Md Moynul Hasan

mdmoynul.hasan@rockets.utoledo.edu | mmh38.github.io | Md Moynul Hasan

Toledo, Ohio 43607, United States

Education

- **The University of Toledo** — Jan 2024 – Dec 2025
  M.S. in Mechanical Engineering — Toledo, OH, USA
  Focus: Thermal-Fluid Sciences
  GPA: 3.76 / 4.00
- **Bangladesh University of Engineering and Technology (BUET)** — Feb 2017 – Aug 2022
  B.Sc. in Naval Architecture and Marine Engineering — Dhaka, Bangladesh
  GPA: 2.93 / 4.00

Publications

1. Keval Suthar, **Md Moynul Hasan**, Saketh Merugu, Michal Marszewski, Anju Gupta. Pool Boiling Enhancement With High Entropy Oxides (HEOs). *In Preparation*, 2025.
2. Abishek Balsamy-Kamaraj, **Md Moynul Hasan**, Saketh Merugu, Anju Gupta. Comparison of 3D-Printed Copper Surfaces for Enhanced Pool Boiling Heat Transfer. *Manufacturing Letters*, 2025.
   DOI: https://doi.org/10.1016/j.mfglet.2025.06.184
3. Saketh Merugu, **Md Moynul Hasan**, Anupma Thakur, Jacob Patenaude, Babak Anasori, George Choueiri, Anju Gupta. $Ti_3C_2T_x$ MXene Additives for Enhanced Pool Boiling Regime. ***ACS Omega***, 2025.
   DOI: https://doi.org/10.1021/acsomega.4c06988 **Journal Cover**
4. **Md Moynul Hasan**, Md. Mashiur Rahaman, N. M. Golam Zakaria. Fast Aerodynamics Prediction of Wedge Tail Airfoils Using Multi-head Perceptron Network. *Arabian Journal for Science and Engineering (AJSE)*, 2024.
   DOI: https://doi.org/10.1007/s13369-023-08686-9
5. **Md Moynul Hasan**, Mohammad Fahim Faisal, N. M. Golam Zakaria, Md. Mashiur Rahaman. Predicting Aerodynamic Characteristics of Airfoils Using Artificial Neural Network. *Research Square*, 2024.
   DOI: https://doi.org/10.21203/rs.3.rs-4156906/v1
6. **Md Moynul Hasan**, Md. Mashiur Rahaman, N. M. Golam Zakaria. The Effects of Wedge Tail Thickness on NACA 0021 Airfoil Performance. *Journal of Maritime Research (JMR)*, 2023.
   DOI: https://doi.org/10.21203/rs.3.rs-4156906/v1
7. Md. Latifur Rahman, Nusrat Binta Nizam, Prasun Datta, **Md Moynul Hasan**, Taufiq Hasan, Mohammed Imamul Hassan Bhuiyan. A Wavelet-CNN Feature Fusion Approach for Detecting COVID-19 from Chest Radiographs. *11th International Conference on Electrical and Computer Engineering (ICECE)*, 2020.
   DOI: https://doi.org/10.1109/ICECE51571.2020.9393085

Research Projects

Enhanced Pool Boiling using High Entropy Oxides (HEOs) [PDF]

Jan 25 – Present

Supervisor: Dr. Anju Gupta & Dr. Michal Marszewski — Toledo, OH, USA

- Conducted pool boiling experiments using HEOs as additives in deionized (DI) water, including spinel, perovskites [$La(Co_{0.2}Cr_{0.2}Fe_{0.2}Mn_{0.2}Ni_{0.2})O_3$, $Y(Co_{0.2}Cr_{0.2}Fe_{0.2}Mn_{0.2}Ni_{0.2})O_3$], and rock salt.
- Improved critical heat flux (CHF) by **66.1%** with $La(Co_{0.2}Cr_{0.2}Fe_{0.2}Mn_{0.2}Ni_{0.2})O_3$ and heat transfer coefficient (HTC) by **136.5%** with Y-based perovskite, both at 0.05 wt%, compared to plain copper in DI water.
- Conducted a **15**-day dispersion test in DI water using ultrasonication, capturing images for analysis and identifying mechanisms like de-agglomeration, hydroxyl group formation, and electrostatic repulsion.

