

Md. Ar Rafi Bin Arif

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🌐 LinkedIn 📄 Google Scholar ✉ Mail 🔗 Portfolio

RESEARCH INTERESTS

Computational Fluid Dynamics, Turbulence, Thermal Management, Heat Transfer, Thermodynamic Cycles, PEM Fuel Cell, Renewable Energy, Bio-fluid Mechanics, High-Performance Computing, Big-Data and Machine Learning.

EDUCATION

Texas Tech University

Aug 2025 - Present

Master of Science (M.S.) in Mechanical Engineering

Current GPA: 4.00/4.00

Expected Graduation: May 2027

Awarded the TTU Chaudhuri Designated Mechanical Engineering Scholarship

Islamic University of Technology

Jan 2020 - June 2024

Bachelor of Science (B.Sc.) in Mechanical Engineering

CGPA: 3.63/4.00

Awarded the OIC (Organization of Islamic Cooperation) Scholarship during the four-year bachelor's program in IUT

WORK EXPERIENCE

Turbulence and Big Data (TURB) Laboratory, Texas Tech University

Jun 2026 – Present

Graduate Research

Working under Dr. Dhawal Buaria on turbulence, computational fluid dynamics, numerical simulation, high-performance computing, and scientific computing. Developing experience in MPI-based parallel programming, parallel computing workflows, and large-scale scientific computing using resources from the Texas Tech High Performance Computing Center, Texas Advanced Computing Center, and Oakridge National Laboratory.

Department of Mechanical Engineering, Texas Tech University

Jan 2026 – Present

Graduate Assistant

Assisted faculty with teaching responsibilities, grading, student support, and course-related academic activities in the Mechanical Engineering department.

Physics Division, Science Master (Ed-Tech)

July 2024 – July 2025

Head of Content Design

Led the creation of science curricula and educational resources, developed supporting software tools, and applied research-driven strategies to improve conceptual understanding and student engagement at the higher secondary level.

Computational Fluid Dynamics Department, FlowThermoLab

January 2024 – June 2024

Undergraduate Internship on CFD

Developed practical CFD experience in geometry preparation, mesh generation, solver setup, article-based validation, and post-processing using industry-standard simulation workflows.

RESEARCH PUBLICATIONS

- **Auxiliary dual-mode rotating cylinders for energy-efficient thermal management in prosumer buildings: A coupled TRNSYS-CFD investigation** (*published in Applied Thermal Engineering, Elsevier*). <https://doi.org/10.1016/j.applthermaleng.2025.129558>
 - Developed a coupled TRNSYS-CFD co-simulation framework to evaluate active heat transfer enhancement devices in prosumer buildings.
 - Performed **seasonal thermofluid analysis** under forced and buoyancy-driven convection regimes.
 - Demonstrated **24.8% heat transfer enhancement** and quantified **CO₂ reduction and energy savings** through optimized operating conditions.
- **Energy-exergy assessment of LS-2 PTSC with dimpled receiver for CO₂ emission reduction: Machine learning algorithms** (*published in Applied Thermal Engineering, Elsevier*) [10.1016/j.applthermaleng.2026.132971](https://doi.org/10.1016/j.applthermaleng.2026.132971)
 - Conducted energy, exergy, enviroeconomic, exergoenvironmental, and exergoenvironoeconomic assessment of a series-connected LS-2 parabolic trough solar collector system with seven receiver configurations.
 - Evaluated the effect of dimpled receiver geometry and wind velocity on thermal performance, exergy efficiency, Nusselt number, pumping power, and CO₂ emission-related cost reduction.

- Applied machine learning algorithms, including Artificial Neural Network, Support Vector Machine, and Decision Tree, to predict receiver outlet temperature, with ANN showing the highest predictive accuracy.
- Demonstrated that the dimpled receiver consistently improved energy and exergy performance compared with the plain receiver while offering better environmental and sustainability outcomes.

