# MD JAHANGIR ALAM

*Researcher—Thermoelectric Module Design & Refrigeration Systems*

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## RESEARCH PROFILE

Heat transfer has been my focus from the start — a Refrigeration & Air-Conditioning diploma (class rank 2), a B.Eng. in Mechanical Design at JUST (class rank 1, top 1%), and an M.Eng. at Laurentian (top 2%) have built a foundation spanning vapour-compression systems, ANSYS/Abaqus structural and thermal FEM, SolidWorks Simulation, and MATLAB thermal modelling. My graduate project on lithium-ion battery thermal management and a review paper on hybrid TEC + vapour-compression sub-cooling architectures put thermoelectric cooling at the centre of my academic work. I now want to deepen that into doctoral research—specifically the mechanical robustness, module fabrication, and system-level integration of magnesium-based thermoelectric coolers for solid-state refrigeration.

## RESEARCH INTERESTS

Thermo-mechanical stress, fatigue, and reliability of thermoelectric modules under thermal cycling (FEM/FEA) • Magnesium-based TE materials ($Mg_2(Si,Sn)$, $Mg_3Sb_2$) — module fabrication, mechanical robustness, and performance testing • Interface and contact engineering: diffusion barriers, bonding, and soldering for TE devices • Hybrid vapour-compression + thermoelectric refrigeration, Peltier sub-cooling, and COP optimisation • Battery-pack thermal management and heat-exchanger design • CFD and structural FEA of thermal enclosures and cooling systems.

## EDUCATION

**M.Eng. in Engineering Science** Jan 2023 – Oct 2024

*Laurentian University, Bharti School of Engineering — Sudbury, ON, Canada • Standing: top 2% of cohort*

- Research project on heat generation and thermal management of battery EVs. Relevant coursework: Research Methods, Project Management.

**M.Eng. in Mechanical Engineering** (Online, 31 credits, discontinued) Sep 2022 – Jun 2024

*Jiangsu University of Science and Technology (JUST) — Zhenjiang, China • Standing: top 1% of cohort*

- Graduate coursework in CAE Technology and Application, Modern Design Theory, Modern Manufacturing Technology, Precision & Ultra-Precision Machining, Modern CNC Machining, Modern Control Theory.

**B.Eng. in Mechanical Design, Manufacturing & Automation** Sep 2018 – Jun 2022

*Jiangsu University of Science and Technology (JUST) — Zhenjiang, China • Standing: class rank 1, top 1%*

- Relevant coursework: Thermal Engineering Fundamentals, Mechanics of Materials, Theoretical Mechanics, Application of CAE Technology, Mechanical Design, 3D CAD Modelling & Drawing, CNC Technology, Hydraulic & Pneumatic Transmission, Advanced Manufacturing Technology, Product Design of Mechatronic Technology, Computer Programming (C++).

**Diploma in Refrigeration & Air-Conditioning Technology** Jan 2014 – Dec 2017

*Brahmanbaria Polytechnic Institute — Bangladesh Technical Education Board • Standing: class rank 2*

- Relevant coursework: Thermodynamics, Refrigeration Cycles & Components, Air-Conditioning Systems, Psychrometrics & Heat Load Calculation, HVAC Installation & Commissioning, Peltier Cooling, Cold Storage & Industrial Chillers.

## RESEARCH & ACADEMIC PROJECTS [drive link]

**Thermal, Cooling & Energy Systems**

- **Project: Heat Generation & Thermal Management of Battery EVs** — Modelled heat generation in lithium-ion packs and compared air, liquid, PCM, and thermoelectric cooling strategies using MATLAB and ANSYS thermal simulations. [Laurentian, Jul 2023]
- **Review Paper: Advances in Hybrid Thermoelectric Refrigeration** — Surveyed hybrid TEC-vapour-compression architectures; analysed COP trade-offs, ZT material selection, and Peltier sub-cooling integration strategies for precision thermal management. [Laurentian, Research Methods, Mar 2023]
- **Quick Water Cooling System** — Invented a portable thermoelectric water chiller for the BBPI Annual Science Fair (2016); independently discovered the Peltier effect and built a TEC-based device that cooled 500 mL from 28°C to 8°C in under 8 minutes — 55% faster than a household refrigerator. [BBPI, 2016]

**FEM, Structural & Reliability Analysis**

- **FEA of Structural Models in Abaqus with Analytical Validation —** Built Abaqus FE models of structural components and checked the stress and displacement fields against analytical solutions [JUST 2022]

