Isha Bayad

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Education

Ph.D. in Mechanical Engineering GPA: 3.75/4.00
Focus in Thermal System Modeling and Controls Expected Graduation: May 2028
Purdue University, West Lafayette, IN

Bachelor of Technology in Chemical Engineering w/ GPA: 9.23/10.00
Minor in Mechanical Engineering Graduated: July 2023
Indian Institute of Technology Gandhinagar, India

Experience

Graduate Research Assistant, Prof. Neera Jain, Purdue University Jan 2025 – Present
Dynamic Component-level Modeling

- Developed the first-of-its-kind reduced-order graph-based dynamic model of a pressure- and temperature-tunable barocaloric phase change material (PCM) thermal energy storage (TES) device
- Experimentally validated the model for a microencapsulated PCM (in collaboration with TAMU)
- Verified model assumptions and heat transfer characteristics against Ansys at higher operating pressures

System-Level Integration, Control & Optimization

- Integrated barocaloric (pressure-tunable) TES device into a single-phase pumped fluid loop hybrid thermal management system to handle transient heat loads in high-power electronics and aerospace architectures
- Engineering a heuristic control strategy for maintaining electronic cold plate temperature by modulating the mass flow rate of the primary fluid, secondary fluid, and pressure of the PCM for faster and more thermal energy storage capacity
- Optimizing TES sizing, viability, and performance for pressure-driven thermal control under high-power operating conditions using set-based reachability for robust control co-design

Graduate Research Assistant, Prof. Andrea Vacca, Purdue University Aug 2023 – 2024

- Developed force-mode and speed-control algorithms for multi-pressure rail actuation, accurately tracking cylinder velocity commands under varying external loads
- Formulated valve-control logic with a 3-way proportional directional control valve to suppress fluid backflow during mode transitions, ensuring precise load holding and smooth dynamic response
- Simulated a 5-ton mini-excavator hydraulic dynamics in Simcenter Amesim, achieving a 33% relative energy efficiency over baseline load-sensing systems

Relevant Publications

- **I. Bayad**, N. Jain, "Pressure- and temperature-dependent dynamic model of a barocaloric phase change material thermal energy storage device," in the *Special Issue: Advanced Phase Change, Intl. Journal of Heat & Mass Transfer*, May 2026.
- **I. Bayad**, N. Jain, "Towards system-level integration of pressure-tunable barocaloric PCM energy storage devices for thermal management applications," in the *21st Intl. Refrigeration & Air Conditioning Conference at Purdue*, July 2026.
- T. Patel, L. Franquilino, E. Menegatti, **I. Bayad**, A. Vacca, C. Young, "An analysis of energy efficient hydraulic actuation architectures for mini excavators (presentation only)," in the *Fluid Power Conference at Purdue*, September 2024.

Skills

Software: MATLAB, Python, C++, Ansys Fluent & Mechanical, Simcenter Amesim, Aspen Plus, Simulink, Gurobi, Cantera
Teaching: ME365 (Fall '24, Spring '25), Redesigned ME375 (Summer '25) at Purdue; ES212 Fluid Mechanics, CL221 Chemical Engineering Thermodynamics, CL422 Process Control at IIT Gandhinagar
Spoken Languages: English, Hindi, Russian (Elementary Proficiency)
Leadership: Treasurer (Herrick Student Resource Committee, Purdue), Industrial Head (AIChE, IIT Gandhinagar), Sponsorship Team Lead (Annual Cultural Fest 2021, IIT Gandhinagar)