Po-Ching Hsu

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RESEARCH INTERESTS

My research focuses on data-driven, deep learning, and machine learning modeling for HVAC, smart building, and variable refrigerant flow (VRF) systems, integrating model predictive control, systems optimization, CFD, surrogate modeling, and the use of low-GWP refrigerants to advance sustainable energy system design

EDUCATION

Ph.D. in Mechanical Engineering, GPA 3.9/4.0 — Expected May 2026
University of Maryland, College Park, MD

- Advanced to Candidacy, Apr. 2025
- Dissertation: Experimental Investigation and Data-Driven Modeling for Variable Refrigerant Flow Systems

M.S. in Mechanical Engineering — June 2017
National Taiwan University, Taipei, Taiwan

- 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

- Capstone Project: An Experimental and Numerical Study of Impinging Micro Channels of Di-electric Fluid for Chip Cooling (Best Undergraduate Capstone Project)

AWARDS

- **Jacob K. Goldhaber Travel Grant**, University of Maryland, May 2025
- **Distinguished Graduate Endowed Fellowship for Energy Innovation**, University of Maryland, Mar. 2023
- **Best Undergraduate Capstone Project Award,** Taiwan Society of Heating Refrigerating and Air-Conditioning Engineers, Apr. 2015
- **Hitachi Air Conditioning Scholarship**, Hitachi Air Conditioning Taiwan Co., Ltd., May 2014

RECOGNITION & MEDIA

- **International Journal of Refrigeration –** Most downloaded paper in the journal in 90 days (Mar. 2025)
- **Featured in Time magazine article: "How AI Is Making Buildings More Energy-Efficient"** (Dec. 11, 2024), for my research on leveraging AI to reduce energy consumption in building HVAC systems, contributing to advancements in energy efficiency and sustainability

RESEARCH EXPERIENCE

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

- Reduced model size by 87% and improved accuracy by 11% over the benchmark by collecting and processing VRF system field test data and developing deep learning models optimized by Bayesian optimization
- Achieved 46% higher prediction accuracy and 67% greater physical consistency by developing a model predictive control-oriented hybrid data-driven and physics-based model for VRF systems
- Cut CFD computation time by 90%, accelerating design decision-making through a Python-ANSYS automated workflow and machine learning-based CFD surrogate modeling of airflow profiles, integrated with in-house heat exchanger and HVAC simulation tools
- Conducted experiments on oil retention and suction-line heat exchangers using refrigerants with 78% lower GWP than the current standard, contributing to optimization of system design for sustainable operation
- Redesigned and built a test facility, reducing uncertainty in two-phase heat transfer measurements for tube-in-tube heat exchangers and improving experimental accuracy

Graduate Research Assistant (M.S.) — Sept. 2015 – June 2017
Energy and Environment Lab, National Taiwan University, Taipei, Taiwan

- 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% by a novel air-breathing pump design
- Reduced fuel cell stack volume by 68% and weight by 76% through an innovative actuator design

Undergraduate Researcher — Feb. 2014 – Jan. 2015
Two Phase Flow and Heat Transfer Enhancement Lab, National Taipei University of Technology, Taipei, Taiwan

- 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 heatsink through CFD simulations and experimental validation

INDUSTRY EXPERIENCE

Thermal Engineer — Nov. 2017 – Mar. 2021
Foxconn Technology Group, New Taipei, Taiwan

- Developed thermal solutions for component- and server-level products over 3 years, including GPU servers, HPC servers, edge servers, storage servers, AI accelerator cards and autonomous vehicle control box
- **Qualcomm AI Accelerator Cards (projected for 1M annual sales)** – Designed and optimized a vapor chamber heatsink by CFD and prototype testing, reducing thermal resistance by 12% and increasing thermal budget of major chipsets by 5 °C under strict design constraints
- **High-Density Storage Server (EBOF) Thermal Optimization** – Improved thermal budget of critical components by 5 °C under fan redundancy through CFD-optimized air duct design and prototyping, within manufacturing and installation limits
- **GPU Server Thermal Test Matrix Optimization** – Reduced chamber thermal test time by 70% by applying Design of Experiments (DOE) to CFD simulations and experiments, identifying critical test cases to inform design decisions and validation
- **Cost- and Performance-Driven HPC Server Cooling Solution** – Reduced manufacturing costs by 10% while maintaining thermal performance by leading vendor designs for remote heat pipe CPU heatsinks and optimizing fan selection using vendor data, validated using CFD

PUBLICATIONS

- **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 (most downloaded paper in the journal in 90 days)
- 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

PRESENTATIONS & CONFERENCES

Deep Learning for Science School – Lawrence Berkeley National Lab, Berkeley, CA June 2025

- Poster Presenter: "Field Testing and Data-Driven Modeling of VRF Systems in Buildings"
- Selected participant (top 35% of 500+ applicants), awarded registration fee waiver and accommodation support by Lawrence Berkeley National Lab

Climate Tech Hackathon – Maryland Energy Innovation Accelerator (MEIA), Largo, MD May 2025

- Developed and pitched the concept "Next-generation Smart HVAC System in Household"

2nd International Conference on Battery & Fuel Cell Technology, Rome, Italy July 2017

- Oral Presenter: "Magnetically driven piezoelectric PEMFC stack with built-in manifold"
- Awarded full sponsorship (airfare and registration fee) by Taiwan's National Science and Technology Council

PROFESSIONAL ACTIVITIES

- Paper Reviewer, 15th IEA Heat Pump Conference 2026, Vienna, Austria
- EPA Certified Universal Technician, Section 608 of the Clean Air Act
- Student Member, ASHRAE

SELECTED PROJECTS EXPERIENCE

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

- Achieved 18% thermal comfort improvement in household field tests by designing and prototyping a retrofit smart heater control system integrating IoT sensing, predictive control, and weather data

Blade Server CPU Heatsink Optimization Sept. 2022

Graduate Course Project – Engineering Optimization**,** University of Maryland, College Park, MD

- Conceived and led a semester project leveraging prior industry experience to optimize server CPU heatsink design, reducing thermal resistance by 56% under constraints by generating the Pareto front using MATLAB-based multivariable optimization

SKILLS

- **Thermal & CFD Simulation:** Flotherm, ANSYS Icepak, ANSYS Fluent
- **CAD & Design:** Pro/ENGINEER (Creo), SOLIDWORKS
- **Energy System Modeling:** EnergyPlus, CoilDesigner, VapCyc
- **Programming & Scripting:** Python, MATLAB, EES, C, LabVIEW
- **Machine Learning:** PyTorch, TensorFlow, Keras, Scikit-learn