- **A comprehensive analysis of PEM fuel cell with integrated ORC system (*Undergraduate Thesis Project* – published in the 9th BSME International Conference on Thermal Engineering)**

<https://doi.org/10.1063/5.0327703>

- Developed a comprehensive thermodynamic and electrochemical model of the PEM fuel cell in MATLAB/Simulink.
- Developed a detailed waste heat recovery system for the PEM Fuel Cell using Organic Rankine Cycle (ORC) in Aspen Plus
- Compared the PEMFC-ORC system performance with different zeotropic mixtures to identify the most effective working fluid to recover the waste heat
- Conducted a sensitivity analysis of the PEM Fuel Cell and the economic analysis was done using the best zeotropic mixture

PROJECTS AND RESEARCH

- **Thermodynamic and Exergy analysis of Combined Supercritical CO₂ cycle and Organic Rankine Cycle using CO₂ based binary mixture for Gas Turbine waste heat recovery**

- Conducted comprehensive thermodynamic and exergoeconomic analysis of a novel combined cycle integrating two S-CO₂ cycles and a Gas Turbine Cycle to recover the heat wasted in a gas turbine.
- Added an ORC for better efficiency by using CO₂ based zeotropic mixtures
- Used the REFPROP library in both MATLAB and Python to model the entire cycle

- **Computational Fluid Dynamics Projects in Biomedical Engineering**

- ❖ **Coronavirus Dispersion in an Elevator due to Sneeze**
Focused on virus particle behavior in confined spaces to simulate real-world pandemic-related scenarios.
- ❖ **Covid-19 Airborne Risk Measuring in a Classroom**
Worked on assessing airborne risks in educational environments, combining public health relevance with CFD.
- ❖ **Aorta: Non-Newtonian Pulsating Blood Flow**
Developed knowledge of complex biological flows, essential for biomedical applications, and developed experience with non-Newtonian flow modeling.
- ❖ **Lumen Blood Vessel (FSI & Non-Newtonian)**
Gained exposure to advanced CFD techniques such as Fluid-Structure Interaction (FSI) for simulating blood flow.

TECHNICAL SKILLS

Design and Analysis Tools: SOLIDWORKS, Ansys Fluent, OpenFOAM, ANSA, CONVERGE, KeyShot

Programming Languages: Fortran, C, C++, Python, MATLAB/Simulink, LaTeX

Computer Skills: MS Office, Google Workspace

LANGUAGE PROFICIENCY TEST

IELTS Band Score – 7.5 | Listening – 8.5 , Reading – 7, Writing – 7, Speaking – 7.5

EXTRACURRICULAR ACTIVITIES

- **IUT CAD Society | Content Team Lead** July 2023
Managed the content team to create compelling society event presentations, social media content, and promotional films. Created 3D models to improve the society's digital presence and orientation sessions. Managed creative direction and teamwork to maintain a professional brand image.
- **Formula IUT-FSAE Racing Team | Senior Design Executive** June 2023
Performed CFD simulations in Ansys Fluent to analyze and optimize the aerodynamic performance of the car's wing, evaluating lift, drag, and downforce characteristics across multiple design iterations. Designed various car components based on structural and aerodynamic design requirements within FSAE competition constraints.
- **Bangladesh Power Development Board | Mechanical Engineering Trainee** May 2023
Gained practical exposure to thermal power plant operations, industrial processes, sustainability practices, and energy management through field training and industrial site visits.

AWARDS AND CERTIFICATIONS

- **Intra IUT CAD Competition | TRACTION 2.0**
Secured the Runners-Up position in the Project Design Segment of Traction 2.0, facilitated by PuzzleFun World and hosted by the IUT CAD Society.
- **SOLIDWORKS Certifications | Dassault Systèmes**
 - Certified SolidWorks Associate (CSWA), May 2021

- Certified SolidWorks Professional (CSWP), *May 2022*
- Certified SolidWorks Professional - Drawing, *September 2022*
- Certified 3DEXPERIENCE 3DSwymer - Associate, *March 2024*