Scientific Machine Learning
- Material Design
- Additive Manufacturing
- Multiphysics Modelling
- Digital twin, inverse design

Research Experience

Decoding Anisotropic Porous Medium: A Synergy of Lattice Boltzmann Modelling and Operator Learning to Predict Permeability as a Function of Orientation — *Feb 2025- Aug 2025*, *Texas, United States*

Funding Agency: U.S. Department of Energy (DoE)
Collaborators : Sandia National Laboratories, Arizona State University

- Developed model for calculating directional permeability values from micro-CT images
- Used operator learning to predict anisotropy of medium as a function of orientation of medium

Multiscale Multiphysics Modelling for predicting permeability and heat conductivity for enhanced geothermal system — *July 2024- Dec 2024*, *Texas, United States*

Funding Agency: U.S. Department of Energy (DoE)
Collaborators : Sandia National Laboratories, University of Utah, Florida State University, Alma Energy LLC

- Developing mesoscale hydrothermal model using Lattice Boltzmann Method
- Model has been developed from scratch using Python, implemented JAX for implementing high performance computing
- ML surrogate model is being trained for different porous structures

Toolpath Design for Controlled Microstructure in additive manufacturing: Integrating reduced order phase-field modeling and Deep Reinforcement Learning — *May 2024- Dec 2024t*, *Texas, United States*

- Employed deep reinforcement learning to guide the laser movement and generate scan path to result in microstructure with desired aspect ratio and grain volume
- 3D U-Net CNN has been used to train the surrogate model of the main phase field model

Modelling of Heart Failure due to preserved ejection fraction (HFpEF) by Variation of Active Contractility and Passive Stiffness of Myocardial Fiber along the different layers of Cardiac Wall — *March 2021- May 2022*, *Dhaka, Bangladesh*

- 3D geometry was modelled using GMSH; VTK and Python libraries were used to assign myofiber directions & split domains.
- Finite Element Method problem was defined to emulate the mechanical model of heart using Dolfin library of FEniCS (an open-source FEM Solver).

- FEM Model was coupled to a lumped parameter model using Python to emulate the hemodynamics.
- Active contractility and passive stiffness of myocardial fiber was varied along the different layers of left ventricle to simulate different conditions of Heart Failure due to Preserved Ejection Fraction (HFpEF)

Publication

'Laser Scan Path Design for Controlled Microstructure in Additive Manufacturing with Integrated Reduced-Order Phase-Field Modeling and Deep Reinforcement Learning' submitted to ***Communication Engineering – Nature;*** (reference number: COMMSENG-24-0672)

Professional Experience

Graduate Research Assistant, Meso-AM Research Group *September 2023- May 2025*
- Worked in building physics model for studying pore-scale flow phenomenon
- Assisted in projects related to toolpath design for controlled microstructure

Visiting Student Intern, Sandia National Laboratories *July 2024 – August 2024*
- Developed a Python based accelerated multi-physics simulator to study flow and energy exchange in porous medium
- Worked in debugging and optimizing models for high-speed uses

Process Engineer, Square Pharmaceuticals PLC *December 2022 – July 2023*
- Worked in the Formulation Plant of the biggest FDA approved pharmaceutical industry of the country
- Supervised corrective and breakdown maintenance at a regular manner
- Wrote SOP and reports for GMP compliance manufacturing units

Projects

Go-Kart Design and Fabrication - *International Go-Kart Championship* *2019-2021*
- Assisted in designing the steering system of Go-Kart, did CAD modeling
- Performed FEA analysis for the chassis to ensure it can withstand certain dynamic load, did crash analysis
- Did material testing of chassis material and supervised the fabrication process

Control System Design for an Autonomous Two-Wheeler Robot - *Control Engineering Project* *2022*
- Analyzed stability, steady-state error and sensitivity
- Derived the transfer function of the system and did the PID tuning

Thermal and Economic Optimization of a Hair-Pin Heat Exchanger *-Thermal Engineering Project* *2020*
- Analyzed heat transfer and efficiency, under varying thermal conditions
- Built an optimization program from in *Python* to determine the most economic system parameters
- Did the 3D modeling for the fabrication process

Design and Fabrication of a Robotic Vacuum Cleaning System *– Electro-Mechanical System Design Project* *2018*
- Prototyping in SolidWorks and 3D printer. Fabricated the custom designed propeller for the vacuum system
- Did complete wiring from batteries to motors, sensors, microcontroller
- Programmed the Arduino microcontroller for automation using the feedback from sonar sensors and path optimization

Leadership Roles

Founding Chair, Institution of Mechanical Engineers (IMechE) BUET Student Chapter *February 2021- June 2022*
- Founded a general regional society for mechanical engineering students across the country
- Organized Speak Out for Engineering event in campus
- Organized three technical workshops, two networking events aiming to develop various engineering skills

Assistant Joint Secretary, BUET Automobile Club *April 2021-June 2022*
- Organized workshops on 3D design, basic and advanced
- Participated in International Go-Kart Championship, 2020, 1st in Innovation & Automotive Styling Segment

Finalist, Young Engineer and Scientist Award Competition, arranged by Honda, Japan *July 2022*

Affiliations

- Associate Member, The Institution of Engineers, Bangladesh (IEB)
- Affiliate Member, Institution of Mechanical Engineers (IMechE)