

Po-Ching Hsu

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EDUCATION

Ph.D. in Mechanical Engineering, GPA 3.9/4.0 (Advanced to Candidacy, Apr. 2025) Expected May 2026
University of Maryland, College Park College Park, MD

- Supervisors: Prof. Reinhard Radermacher, Prof. Yunho Hwang
- Concentration: Thermal systems & controls
- Dissertation: Experimental Investigation and Data-Driven Modeling for Variable Refrigerant Flow Systems

M.S. in Mechanical Engineering, GPA 3.8/4.3 June 2017
National Taiwan University Taipei, Taiwan

- Supervisors: Prof. Hsiao-Kan Ma
- Concentration: Thermoscience
- Thesis: A Bi-cell Proton Exchange Membrane Fuel Cell Stack with a Magnetically Driven Piezoelectric Actuator

B.S. in Energy and Refrigerating Air-Conditioning Engineering June 2015
National Taipei University of Technology Taipei, Taiwan

- Supervisors: Prof. Lian-Han Chien
- Concentration: Thermal systems
- Capstone Project: An Experimental and Numerical Study of Impinging Micro Channels of Di-electric Fluid for Chip Cooling (Best Undergraduate Capstone Project)

RESEARCH & PROFESSIONAL EXPERIENCE

Graduate Research Assistant (Ph.D.) Aug. 2021 – Present
Center for Environmental Energy Engineering, University of Maryland College Park, MD

Supervisors: Prof. Reinhard Radermacher, Prof. Yunho Hwang

Research Projects:

VRF System Field Testing, Data-Driven Modeling and Control Aug. 2021 – Present

- Conducted field testing and data analysis to evaluate VRF system performance and occupant comfort across diverse operating modes and environmental conditions, enriching the long-term performance database
- Developed LSTM models for VRF systems that accurately captured system dynamics, achieving 87% model size reduction and 11% accuracy improvement using Bayesian optimization for hyperparameter tuning, validated with field test data
- Achieved 46% higher accuracy and 67% greater physical consistency by developing a hybrid model for VRF systems, enabling model-based optimized control (MPC) that reduced energy consumption by 10% while maintaining thermal comfort

Residential Heat Pump Field Testing July 2024 – Present

- Deployed IoT sensing and built a data pipeline to collect and preprocess cloud data from R-32 residential heat pump and water heater units, supporting system performance evaluation and validation

Impact of Internal Heat Exchanger (IHX) and Oil Retention on R410A and R454B Systems Jan. 2023 – Dec. 2024

- Conducted experiments and thermodynamic modeling in EES of advanced vapor compression cycles with IHX, guiding next-generation low-GWP and environmentally compliant system designs
- Performed oil retention tests following ASHRAE Standard 41.4, validating a 6–21% reduction in oil circulation ratio (OCR) with oil separators in R-454B systems

Numerical Study of Air Maldistribution Influence on Heat Pump Performance June 2023 – Apr. 2024

- Developed automated CFD + ML surrogate modeling workflow (PyAnsys) reducing simulation time by 90% and integrated CFD air velocity profiles with CoilDesigner heat exchanger and Vapcyc system models for comprehensive heat pump analysis
- Calibrated Vapcyc models with experimental data ($\pm 20\%$ accuracy), identifying up to 7% capacity and 10% COP degradation from air maldistribution, informing coil design optimization

Enhancement of In-tube Heat Transfer Experiments Aug. 2021 – Mar. 2022

- Redesigned and improved test facility, reducing uncertainty in two-phase heat transfer measurements and improving the experimental accuracy of tube-in-tube heat exchangers

Teaching Assistant Aug. 2022 – Dec. 2022
Department of Mechanical Engineering, University of Maryland College Park, MD

Course: *Sustainable Energy Conversion and the Environment (ENME701)*

- Assisted course instructors with grading assignments, quizzes, and student projects, ensuring consistency and fairness in evaluation

Thermal Engineer

Foxconn Technology Group

Nov. 2017 – Mar. 2021

New Taipei, Taiwan

- Led thermal design and validation for enterprise server platforms (HPC, GPU, storage, and edge servers, AI accelerator cards, autonomous vehicle control boxes), ensuring compliance with mechanical and thermal requirements for large-scale deployments

Key Achievements:

