Arash Jalil Khabbazi, MS

PhD Student, Mechanical Engineering, Purdue University

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Research interests

I work on machine learning, optimization, and advanced control strategies for intelligent buildings and distributed energy resources.

Education

Purdue University, IN, United States — 2023 – Present
PhD in Mechanical Engineering — **GPA:** 4.0/4.0
(Minor: Computational Science and Engineering)
Adviser: Kevin J. Kircher

University of British Columbia, BC, Canada — 2021 – 2023
MS in Mechanical Engineering — **GPA:** 4.33/4.33 (94%)
Thesis: *Mixing gaseous hydrogen into natural gas distribution pipelines*
Adviser: Sunny Ri Li

University of Tabriz, EA, Iran — 2016 – 2020
BS in Mechanical Engineering — **GPA:** 4.0/4.0 (19.12/20) — **Rank:** 1/155+
Thesis: *Thermodynamic analysis of Kalina cycle system 11*
Adviser: S. Mohammad S. Mahmoudi

Publications

Journal articles

2. **A.J. Khabbazi**, E.N. Pergantis, L.D. Reyes Premer, P. Papageorgiou, A.H. Lee, J.E. Braun, G.P. Henze and K.J. Kircher, "Lessons learned from field demonstrations of model predictive control and reinforcement learning for residential and commercial HVAC: A review," *arXiv preprint*, 2025 (doi)

1. **A.J. Khabbazi**, M. Zabihi, R. Li, M. Hill, V. Chou, and J. Quinn, "Mixing hydrogen into natural gas distribution pipeline system through Tee junctions," *International Journal of Hydrogen Energy*, 2024. (doi)

Conference proceedings

4. **A.J. Khabbazi**, E.N. Pergantis, L.D. Reyes Premer, A.H. Lee, J. Ma, H. Liu, G.P. Henze, K.J. Kircher, "What Have We Learned From Field Demonstrations of Advanced Commercial HVAC Control?," *International High Performance Buildings Conference*, 2024, pp. 1–10. (doi)

3. **A.J. Khabbazi**, M. Zabihi, R. Li, V. Chou, and J. Quinn, "Blending of Hydrogen into a Natural Gas Distribution Pipeline in British Columbia through a Tee Junction for Reducing GHG Emissions," *Canadian Society for Mechanical Engineering International Congress*, 2023, pp. 1–6. (doi)

2. **A. Khabbazi**, R. Li, and J. Quinn, "Green Hydrogen Supply to Urban Infrastructure and Buildings through Blending into the Existing Grid," *Canadian Society for Mechanical Engineering International Congress*, 2022, pp. 1–1. (doi)

1. **A. Khabbazi**, R. Li, and J. Quinn, "The Blending and Transmission of Hydrogen and Natural Gas in Transmission and Distribution Pipelines," *International Green Energy Conference (IGEC-XIII)*, 2021, pp. 1–1. (doi)

Honors & awards

Selected

ASHRAE Graduate Student Grant-in-Aid Award. *(link)*. — ASHRAE, 2025

Best Paper Award at CSME 2023 Conference. *(link)*. — CSME, 2023

Best Presentation Award at CSME 2022 Conference, Advanced Energy Symposium. *(link)*. CSME, 2022

Others

Purdue University Graduate School "Say It In 6" Finalist. Purdue, 2024

UBC Graduate Scholarship. UBC, 2022

UBC Dean's Entrance Scholarship. UBC, 2021

2nd rank in CGPA (4.0/4.0) among 155+ students. BS, 2016 – 2020

Conferences

8th International High Performance Buildings Conference, West Lafayette, USA 07/2024

ASHRAE Winter Conference, Chicago, USA 01/2024

Canadian Society for Mechanical Engineering 2023 Conference, Sherbrooke, Canada 05/2023

Canadian Society for Mechanical Engineering 2022 Conference, Edmonton, Canada 07/2022

13th International Green Energy Conference, Virtual 07/2021

Workshops & seminars

Intelligent Building Operations (IBO) Workshop, West Lafayette, USA 07/2024
What have we learned from field demonstrations of advanced commercial HVAC control? (Recording)

Industry experience

PhD Intern, Tesla (Reno, NV, United States) 05/2025 – 08/2025

- Developed machine learning models for applications in Drive Unit Inverter team.

