

School of Engineering Seminar



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Speaker:

Dr. Sarvenaz
Sobhansarbandi

Assistant Professor in
Mechanical Engineering,
University of Missouri –
Kansas City (UMKC)

Date:

Tuesday
Feb. 14, 2023
1:00-1:50 PM

Location:

Hensill Hall (HH) 803

Performance Enhancement of Energy Storage Based Solar Thermal Systems: A Multi-Pronged Solution

Abstract: Solar water heating systems (SWHs) have attracted much attention in recent years. However, due to the intermittency in solar intensity, SWHs may not work at their maximum functionality. Latent heat storage is considered a viable solution for augmenting the thermal behavior of various energy storage systems such as solar systems. The main component of a SWH system is the solar collector, and among various types of solar collectors, heat pipe evacuated tube solar collectors (HPETCs) are widely used. In this talk, I will present my research on understanding the heat transfer phenomena in HPETCs by performing computational fluid dynamics (CFD) modeling of the collector and improving their efficiency by the integration of phase change materials (PCMs). To address challenges associated with computational efficiency, my research developed a novel hybrid computational method which is several orders of magnitude faster than traditional direct numerical simulation methods. Further performance optimization of the collector was carried out by investigating the effect of: 1) heat pipe position, 2) various types of PCMs integrated within the HPETCs, and 3) custom-made involuted reflectors. Furthermore, thermal analysis of nanoparticle based PCMs was performed with a differential scanning calorimeter (DSC) to investigate the thermal properties enhancement of PCMs with various concentrations of nanoparticles. I will also briefly introduce the feasibility analysis of the system, which was performed in-house, as an example of the practical application of my research. The results from this study can lead to overall efficiency improvements in SWH systems and a reduced dependence on nonrenewable energy sources.

Speaker Bio: Dr. Sarvenaz Sobhansarbandi is an assistant professor of mechanical engineering and director of Advanced Renewable/Thermal Energy (ART-E) laboratory at University of Missouri – Kansas City (UMKC). Dr. Sobhansarbandi received her Ph.D. in Mechanical Engineering from the University of Texas at Dallas in May 2017. Her research work is in the area of thermal and fluid sciences, with the focus on solar thermal technologies and energy storage systems. Her other focused research area is the design/optimization of thermal management systems (TMS) for high power applications. Dr. Sobhansarbandi has gained several years of research experience in the broad area of Thermo-Fluids including: (a) computational fluid dynamics/hybrid numerical modeling, and experimental analysis of solar water heating (SWH) technology; and (b) design/development of energy storage units by utilization of thermal energy storage composites and/or batteries.

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