- Designed, simulated, and validated vapor chamber heat sink via thermal simulation, prototype testing, and tolerance analysis, reducing thermal resistance by 12% and increasing chipset thermal margin by 5°C under strict design constraints for Qualcomm AI Accelerator Cards (projected for 1M annual sales)
- Improved the thermal margin of critical components by 5°C to mitigate thermal throttling under fan redundancy via air duct optimization, collaborating with cross-disciplinary teams (mechanical, electrical, and PCB layout) to ensure manufacturability and installation compliance for High-Density Storage Server (EBOF)
- Cut chamber test time by 70% by applying design-of-experiments to CFD simulations and experiments, identifying critical cases and designing verification plans with software team to develop thermal policies for GPU Server Cooling Systems
- Reduced manufacturing costs by 10% while maintaining thermal performance by leading thermal design reviews, collaborating with overseas vendors, and applying design-for-manufacturing principles to refine product architecture and component selection (fan, thermal pad) for an HPC Server Cooling Solution

Graduate Research Assistant (M.S.)

Energy and Environment Lab, National Taiwan University

Sept. 2015 – June 2017

Taipei, Taiwan

Supervisors: Prof. Hsiao-Kan Ma

Research Projects: *Proton Exchange Membrane Fuel Cell Stack with Piezoelectric Air-Breathing Pump*

- Improved the airflow of a piezoelectric air-breathing pump for a PEM fuel cell stack by 30% through CFD-optimized design
- Boosted maximum net power output of the fuel cell stack by 20% via a novel air-breathing pump design
- Reduced fuel cell stack volume by 68% and weight by 76% through an innovative actuator design

Undergraduate Researcher

Two Phase Flow and Heat Transfer Enhancement Lab, National Taipei University of Technology

Feb. 2014 – Jan. 2015

Taipei, Taiwan

Supervisors: Prof. Lian-Han Chien

Research Projects: *Experimental and Numerical Study of Dielectric Fluid Impinging Microchannels for Chip Cooling*

- Reduced thermal resistance by 30% in a two-phase dielectric fluid (FC-72) chip cooling module by optimizing jet orifice dimensions of an impinging microchannel heat sink through CFD simulations and experimental validation

PUBLICATIONS – JOURNALS & THESES

- **Hsu, P.-C.**, & Hwang, Y. (2026). Hybrid machine learning–physics-based modeling and model predictive control of variable refrigerant flow systems in buildings. *Energy and Buildings*, 356, 117086. <https://doi.org/10.1016/j.enbuild.2026.117086>.
- **Hsu, P.-C.**, Gao, L., Hwang, Y., & Radermacher, R. (2025). *A review of the state-of-the-art data-driven modeling of building HVAC systems*. *Energy and Buildings*, 342, 115881. <https://doi.org/10.1016/j.enbuild.2025.115881>.
- **Hsu, P.-C.**, Gao, L., & Hwang, Y. (2025). *Comparative study of LSTM and ANN models for power consumption prediction of variable refrigerant flow (VRF) systems in buildings*. *International Journal of Refrigeration*, 169, 55–68. <https://doi.org/10.1016/j.ijrefrig.2024.10.020>.
- Ma, H., Hsu, Y., & **Hsu, P.-C.** (2017). *A Novel Hybrid Actuator Driven Magnetically in the Bi-Cell PEM Fuel Cell Stack*. *Metals*, 7(11), 453. <https://doi.org/10.3390/met7110453>.
- **Hsu, P.-C.** (2017). *A Bi-cell Proton Exchange Membrane Fuel Cell Stack with a Magnetically Driven Piezoelectric Actuator* (Master's thesis, National Taiwan University, Department of Mechanical Engineering). <https://doi.org/10.6342/NTU201701095>.

CONFERENCE PUBLICATIONS

- **Hsu, P.-C.**, & Hwang, Y. (2026, January). *A Hybrid Modeling Approach for Variable Refrigerant Flow Systems*. Paper to be presented at the 2026 ASHRAE Winter Conference, Las Vegas, NV, USA. (Accepted for presentation)
- **Hsu, P.-C.**, Gao, L., & Hwang, Y. (2025, June). *Field Testing and Data-Driven Modeling of VRF Systems in Buildings [Poster presentation]*. *Deep Learning for Science School*, Lawrence Berkeley National Laboratory, Berkeley, CA, USA. <https://dl4sci-school.lbl.gov/posters>.
- **Hsu, P.-C.**, Ma, H., Hsu, Y., & You, Y.-X. (2017, July). *Magnetically driven piezoelectric proton exchange membrane fuel cell stack with built-in manifold*. In *Proceedings of 2nd International Conference on Battery &*

Fuel Cell Technology 2017: Journal of Fundamentals of Renewable Energy and Applications, 7(6), 56.
<https://doi.org/10.4172/2090-4541-C1-035>.

