

# Hanlong Wan

Postdoctoral Research Associate  
Doctor of Philosophy  
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## EDUCATION

### Ph.D., Mechanical Engineering

August 2017-December 2021

University of Maryland, College Park

Dissertation: Next Generation Heat Pump System Evaluation Methodologies

Advisor: Prof. Reinhard Radermacher, Prof. Yunho Hwang

### B.S., Building Science

August 2012-June 2016

Tsinghua University, Beijing

Thesis: Thermal history and people's thermal adaptation

Dual Degree: Management

## RESEARCH EXPERTISE

- Proficient in developing physics-based and data-driven models for equipment and building systems
- Experienced in intelligent building data monitoring and energy simulation techniques
- Skilled in assessing Life Cycle Climate Performance of energy systems
- Knowledgeable in designing and analyzing HVAC&R systems that use low Global Warming Potential (GWP) refrigerants
- Expertise in developing and testing thermoelectric system prototypes, including experiment design and analysis

## RESEARCH EXPERIENCE

### Postdoctoral Research Associate

April 2022-present

Oak Ridge National Laboratory

- Thermoelectric (TE) technique applications:
  - Developed a TE-Heat Pump modeling framework.
  - Designed, simulated, and tested a novel TE-Cold Climate Heat Pump system.
  - Developed a novel TE Heat Pump Dishwasher.
  - Developed a dual-evaporator, variable-capacity refrigerator coupled with a TE freezer.
- ORNL Heat Pump Design Model (HPDM) support:
  - Developed the ASHRAE Standard 205 performance table conversion support tool.
  - Developed an HPDM-to-EnergyPlus Python Plugin API package.
  - Conducted HPDM-based equipment models to the EnergyPlus-based building model co-simulation

### Postdoctoral Research Associate

March 2022-April 2022

University of Maryland, College Park

- Reviewed recent studies on Cold Climate Heat Pump systems.

**Graduate Research Assistant**

August 2017- December 2021

University of Maryland, College Park

- Developed a four-year VRF system field test dataset and compared different performance metrics in all time scales.
- Compared Recurrent-Neuron-Network-based, Convolutional-Neuron-Network-based, and traditional methods in HP systems and their subcomponents modeling.
- Applied Model Predictive Control in VRF system field tests.
- Designed and simulated a novel Unitary Air Conditioner for flammable refrigerant.
- Developed component-based dynamic VRF system models in Modelica.
- Conducted Enhanced Life Cycle Climate Performance evaluation for HP systems with realistic assumptions.

**Research Assistant**

September 2016 – August 2017

University of Hong Kong, Hong Kong

- Conducted Life Cycle Assessment for prefabricated buildings.

**TEACHING EXPERIENCE****Teaching Assistant**

September 2019 – September 2020

University of Maryland, College Park

Courses: Sustainable Energy Conversion and the Environment, Energy Systems Analysis

**PUBLICATIONS****BOOK CHAPTER**

1. **Wan, H.**, Hwang, Y., & Radermacher, R. (2023). Variable Refrigerant Flow (VRF) System Field Test and Data Analysis Methodologies. In Variable Refrigerant Flow Systems: Advances and Applications of VRF (pp. 223-245). Singapore: Springer Nature Singapore. [https://doi.org/10.1007/978-981-19-6833-4\\_10](https://doi.org/10.1007/978-981-19-6833-4_10)

**SOFTWARE**

1. **Wan, H.**, and Shen, B. HPDM-STD205. Computer Software. <https://github.com/ORNL/HPDM-STD205>. USDOE. 01 Mar. 2023. Web. <https://doi:10.11578/dc.20230213.1>

**JOURNAL PUBLICATIONS**

1. **Wan, H.\***, Gluesenkamp, K. R., Shen, B., Li, Z., Patel, V. K., & Kumar, N. (2023). A Thermodynamic Model of Integrated Liquid-to-Liquid Thermoelectric Heat Pump Systems. International Journal of Refrigeration. <https://doi.org/10.1016/j.ijrefrig.2023.01.024>
2. **Wan, H.**, Cao, T., Hwang, Y., et al. A Comprehensive Review of Life Cycle Climate Performance of Air Conditioning Systems; International Journal of Refrigeration [J]. <https://doi.org/10.1016/j.ijrefrig.2021.06.026>
3. **Wan, H.**, Cao, T., Hwang, Y., et al. Comprehensive Investigations on Life Cycle Climate Performance of Unitary Air-Conditioners; International Journal of Refrigeration [J]. <https://doi.org/10.1016/j.ijrefrig.2021.04.033>