Enhanced Pool Boiling on 3D Printed Copper Surfaces [📄] Apr 24 – Aug 24
Supervisor: Dr. Anju Gupta & Dr. Abishek Balsamy-Kamaraj Toledo, OH, USA

- Performed comparative analysis of six 3D printed copper thermal enhancement surfaces to assess pool boiling performance using DI water, ethanol, and water/ethanol mixtures (90/10 and 60/40 wt%).
- Conducted pool boiling on fused deposition modeling (FDM) copper surfaces, achieving a **260%** CHF increase with ethanol on the vertical wave surface, with an enhancement ratio for CHF (ER_{CHF}) of **3.53**.
- Measured surface roughness and linked wicking-assisted bubble dynamics to better liquid replenishment. The vertical wave surface (Sa = 6.7 ± 0.14 μm) showed a low enhancement index (EI) of **1.54** in DI water.

MXene Enhanced Pool Boiling Performance [📄] Jan 24 – Apr 24
Supervisor: Dr. Anju Gupta & Dr. Babak Anasori Toledo, OH, USA

- Investigated titanium carbide ($Ti_3C_2T_x$) MXene as a DI water additive for pool boiling, achieving a **70.1%** increase in CHF and **213.5%** in HTC at just 0.1 wt% compared to plain copper with DI water.
- Measured sessile drop contact angle, showing a **33.7%** reduction in contact angle on copper after boiling with 0.1 wt% MXene compared to plain copper with DI water, indicating enhanced wettability.
- Performed comparative analysis with literature, showing **11%** higher CHF and **45%** higher HTC than top Ag/ZnO fluids, establishing $Ti_3C_2T_x$ MXene dispersions as superior for advanced thermal management.

Neural Network Modeling of Wedge Tail Airfoils [📄] Mar 23 – Jul 23
Supervisor: Dr. N. M. Golam Zakaria & Dr. Md. Mashiur Rahaman Dhaka, Bangladesh

- Engineered a dataset of **220** RANS-CFD simulationa for NACA airfoils with wedge tails, enabling robust training of machine learning (ML) models to predict aerodynamic performance for marine applications.
- Developed a multi-head perception (MHP) network to predict flow fields and aerodynamic coefficients, achieving **125x** speedup over RANS-CFD with R^2 up to **0.9999**, outperforming traditional ML models.
- Validated MHP predictions against RANS-CFD with near-**zero** residuals for velocity fields and accurate lift/drag estimates, enabling **point-by-point** flow predictions to improve accuracy near airfoil boundaries.

Wedge Tail Thickness Effects on NACA 0021 Airfoil [📄] Oct 22 – Mar 23
Supervisor: Dr. N. M. Golam Zakaria & Dr. Md. Mashiur Rahaman Dhaka, Bangladesh

- Designed wedge tail geometries for NACA 0021 airfoil with trailing edge thicknesses of **0.1**, **0.125**, and **0.15** times chord length (c), boosting lift coefficient (C_L) by up to **100%** at Re = $\mathbf{1 \times 10^6}$.
- Conducted RANS-CFD simulations using ANSYS Fluent to analyze aerodynamic performance over Mach (0.05–0.25) and Reynolds numbers (0.25×10^6–1×10^6), optimizing lift and drag for marine rudders.
- Evaluated the impact of angle of attack (**1–9°**), identifying wedge tail with **0.125c** as the optimal design with the highest lift coefficient increase of **60–100%**, balancing drag penalties for ship maneuverability.

