Zhenning Li

R&D Staff Scientist | liz5@ornl.gov
Ph.D. | 301-503-8568
MathWorks® Certified MATLAB® Professional | Linkedin
Microsoft® Certified Solutions Associate | Google Scholar
Building and Transportation Science Division | Scopus
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Education

Ph.D., Mechanical Engineering 08/2014-12/2019
University of Maryland, College Park, MD, USA
Dissertation: Advanced Modeling and Refrigerant Flow Path Optimization for Air-to-refrigerant Heat Exchangers with Generalized Geometries
Advisor: Prof. Reinhard Radermacher, Prof. Vikrant Aute

B.S., Mechanical Engineering 09/2010-07/2014
Shanghai Jiao Tong University, Shanghai, China
Thesis: Visualization Study on Nucleate Bubble Dynamics in Confined Jet Array Impingement Boiling
Advisor: Prof. Fangjun Hong

Research Experience

Associate R&D Scientist 2022/01-current
Oak Ridge National Laboratory, Oak Ridge, USA
- ✧ Develop high-performance low-charge heat pump systems using ultra-low-GWP refrigerants.
- ✧ Develop dual fuel heat pump with grid-responsive controls.

Postdoctoral Research Associate 2020/01-2021/12
Oak Ridge National Laboratory, Oak Ridge, USA
Advisor: Dr. Kyle Gluesenkamp, Dr. Bo Shen
- ✧ Develop heat pumps and domestic hot water heating technologies integrated with thermal energy storage.
- ✧ Develop separate sensible and latent cooling technologies.

Graduate Research Assistant 08/2014-12/2019
Center for Environmental Energy Engineering, University of Maryland, College Park, USA
Advisor: Prof. Reinhard Radermacher, Prof. Vikrant Aute
- ✧ Develop an integer permutation-based Genetic Algorithm for heat exchanger flow path optimization.
- ✧ Develop a variable geometry heat exchanger model to simulate next-generation heat exchangers.
- ✧ Develop a CoilDesigner®-CFD co-simulation tool to predict airflow maldistribution in the fan-coil units.
- ✧ Day-to-day support for CoilDesigner® (software enhancement, experiment validation, customer support)

Undergraduate Research Assistant 2013/09-2014/06
Shanghai Jiao Tong University, Shanghai, China
Advisor: Prof. Fangjun Hong
- ✧ Build jet array impingement cooling experiment test loop, conduct CFD simulation with ANSYS® Fluent®
- ✧ Visualize nucleate bubble dynamics in confined jet array impingement boiling.

Internship 08/2013-12/2013

Audi China, Electric/Electronic Department, Beijing, China

Host: Gerhard Wager

Teaching Experience

Teaching Assistant 06/2018-07/2018

Hamburg University of Technology, Hamburg, Germany

Course: International Joint Graduate Course on Sustainable Energy

Teaching Assistant 08/2016-12/2016

University of Maryland, College Park, MD, USA

Course: Heat and Mass Transfer

Journal Publications

Li, Z., Shen, B., Wan H., Fricke B. 2023. Heat Exchanger Circuitry Optimization using an Enhanced Integer Permutation-based Genetic Algorithm in Low-GWP Reversible Heat Pump Applications, Applied Thermal Engineering.

Li, Z., Shen, B., and Gluesenkamp, K. R., 2021. Multi-objective Optimization of Low-GWP Mixture Composition and Heat Exchanger Circuitry Configuration for Improved System Performance and Reduced Refrigerant Flammability. International Journal of Refrigeration, 126, pp. 1333

Li, Z., Gluesenkamp, K. R., and Nawaz, K., 2020. Analysis of Basic Airflow Configurations for Separate Sensible and Latent Cooling Systems with Indoor Air Recirculation. International Journal of Refrigeration.

Li, Z., Aute, V. and Ling, J., 2019. Tube-fin heat exchanger circuitry optimization using integer permutation-based genetic algorithm. International Journal of Refrigeration, 103, pp.135-144.

Li, Z., Yana Motta, S., Shen, B. and Fricke, B., 2022. Optimization of Residential Air Source Heat Pump using Low–low-global warming Potential Refrigerants. Heat Pumping Technologies Magazine, 42(1).

Hirschey, J., **Li, Z**., Gluesenkamp, K.R., LaClair, T.J. and Graham, S., 2023. Demand reduction and energy saving potential of thermal energy storage integrated heat pumps. International Journal of Refrigeration.

Lee, M. S., **Li, Z.**, Ling, J. and Aute, V., 2018. A CFD-Assisted Segmented Control Volume Based Heat Exchanger Model for Simulation of Air-to-refrigerant Heat Exchanger with Air Flow Mal-Distribution. Applied Thermal Engineering 131: 230-243.

Huang, Z., **Li, Z.**, Hwang, Y. and Radermacher, R., 2016. Application of Entransy Dissipation Based Thermal Resistance to Design Optimization of a Novel Finless Evaporator. Science China Technological Sciences 59(10): 1486-1493.

