



Mechanical Engineering Seminar Series

Practical Pathways to Energy Decarbonization, Frugal Water Use, and Food Preservation

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4:00 p.m. - 1303 EECS

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Abstract

In the push toward decarbonization, electrification alone may not yield immediate reductions in carbon emissions and may in fact exacerbate the problem, because fossil-free renewable options are still in the ramp up phase. A more judicious process that leverages innovation in energy conversion, storage, recovery, and end use is likely to yield the desired reductions in carbon emissions. Innovations to address the large building energy systems load using miniaturized absorption systems driven by waste heat or renewable energy sources will be presented. Extensions to address the challenge of cold climate heat pumping and water heating will also be discussed. Waste heat driven sorption heat pumps to provide cooling in forward operating bases as well as in aircraft carriers will be shown to reduce the carbon footprint at kW to MW scales. In addition, fast heat and mass transfer kinetics in hollow sorbent loaded microchannel fibers are exploited to enable rapid temperature swing adsorption (RTSA) for CO₂ capture from 750 MW coal power plants, requiring the lowest parasitic load compared to existing capture technologies. Additional applications of sorption, including enhancing the performance of commercial dryers, and the development of seasonal thermal storage systems, will be discussed. Adsorption chillers driven by biomass, solar, or waste heat being developed with collaborators from India for use in the cold chain to reduce food spoilage. Other initiatives include enhancement of the air- and steam- side heat transfer in power plant condensers to enable waterless power generation, and simultaneous space-conditioning and water purification systems at the residential scale. Finally, optimization of electricity consumption through load forecasting, peak load shifting, and maximization of PV-based generation and storage at the individual residence as well as the community scale, will be presented. These representative applications demonstrate the vast potential for innovations and impact in energy and emissions, water consumption, and the food supply chain.

Bio

Dr. Srinivas Garimella is the Hightower Chair in Engineering and Director of the Sustainable Thermal Systems Laboratory at Georgia Institute of Technology. He has held prior positions as Research Scientist at Battelle Memorial Institute, Senior Engineer at General Motors Corp., and Associate Professor at Western Michigan University and Iowa State University. He is a Fellow of the ASME, past Associate Editor of the ASME J. Heat Transfer, and Editor of the Int. J. Air-conditioning and Refrigeration. He has also served as Associate Editor of the ASME J Energy Resources Technology, and Past Chair of the Advanced Energy Systems Division of ASME. He was an Associate Editor of the ASHRAE HVAC&R Research Journal and was on the ASHRAE Research Administration Committee. He held the William and Virginia Binger Associate Professorship of Mechanical Engineering at ISU. He has mentored over 75 postdoctoral researchers, research engineers and students pursuing their M.S. and Ph.D. degrees, with his research resulting in over 350 archival journal and conference publications, a textbook on Heat Transfer and Fluid Flow in Minichannels and Microchannels (2nd Ed., Elsevier 2014), and books on Condensation Heat Transfer (World Scientific Publishing, 2015) and Adsorption Heat Pumps (Springer Nature, 2021.) He has been awarded seventeen patents. He is the recipient of the NSF CAREER Award (1999), the ASHRAE New Investigator Award (1998), the SAE Ralph E. Teeter Educational Award for Engineering Educators (1998), and was the Iowa State University Miller Faculty Fellow (1999-2000) and Woodruff Faculty Fellow (2003-2008) at Georgia Tech. He received the ASME Award for Outstanding Research Contributions in the Field of Two-Phase Flow and Condensation in Microchannels, 2012. He also received the Thomas French Distinguished Educator Achievement Award (2008) from The Ohio State University, and the Zeigler Outstanding Educator Award (2012) at Georgia Tech.

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