Work Experience

Interfacial Thermal and Transport Laboratory (ITTL) [🌐] Jan 2024 - Present
Graduate Research Assistant Toledo, OH, USA

- Conducted pool boiling experiments with DI water, ethanol, and water/ethanol mixtures on 3D-printed copper surfaces, assessing thermal enhancement geometries and the effects of $Ti_3C_2T_x$ MXene and HEO additives. Contributed to publications in top-tier journals, including one featured on the **journal cover.**
- Developed a Python-based pipeline to automate post-processing of LabVIEW temperature acquisition data, computing wall superheat, heat flux, and HTC, replacing manual Excel-based methods and reducing data analysis time from hours or days to **seconds**.
- Enhanced experimental throughput by streamlining data analysis workflows, enabling **faster** iteration and systematic testing of diverse surface geometries and fluid additive concentrations. This optimization led to **richer** datasets, deeper insights, and significantly improved research outcomes.

Bangladesh University of Engineering and Technology (BUET) Oct 2022 – Jul 2023
Research Assistant Dhaka, Bangladesh

- Conducted RANS-CFD simulations using ANSYS Fluent to evaluate the effects of wedge tail on NACA 0021 airfoil lift and drag characteristics under varying Mach and Reynolds numbers.
- Developed ML models using MHP to predict flow fields, such as pressure and velocity, along with lift and drag coefficients for various wedge tail airfoils, validated against RANS-CFD simulations.
- Authored a **Q1** journal article on MHP-based wedge tail airfoils aerodynamic predictions and a **Q2** article on RANS-CFD analysis of NACA 0021 wedge tail airfoil, contributing to manuscript drafting and revision.

Academic Projects

Design of a General Cargo Ship Of 2500 Tonnes Cargo Capacity [PDF] Jul 19 – Dec 20
Supervisor: Dr. N. M. Golam Zakaria Dhaka, Bangladesh

- Designed a 2500-tonne cargo ship for the Dhaka-Chittagong route (304 km) with 10-knot speed and optimized dimensions **(L = 73.8 m, B = 13.7 m, T = 4.2 m)** using empirical and Posdunine/Benford methods.
- Conducted comprehensive structural and hydrostatic analyses, including scantling, lines plan, and stability calculations, ensuring compliance with ABS/GL rules and achieving a maximum GZ at **40°**.
- Developed detailed construction plans (midship section, shell expansion, rudder arrangement) and performed resistance and power calculations, enabling a trimmed stern draft of **4.26** m.

Teaching and Volunteer Experience

The University of Toledo Jan 2024 – Present
Graduate Teaching Assistant Toledo, OH, USA

- **MIME 2700: Applied Measurement and Instrumentation**
  Course Teacher: Dr. George Choueiri
  Supported a cohort of **39** students in Summer 2024 by conducting lab sessions on sensors, electrical circuits, LabVIEW-based data acquisition, and instrumentation. Guided hands on experiments involving strain gauges, thermocouples, RC filters, and rotary encoders. Mentored Arduino-based final projects and evaluated lab reports, emphasizing analytical clarity and technical accuracy.
- **MIME 3410: Thermodynamics II**
  Course Teacher: Dr. Sorin Cioc, Dr. Omid Amili, & Dr. Qiuying Zhao
  Appointed as a TA for four consecutive terms (Summer 2024 - Summer 2025) for consistent performance and subject expertise. Supported a total of **163** students by creating problem sets, preparing solutions, holding office hours, and grading assessments. Assisted with topics including vapor power cycles, refrigeration, and combustion analysis, enhancing student understanding.
- **MIME 3420: Fluids Laboratory**
  Course Teacher: Dr. Omid Amili
  Conducted lab sessions for a cohort of **25** students during Spring 2025, covering experiments on surface tension, buoyancy, viscosity, Bernoulli's principle, pipe flow, and airfoil aerodynamics. Held TA office hours, guided students in data analysis and lab report writing, and evaluated final quizzes and reports, focusing on technical accuracy and conceptual understanding.

