

Bo Shen

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Professional Experiences

Research and Development Scientist

**Building Technologies Research and Integration Center, Oak Ridge National Labs
2010-Present**

- Developer of ORNL Heat Pump Design Model (<http://hpdmflex.ornl.gov/hpdm/wizard/welcome.php>)
- Member of EnergyPlus development team, developed variable-speed water-source and air-source heat pump models

Primary Investigator

- Develop high efficiency rooftop air conditioner (collaborating with Trane, Ingersoll Rand)
- Develop high efficiency cold climate heat pump (collaborating with Emerson Climate Technologies)
- Develop air-source integrated heat pump (collaborating with Nortek Global HVAC)
- Develop ground-source integrated heat pump (collaborating with Climate Master)
- Develop 13 EER window air conditioner (collaborating with GE)
- Develop heat pump clothes dryer (collaborating with GE)
- Develop high efficiency refrigerator using linear compressor (collaborating with Whirlpool)
- Evaluate low GWP (global warming potential) refrigerants in air conditioning application

Modeling Engineer Trane Commercial Systems, Ingersoll Rand, La Crosse, WI 2006-2010

- Developed a segment-by-segment finite-difference fin-tube coil model, which is capable of arbitrary coil configuration, fluid type, any entering and leaving states.
- Developed a row-by-row finite-difference shell-&-tube flooded evaporator model, which is capable of revealing complicated tube bundle effect like liquid drops recirculation, flow pattern transition upon local velocity, etc.
- Developed a row-by-row finite-difference shell-&-tube flowing pool evaporator model, which is capable of revealing the effect of oil migration on local heat transfer degradation.
- Developed “reduced-detailed” modeling approach for integrating complicated component models to Trane internal system model, which greatly boosted analytical ability of the engineering simulation tool.

Research Assistant Herrick Labs, Mechanical Engineering School, Purdue University 2001-2006

System Engineer Hitachi Electrical Appliances Co., Shanghai, China 1999-2001

Education

Ph.D. Feb. 2006	Thermal System Purdue University Dissertation: “Improvement and Validation of Unitary Air Conditioner and Heat Pump Simulation Models at Off-Design Conditions” Advisors: Dr. Eckhard A. Groll and Dr. James E. Braun	West Lafayette, IN, USA
M.S. April 1999	Thermal System Shanghai Jiao Tong University Dissertation: “Dynamic Simulation and Fuzzy Control Strategy for VRV Air Conditioner”	Shanghai, China
B.S. July 1996	Thermal Engineering Shanghai Jiao Tong University	Shanghai, China

Research Expertise

- Vapor Compression Equipment Modeling and Design
- Building Energy Modeling and Analysis
- Heat Pump Technologies

Other Relevant Information

- Member ASHRAE
- Six Sigma Green Belt Certified, and Black Belt Trained

- R&D 100 Award, 2013

Selected Technical Publications

- Shen, B., Omar Abdelaziz, Keith Rice, Van Baxter and Hung Pham, “Cold Climate Heat Pumps Using Tandem Compressor”, Conference Paper in 2016 ASHRAE Winter Conference
- Shen, B., Omar Abdelaziz, Van Baxter and Keith Rice, “Compressor Selection and Equipment Sizing for Cold Climate Heat Pumps”, Conference Paper in 11th International Energy Agency Heat Pump Conference, 2014
- Shen, B., Bansal, Pradeep, “Assessment of Environmentally Friendly Refrigerants for Window Air Conditioners”, 15th International Refrigeration and Air Conditioning Conference at Purdue, July 14-17, 2014
- Shen, B., Rice, C. K. & Vineyard, E. A. “Development of 20 integrated energy efficiency ratio rooftop units—system modeling and building energy simulations”. ASHRAE HVAC&R Research Journal, 19(7):836–846 (2013).
- Shen, B., Mahderekal, I. & Vineyard, E. A. “System modeling and building energy simulations of gas engine driven heat pump”. ASHRAE HVAC&R Research Journal, 19(7):847–856 (2013).
- Shen, B., Rice C. K.(2013), McDowell, T., Baxter, V., “Energy Simulation of Integrated Multiple-Zone Variable Refrigerant Flow System ”, Conference CD of ASHRAE 2013 Summer Conference, Denver, CO
- Shen, B., Abdelaziz, O., Rice C. K.(2012), “Auto-Calibration and Control Strategy Determination for a Variable-Speed Heat Pump Water Heater Using Optimization”, HVAC&R Research, 18(5):904–914, 2012.
- Shen, B., Rice C. K.(2012), “Multiple-Zone Variable Refrigerant Flow System Modeling and Equipment Performance Mapping”, Conference CD of ASHRAE 2012 Winter Conference, Chicago, IL
- Shen, B., Braun, J. E. and Groll, E. A. (2011) “The Impact of Refrigerant Charge, Air Flow and Expansion Devices on the Measured Performance of an Air-Source Heat Pump - Part I”, ASHRAE Transactions, Volume 117, Part 2, July, 2011, Presented at ASHRAE 2011 Summer Conference, Montreal, Canada
- Shen, B., Groll, E. A. and Braun, J. E. (2011) “Modeling Improvements for Air Source Heat Pumps using Different Expansion Devices at Varied Charge Levels - Part II”, ASHRAE Transactions, Volume 117, Part 2, July, 2011, Presented at ASHRAE 2011 Summer Conference, Montreal, Canada
- Shen, B., Braun, J. E. and Groll, E. A. (2009) “Improved Methodologies for Simulating Unitary Air Conditioners at Off-Design Conditions”, International Journal of Refrigeration, Volume 32, Page 1837-1849
- Shen, B., Braun, J. E. and Groll, E. A. (2006) “A Method for Tuning Refrigerant Charge in Modeling Off-Design Performance of Unitary Equipment”, HVAC&R Research, Volume 12, Issue 3, July 2006
- Shen, B. and Groll, E. A. (2005) “A Critical Review of the Influence of Lubricants on the Heat Transfer and Pressure Drop of Refrigerants, Part I: Lubricant Influence on Pool and Flow Boiling”, HVAC&R Research, Volume 11, Issue 3, July 2005, Page 341-360
- Shen, B. and Groll, E. A. (2005) “A Critical Review of the Influence of Lubricants on the Heat Transfer and Pressure Drop of Refrigerants, Part II: Lubricant Influence on Condensation and Pressure Drop”, HVAC&R Research, Volume 11, Issue 4, October 2005, Page 511-526