Student Researcher, FortisBC, Renewable Gas Supply (Greater Vancouver, Canada) 09/2021 – 09/2023

- Reviewed project progress and contributed to **technical assessments** on **natural gas pipeline systems**, including UBC H_2Lab construction.
- Analyzed **distribution pipeline data** and collaborated with the FortisBC team to support **renewable gas supply** initiatives.

Research experience

PhD Research Assistant, Purdue University (IN, USA) 09/2023 – Present

- Contributed to the **commissioning of Herrick Labs** as a testbed for advanced HVAC control by assisting in retrofitting its **Building Automation System (BAS)** with **Tridium Niagara** and integrating **ModBus** for real-time monitoring. Helped develop **occupant-facing dashboards** for comfort and energy feedback.
- Developed **machine learning models** for smart HVAC control at Herrick Labs, using **CO_2 sensor data** to detect occupancy with **98.3% accuracy**. Automated data pipelines in **Python** and optimized real-time analysis with **InfluxDB** and **Linux**, integrating results into control strategies for dynamic energy management.
- Designed and simulated **MPC** and **DeePC**-based HVAC control using **MATLAB CVX** and **Python CVXPY**, optimizing energy use and comfort. Evaluated **MPC's model-based** vs. **DeePC's data-driven** approach, showing DeePC's ability to match MPC performance without an explicit system model.
- Reviewed 100+ peer-reviewed studies on field demonstrations of advanced HVAC control in residential and commercial buildings. Used **Python** and **visualization tools** to analyze research trends. Presented findings at **one conference** and **one workshop**; a high-impact **journal review paper** is in preparation.
- Conducted **thermodynamic modeling** of **low-GWP refrigerants** in heat pump systems for cold climates. Developed cycle models in **EES**, analyzing efficiency trade-offs to inform sustainable HVAC design and decarbonization efforts.

MS Research Assistant, University of British Columbia (BC, Canada) 07/2021 – 09/2023

- Conducted a **comprehensive study** on the **injection of hydrogen into natural gas pipelines**, including **CFD analysis**, real gas modeling in **C**, and CAD-based **pipeline design**.
- **Analyzed 1 TB of data**, published **one journal paper**, and presented findings at **three conferences**, earning **two awards**.

Teaching experience

Graduate Teaching Assistant, University of British Columbia (BC, Canada) 09/2021 – 04/2023

- Co-taught fundamental and specialized **mechanical engineering courses**, including Engineering Analysis I, Fluid Mechanics II Lab, and Heat Transfer Applications Lab.
- Achieved an overall satisfaction rate **exceeding 80%**, based on course evaluations.

Skills

Programming: Python, C, MATLAB, Markdown, Git, HTML, R

Machine Learning & Data Science: TensorFlow, Keras, NumPy, Pandas, scikit-learn, SciPy, Matplotlib, Seaborn

Data Management & Operating Systems: MySQL, Grafana, InfluxDB, Linux

Communication Protocols: Modbus, IO-Link, MTConnect

Engineering Tools: EES, ANSYS Workbench, OpenFOAM, Tecplot, SOLIDWORKS, CATIA

Selected courses

Thermal and Energy Systems: Distributed Energy Resources (ME597) — Analysis of Thermal Systems (ME518) — Advanced Thermodynamics (ME500) — Thermodynamics I&II — Refrigeration Systems — Power Plants — Heat Transfer I

Applied Mathematics & Data Science: Applied Machine Learning (ENGR418) — Statistical Methods (STAT511) — Advanced Mathematics I (MA527) — Numerical Computations

Automation, Control, and IoT: Introduction to Convex Optimization (AAE561) — Industrial IoT Implementation (ME597)

Fluids: Computational Fluid Dynamics (CFD) — Fundamentals of CFD — Multiphase Flows — Turbulence — Fluid Mechanics I&II

Academic services

Society memberships:

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 2023 – present
Canadian Society for Mechanical Engineering (CSME) 2021 – present

Reviewing:

8th International High Performance Buildings Conference, West Lafayette, USA 07/2024

Certifications

Supervised Machine Learning: Regression and Classification. *(Certificate)*. Deep learning.AI

Introduction to Data Science in Python. *(Certificate)*. Coursera

Applied Plotting, Charting & Data Representation in Python. *(Certificate)*. Coursera

Python Data Structures. *(Certificate)*. Coursera