System Modeling Short Course: Steady-state, Dynamic and Reduced-Order Models of Heat Pump Systems and their Components

Sunday, July 14, 2024, from 8:00 a.m. to 5:00 p.m.
Purdue University
RAWLS, Room TBD
West Lafayette, Indiana 47907, USA
Organized by the Ray W. Herrick Laboratories

Short Course Summary
Coordinated by: Davide Ziviani (Purdue University), Haotian Liu (Purdue University), Jinwoo Oh (Purdue University)

The HVAC&R industry is facing numerous challenges including transition to low-GWP refrigerants, upcoming energy standards, decarbonization targets and electrification of heating. Model-based engineering design is an essential tool to evaluate design trade-offs, investigate new technologies and optimize year-round operation of equipment. In this Short Course, steady-state and dynamic modeling techniques will be covered to predict the performance of HVAC&R systems. Digital-twin and reduced order models (ROMs) will also be discussed to enable control development and fast computational models. Case studies will include residential, commercial, transport, and industrial applications as well as integration of thermal storage. The Short Course will be based on common modeling platforms such as Python and Dymola/Modelica.

Speakers:
Abd Bani Issa, Purdue University
Craig Bradshaw, Oklahoma State University
Weigang Hou, Purdue University
Donghun Kim, Lawrence Berkeley National Laboratory
Jiacheng Ma, Modelon Inc./Purdue University
Marie Rae Shelly, Purdue University
Davide Ziviani, Purdue University

<u>Schedule:</u>

07:30 – 08:00 am	Registration and Continental Breakfast (provided)
08:00 – 08:10 am	Welcome and Introduction of the Short-Course [Ziviani]
08:10 – 09:00 am	Session 1 – Comprehensive Mixture Fluid Screenings for Various Applications: Examples of Residential Heat Pumps and High Temperature Heat Pumps [Ziviani]
09:00 – 09:50 am	Session 2 – Coupled Building/Thermal Storage/Heat Pump Modeling Framework [Bani Issa]
09:50 – 10:10 am	Coffee Break
10:10 – 11:00 am	Session 3 – Reduced Order Models for Compressor Technologies [Bradshaw]
11:00 – 11:50 am	Session 4 – Metamodel-Based Heat Pump Optimizations [Hou/Ziviani]
12:00 – 01:00 pm	Lunch (provided)
01:00 – 01:50 pm	Session 5 – Dynamic Frosting/Defrosting Models for Reversible Heat Pump Systems [Kim/Ma]
01:50 – 02:40 pm	Session 6 – Multi-Scale Thermal Management of Electric Vehicles [Shelly/Ziviani]
02:40 – 03:00 pm	Coffee Break
03:00 – 03:50 pm	Session 7 – Bayesian-Based System Identification [Kim/Ma]
03:50 – 04:40 pm	Session 8 – Open Discussion on Future Modeling Techniques [All]
04:40 – 05:00 pm	Short-Course Wrap-Up and Feedback [Ziviani/All]
05:00 – 06:00 pm	Optional Tour of Herrick Labs