- Hsu, Y., Ma, H., **Hsu, P.-C.**, & You, Y.-X. (2017, July). *Development of a Bi-Cell proton exchange membrane fuel cell with optimized groove-designed piezoelectric actuator*. In *Proceedings of 2nd International Conference on Battery & Fuel Cell Technology 2017: Journal of Fundamentals of Renewable Energy and Applications*, 7(6), 55. <https://doi.org/10.4172/2090-4541-C1-035>.

AWARDS & HONORS

- **ASHRAE-National Capital Chapter Endowed Scholarship**, awarded by ASHRAE Dec. 2025
- **Registration fee waiver and accommodation support** as a selected participant (top 35% of 500+ applicants) for Deep Learning for Science School, Berkeley, CA, awarded by Lawrence Berkeley National Lab June 2025
- **Jacob K. Goldhaber Travel Grant**, awarded by University of Maryland May 2025
- **Distinguished Graduate Endowed Fellowship for Energy Innovation**, awarded by University of Maryland Mar. 2023
- **Full sponsorship (airfare and registration fee)** for 2nd International Conference on Battery & Fuel Cell Technology, Rome, Italy, awarded by Taiwan's National Science and Technology Council July 2017
- **Best Undergraduate Capstone Project Award**, awarded by Taiwan Society of Heating, Refrigerating and Air-Conditioning Engineers (TSHRAE) Apr. 2015
- **Hitachi Air Conditioning Scholarship**, awarded by Hitachi Air Conditioning Taiwan Co., Ltd. May 2014

MEDIA & RECOGNITION

- Featured in **Time Magazine article**: "How AI Is Making Buildings More Energy-Efficient" (Dec. 11, 2024) — for my research on using AI to improve HVAC energy efficiency and sustainability
- Featured in **Maryland Today**: "AI Face-off: Researchers Pit Old AI Tech vs. New in HVAC Efficiency Test" (Nov. 7, 2024)
- International Journal of Refrigeration — **Most Downloaded Paper in the journal over a 90-day period** (Mar. 2025)

REVIEWER

- Paper Reviewer, 2026 ASHRAE Winter Conference, Las Vegas, NV, USA Jan. 2026
- Paper Reviewer, 15th IEA Heat Pump Conference 2026, Vienna, Austria May 2026
- Paper Reviewer, IIR Conference on Thermophysical Properties and Transfer Processes of Refrigerants, College Park, Maryland, USA June 2025

PROFESSIONAL ACTIVITIES

- Member, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- EPA Certified Universal Technician, Section 608 of the Clean Air Act
- Volunteer, 7th IIR Conference on Thermophysical Properties and Transfer Processes of Refrigerants, College Park, MD, USA June 2025
- Volunteer, 8th Thermal and Fluids Engineering Conference (TFEC 2023), American Society of Thermal and Fluids Engineers (ASTFE), College Park, MD, USA Mar. 2023
- Volunteer, 13th International Conference on Combustion & Energy Utilization (ICCEU 2016), Taipei, Taiwan Oct. 2016
- Member, Student Association, Department of Energy and Refrigerating Air-Conditioning Engineering, National Taipei University of Technology Feb. 2013 – Jan. 2014

INVENTION

- **Intelligent Control of Space Heaters for Room-Level Temperature Regulation** June 2025
Independent Invention (patent filing in progress with University of Maryland) College Park, MD
- Designed and prototyped a retrofit smart heater control system integrating IoT sensors, predictive control, and weather forecast data, achieving 18% improvement in thermal comfort in household field tests
- **Climate Tech Hackathon — Maryland Energy Innovation Accelerator (MEIA)** May 2025
- Developed and pitched the concept "Next-generation Smart HVAC System in Household" Largo, MD

SKILLS

- **Thermal Modeling & Control**: EES, VapCyc, Simulink, CoilDesigner, EnergyPlus, CasADi (MPC)
- **Thermal Management**: Heat transfer, fluid mechanics, thermal analysis, cooling system design
- **Machine Learning**: PyTorch, TensorFlow, Keras, Scikit-learn, Hyperopt (Bayesian optimization)
- **Design Optimization**: Multivariable optimization, design-of-experiments, surrogate modeling
- **Programming & Data Analysis**: Python, MATLAB, C, C#, LabVIEW

- **CFD & CAD Software:** Creo (Pro/ENGINEER), SOLIDWORKS, ANSYS Fluent, ANSYS Icepak, Flotherm
- **Laboratory Skills:** Thermal chamber and wind tunnel testing, DAQ & sensor instrumentation (thermocouples, pressure and IoT devices), IR thermography, uncertainty analysis, machining