

Arash Jalil Khabbazi, MS

🎓 PhD Student, Mechanical Engineering, Purdue University

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Research interests

energy and data enthusiast exploring thermal systems, HVAC, and buildings, as well as the power grid through smart control, optimization, and machine learning.

Education

Purdue University, IN, United States 2023 – Present
PhD in Mechanical Engineering — **GPA:** 3.94/4.0
(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) — Highest Honors and Distinction
Thesis: *Thermodynamic and Exergy Analysis of Double-Pressure Kalina Cycle System (KCS-11)*
Adviser: [S. Mohammad S. Mahmoudi](#)

Professional and research experience

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 **CO₂ 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**.

Industry experience

Research Engineer, 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 H₂Lab construction.
- Analyzed **distribution pipeline data** and collaborated with the FortisBC team to support **renewable gas supply** initiatives.

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, MTCConnect

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

Publications

Journal articles

3. **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,” *In review*. (doi)
2. **A. J. Khabbazi** and K. J. Kircher, “Small demonstrations of heating and cooling control in larger buildings risk overestimating savings,” *under preparation*.

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

5. E. N. Pergantis, L. D. Reyes Premer, **A. J. Khabbazi**, Priyadarshan, F. Wu, D. Ziviani and K. J. Kircher, “Active current limiting control of residential appliances for breaker panel protection across the US: a parametric study,” *CISBAT 2025 International Scientific Conference on the Built Environment in Transition*, 2025, *accepted*

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

- Best Paper Award at CSME 2023 Conference. ([link](#) [in](#)). CSME, 2023
- Best Presentation Award at CSME 2022 Conference, Advanced Energy Symposium. ([link](#) [in](#)). 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](#))

Academic Service

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