- **FEA of Bars, Beams, Plates & Structural Geometries (ANSYS) —** Static and modal ANSYS FEA on bars, beams, plates and more complex geometries; validated against closed-form solutions. [JUST, 2021]
- **Vibration-Based Condition Monitoring —** Vibration-signature analysis on rolling-element bearings to catch early-stage faults — applied to TE module reliability analysis as a transferable methodology. [Laurentian 2024]
- **Impact Testbed with PLC Control —** Drop-hammer impact testbed with automated release and PLC control, built to study crashworthiness and energy absorption of honeycomb materials; full 2D/3D SolidWorks package. [JUST, 2022]

**Mechanical Design, Automation & Manufacturing**

- **Selected projects:** Injection Mould for a Two-Plate Mine Cable Hook (runner/gate/cooling-channel design), • Belt Conveyor Transmission System, • Material Sorting Device, • CNC Tool-Path & Machining Simulation, • Household Room-Cleaning Robot, • Clutch-Gear Assembly & Fixture CAD, • Mechanical & Electrical Control Product Design. [JUST, 2020–2022]

**Other Academic Work**

- **Reports & seminars:** Sill-mat design for underground mine backfill (group project) • Hazard Identification & Risk Assessment in mining operations (OH&S course) • Seminar review on wastewater treatment by adsorption. [Laurentian]

## PROFESSIONAL EXPERIENCE

**Mechanical Designer (Freelance)** Jan 2018 – Present

*Upwork / independent clients — Remote (Canada, China, Germany, USA)*

- Delivered mechanical components and sub-assemblies in SolidWorks and AutoCAD for consumer-product, furniture and light-industrial clients; production-ready drawings with GD&T and BOMs.

**Product Development & Sourcing Specialist** Aug 2020 – Nov 2022

*AMACOA GmbH, Germany — Remote*

- Supported the German product-development team in specifying, sourcing, and qualifying mechanical and electromechanical components; worked between European engineers and Asian suppliers with DIN/EN documentation.

**Engineering Intern — Refrigeration & Air-Conditioning** Jun 2017 – Jun 2018

*Engineering Project Development Ltd., Bangladesh*

- Heating and cooling load calculations, cost estimation, and on-site commissioning support for vapour-compression and split-type systems.

## TECHNICAL SKILLS

**FEM / CAE:** ANSYS (thermal, structural, modal), Abaqus, SolidWorks Simulation, basic CFD, model validation against analytical solutions.

**Thermal & Refrigeration Systems:** MATLAB / Simulink thermal modelling, vapour-compression and absorption cycles, Peltier / thermoelectric coolers, heat-exchanger sizing, HVAC load calculation, battery-pack thermal management.

**CAD / Drafting:** SolidWorks, AutoCAD, MicroStation, CATIA (basic), GD&T (ISO 1101 / ASME Y14.5).

**Manufacturing & Controls:** CNC/CAM programming, injection-mould design, sheet metal, PLC-based control, mechanical measurement techniques.

**Programming & Tools:** MATLAB, C++ (coursework), Python (intro), LaTeX, Git (basic), Microsoft 365.

**Standards & Research:** ASME, CSA, DIN/EN familiarity; literature review, experimental planning, scientific writing, and fluent English for international collaboration.

## AWARDS & SCHOLARSHIPS

- **Ontario–Ukraine Solidarity Scholarship** — *Laurentian University, April 2024*. Awarded on academic merit and to students who lost employment because of the Russia–Ukraine conflict (remote role at AMACOA GmbH, Germany).
- **Jasmine Jiangsu Government Scholarship** (4 years) — *Jiangsu Provincial Government, 2019–2022*. Granted for outstanding academic performance and substantial volunteer contribution to the university community.
- **Academic Scholarship**, Top 1% (4 years*) — JUST, 2019–2022*. Annual award based on academic ranking.
- **Presidential Scholarship** (4 years)—*JUST, 2018*. Merit-based recognition during admission.
- **Skills & Training Enhancement Project (STEP) Scholarship** — *World Bank & Canada, BBPI 2014–2017;* competitive talent-based award for outstanding diploma-level students.

## LANGUAGES, LEADERSHIP & REFERENCES

**Languages:** English (fluent), Bengali (native), and German (beginner—actively improving).

**Leadership:** Head of Publicity, International Students' Union, JUST (2018–2020) • President, SAARC Human Rights Foundation (BBPI student chapter), Bangladesh (2016–2017).

**References:** Academic and professional references available on request.