4. **Wan, H.**, Cao, T., Hwang Y., et al. Machine-Learning-Based Compressor Models: A Case Study for Variable Refrigerant Flow Systems [J]. International Journal of Refrigeration, 2020. 123: 23-33. <https://doi.org/10.1016/j.ijrefrig.2020.12.003>
5. **Wan, H.**, Cao, T., Hwang Y., et al. A review of recent advancements of variable refrigerant flow air-conditioning systems[J]. Applied Thermal Engineering, 2020, 169: 114893. <https://doi.org/10.1016/j.applthermaleng.2019.114893>
1. **Wan, H.**, Cao, T., Hwang Y., et al. An electronic expansion valve modeling framework development using artificial neural network: A case study on VRF systems[J]. International Journal of Refrigeration, 2019, 107: 114-127. <https://doi.org/10.1016/j.ijrefrig.2019.08.018>

#### REFEREED CONFERENCE ARTICLES

1. **Wan, H.**, Shen, B., Li, Z. The Potential of Thermoelectric Heat Pumps in Cold Climate Buildings. ASHRAE and SCANVAC HVAC Cold Climate Conference 2023 Alaska, US Mar 2023
2. Li, Z., Yana Motta, S., Shen, B., Fricke, B., & **Wan, H.**. Critical Analysis of Replacements for R-410A in Heat Pump Applications. Purdue Conference 2022. Indiana, US Jul. 2012 <https://docs.lib.purdue.edu/iracc/2484/>
3. Hwang Y, **Wan H.** R-32 Super-Efficient Room ACs Replacement Field Tests. ASHRAE Conference 2022
4. **Wan H**, Cao T, Hwang Y, et al. Development of Dynamic Modeling Framework Using Convolution Neuron Network for Variable Refrigerant Flow Systems; Purdue Conference, May 2021.
5. **Wan H**, Cao T, Hwang Y, et al. "Investigation of VRF System under Cooling Mode through Field Testing and Machine Learning-based Modeling." 13th IEA Heat Pump Conference 2020, Jeju, April 2021
6. **Wan H**, Cao T, Hwang Y, et al. Performance comparison of three refrigerants in a novel unitary air conditioning system.; 14th IIR-Gustav Lorentzen Conference, December 2020 <http://dx.doi.org/10.18462/iir.gl.2020.1079>
7. **Wan H**, Cao T, Hwang Y, et al. "A Novel Unitary Air Condition System Design for Flammable Refrigerants and Building Ventilation." ICR 2019. Montreal, Canada. Aug. 2019 <https://doi.org/10.18462/iir.icr.2019.0565>
8. **Wan H**, Cao T, Hwang Y, et al. "A Review of Electronic Expansion Valve Correlations for Air-conditioning and Heat Pump Systems." Purdue Conference 2018. Illinois, US Jul. 2018 <https://docs.lib.purdue.edu/iracc/1984/>
9. **Wan H**, Xiang J, Mo J, et al. "A Dynamic Generator of Gaseous Formaldehyde for the Life-span Evaluation of Household Air Cleaners," ISHVAC-COBEE-2015, Tianjin, Jul. 2015
10. Xiang J, Mo J, **Wan H**, et al. Dynamic Preparation of Multi-Component Volatile Organic Compounds via Microsyringe Pump, Indoor air 2014, Hong Kong, Jul. 2014

#### INTELLECTUAL PROPERTY

##### PATENTS GRANTED:

**Wan H**, Mo J, Zhang Y, et al. "Device for measuring clean air quantity attenuation rate of air cleaner" (CN201410391267.8)

##### PATENT APPLICATIONS:

Hwang Y, Radermacher R; and **Wan H.** “Enhanced Unitary Air Conditioning and Ventilation System” (No.: 63/069586)

## PROFESSIONAL ACTIVITIES AND AWARDS

### AWARDS:

Heat Pump Conference 2020 Global Student Video Competition Bronze Medal	Apr. 2021
UMD Future Faculty Program	Nov. 2019
University of Hong Kong Postgraduate Fellowship	Sep. 2016
Y.S. and Christabel Lung Postgraduate Scholarship	Sep. 2016
First prize, Excellent Student Training Program	Dec. 2015
Tsinghua Excellent Research Fund for Undergraduate	Apr. 2015

### JOURNAL ARTICLE REVIEWER:

*Energy* (Elsevier)  
*International Journal of Refrigeration* (Elsevier)  
*Energy and Buildings* (Elsevier)  
*Science and Technology for the Built Environment* (ASHRAE/Taylor and Francis)

### PROFESSIONAL SERVICE

<i>International Institute of Refrigeration (IIR) Junior Commission B1 Member</i>	2022-Present
<i>US National Committee of the IIR (USNC/IIR) Office member, Webmaster</i>	2022-Present
<i>ASHRAE TC 4.7, TC 8.7, TC 8.11 Member</i>	2023-Present

## RELEVANT SKILLS

- Programming ability in Python, C, C++, Modelica, and Java Script (D3)
- Extensive knowledge of Git, Vagrant, SQLite, Tableau, Dymola, LabView, MATLAB, EnergyPlus (EMS & PythonPlugin), & Fluent
- Fluent English, Mandarin (native) & Japanese (N1)

Revised: Feb 2023