Volunteer and Notetaker, NWO 6th Women's Equality Day [in] Aug 2024
Women of Toledo Toledo, OH, USA

- Documented insights from **6** women of diverse backgrounds in an Economic Justice discussion, capturing **7** key areas (e.g., housing, childcare, equal pay) to advance gender equity advocacy.
- Synthesized discussions on financial literacy and workplace equality, highlighting needs like budgeting education and paid parental leave, fostering actionable gender equity solutions.
- Enhanced analytical and communication skills through active listening and summarization, contributing to community driven strategies for systemic gender equity.

Leadership Experience

Member at Large [in] Aug 2024 - Apr 2025
Association of MIME Graduate Students (AMGS), The University of Toledo Toledo, OH, USA

- Contributed to Grad Sound Bites for **15+** graduate students from Civil, Chemical, and Mechanical Engineering, supporting 3-minute research presentations, and a MIME student faculty lunch.
- Supported an industrial tour to First Solar and NorthStar BlueScope Steel plants and new graduate student orientation, enhancing industry exposure and integration for **20-30** MIME students.
- Collaborated on a graduate seminar and fireside chat with Dr. Aranya Chauhan (Tesla Energy) and volunteered on Women's Equality Day 2024, documenting **7** Economic Justice areas to support gender equity.

Technical Skills

- **Engineering Software:** AutoCAD, SolidWorks, Rhinoceros 3D, ANSYS Fluent, OpenFoam
- **Programming Languages:** Python, R, MATLAB, C++, Fortran
- **ML Library:** TensorFlow, Keras, PyTorch, Scikit-learn, OpenCV
- **Data Analysis:** NumPy, Pandas, MS Excel
- **Data Visualization:** Matplotlib, Seaborn, OriginPro, Paraview, Tecplot
- **Experimental Tools:** Attension® Theta Lite, Optical Profilometer, High Speed Camera, LabVIEW
- **Embedded Systems:** Arduino
- **Writing:** LaTeX, MS Word
- **Presentation and Graphics:** MS PowerPoint, Inkscape, GIMP

Relevant Coursework

Fluid and Thermal Sciences

• Hydrostatics and Stability[1] • Fluid Mechanics[1] • Marine Hydrodynamics[1] • Resistance and Propulsion of Ships[1] • Experimental Fluid Mechanics[2] • Marine Engineering[1] • Basic Thermal Engineering[1] • Heat Transfer[1] • Intermediate Fluid Mechanics and Heat Transfer[2]

Mathematics and Physics

• Differential Calculus and Integral Calculus[1] • Coordinate Geometry and Ordinary Differential Equation[1] • Vector Analysis and Differential Equation (Special Types)[1] • Statistics, Partial Differential Equation and Matrices[1] • Fourier Analysis, Harmonic Function, Complex Variable and Laplace Transforms[1] • Advanced Engineering Mathematics I[2] • Reliability[2] • Structure of Matter, Electricity & Magnetism and Modern Physics[1] • Waves & Oscillations, Geometrical Optics and Wave Mechanics[1]

Computational and Design Methods

• Numerical Computations[1] • Control Engineering[1] • Advanced MATLAB for Engineers[2] • Computational Fluid Dynamics I[2] • Ship Design and Drawing[1] • Computer Aided Design (CAD)[1] • Computer Programming in Ship Design[1] • Optimization Methods in Ship Design[1]

Materials and Mechanical Properties

• Shipbuilding Materials[1] • Advanced Materials Science and Engineering[2] • Mechanics of Structure[1] • Ship Structure[1] • Ship Construction[1]

Online Courses

• Machine Learning[3] • Deep Learning Specialization[3] • TensorFlow Developer Professional Certificate[3] • A Hands-on Introduction to Engineering Simulations[4] • MATLAB and Octave for Beginners[4] • AI in the Sciences and Engineering[5]

[1] Undergraduate [2] Graduate [3] Coursera [4] edX [5] ETH Zürich