Malhotra, M., **Li, Z.**, Liu, X., Lapsa, M.V., Bouza, A., Vineyard, E.A. and Fricke, B., 2023. Heat Pumps in the United States: Market Potentials, Challenges and Opportunities. Heat Pumping Technologies Magazine, 41(1).

Li, W., **Li, Z.**, Hong, F, Chen, G., 2015. Visualization Study on Nucleate Bubble Dynamics in Confined Jet Array Impingement Boiling, Cryogenic Engineering 02: 44-50

Wan, H., Gluesenkamp, K.R., Shen, B., **Li, Z**., Patel, V.K. and Kumar, N., 2023. A Thermodynamic Model of Integrated Liquid-to-Liquid Thermoelectric Heat Pump Systems. International Journal of Refrigeration 150: 338-348

Representative Conference Publications

Li, Z., Shen, B., Gluesenkamp, K., Fricke, B., 2023 Heat Exchangers Circuitry Optimization using Low-GWP Refrigerants in Reversible Heat Pump Applications. 26th International Congress of Refrigeration. Paris, France.

Li, Z., Yana Motta, S., Shen, B. and Wan, H., 2023. Optimization of a Residential Air Source Heat Pump using Refrigerants with GWP <150 for Improved Performance and Reduced Emission. The 14th IEA Heat Pump Conference. Chicago, USA

Li, Z., Catano, J., Gluesenkamp, K., Shen, B., LaClair, T., Comparin, R. and Welch, D., 2022. Simulation of a PCM Integrated Heat Pump Using Time-of-Use Utility Structure-based Control Strategy for Demand Response. International Refrigeration and Air Conditioning Conference. Purdue University, USA.

Li, Z., Gluesenkamp, K., Shen, B., Munk, J., Zandi, H., Cheekatamarla, P. and Kowalski, S., 2022. Seamlessly Fuel Flexible Heat Pump with Optimal Model-based Control Strategies to Reduce Peak Demand, Utility Cost and CO2 Emission. 2022 ACEEE Summer Study on Energy Efficiency in Buildings. Monterey, California

Li, Z., Qiao, H. and Aute, V., 2019. Tube-Fin Heat Exchanger Circuitry Optimization for Improved Performance under Frosting Conditions. 13th International Modelica Conference. Regensburg, Germany. Paper-85.

Li, Z., Ling, J. and Aute, V., 2019. Multi-Bank Microchannel Heat Exchanger Pass Arrangement Optimization Using Integer Permutation Based Genetic Algorithm. 25th IIR Int. Congress of Refrigeration. Montreal, Canada.

Li, Z., Ling, J. and Aute, V., 2019. Refrigerant Circuitry Optimization of Heat Exchangers Used as Condensers and Evaporators in Heat Pump Applications. 9th Int. Conf. on Compressor and Refrigeration. Xi'An, China.

Li, Z., Ling, J. and Aute, V., 2018. A Review of Two-Phase Heat Transfer and Pressure Drop Correlations for Natural Refrigerants in Small Diameter Tubes. 13th IIR Gustav Lorentzen Conference. Valencia, Spain.

Li, Z., Ling, J., Aute, V. and Radermacher, R., 2017. Investigation of Port Level Refrigerant Flow Maldistribution in Microchannel Heat Exchanger. 12th IEA Heat Pump Conference. Rotterdam, Netherlands.

Li, Z. and Aute, V., 2018. Optimization of Heat Exchanger Flow Paths Using a Novel Integer Permutation Based Genetic Algorithm. EngOpt 2018 the 6th Int. Conf. on Engineering Optimization, Lisboa, Portugal.

Intellectual Property

Shen, B., Gluesenkamp K., **Li, Z.** Packaged Multi-Functional Air Source Heat Pump Integrated with a Hydronic Loop for Cooling/Heating Energy Storage. ORNL Invention Disclosure ID 202205237, ANAQUA ID#: 81941082. DOE-S NO: S-177989, Granted date: 2023/02

Qi, Z., Cheng, S., Zhao, P., **Li, Z.**, et al. Multi-people-based mobile phone software platform in public space air-conditioner control system. CN103604191B. Granted date: 2013/11

Professional Service

- Member of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- Vice-chair of ASHRAE Technical Committee 1.13-Optimization
- Member of the American Society of Mechanical Engineers (ASME)
- Journal article reviewer for Energy (Elsevier), International Journal of Refrigeration (Elsevier), Applied Thermal Engineering (Elsevier), Applied Energy (Elsevier), Energy and Buildings (Elsevier), Science and Technology for the Built Environment (ASHRAE/Taylor and Francis)

Awards

- First prize, in the 6th National University Student Social Practice and Science Contest on Energy Saving & Emission Reduction, Press release on China Youth Daily. 2013.08
- Best Student Presentation Award in Consortium of Center for Environmental Energy Engineering at the University of Maryland. Press release. 2018.03

Relevant Skills

- Programming: C#, Python, Modelica, MATLAB, Simulink, Simscape, EES
- Software Packages: Visual Studio®, Dymola®, EnergyPlus®