Friday, November 1 • 2:30 PM

PWEB 175

Data-Driven Multi-Scale Design of Engineering Materials under Uncertainty

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Abstract: The area of data-driven materials design has been garnering considerable interest due to the increasing need for high-performance materials in electronics, energy and structural applications, and extreme environments. The research on engineering materials and their manufacturing will potentially extend in the future to the development of new-generation composites, alloys, ceramics, and other materials for extreme environments such as hypersonics applications, fabrication of adaptive thermal response materials, energetic composites in fuel cells, thermal energy harvesting in satellites, and materials for green energy applications with the use of computational and data-driven design strategies.

In this talk, Dr. Acar will present an overview of the multi-scale computational methods developed by her research group to design metallic microstructures and mechanical metamaterials for enhanced mechanical performance. The talk will also discuss the impact of manufacturing-related uncertainty arising from the imperfections and defects during processing on the reliability and performance of these engineering materials. Additional topics will cover the integration of Artificial Intelligence (AI)/Machine Learning (ML) techniques into physics-informed material models to accelerate the design of material systems processed with conventional and additive manufacturing techniques.

Biographical Sketch: Dr. Pinar Acar is an Associate Professor at the Mechanical Engineering Department of Virginia Tech. Her research interests focus on multi-scale materials modeling, materials design, design optimization, uncertainty quantification, and machine learning. She received her Ph.D. degree in 2017 from the Aerospace Engineering Department of the University of Michigan. During her Ph.D., she developed various computational methods for studying the multi-scale modeling and design of metals under uncertainty.

Dr. Acar is the winner of the National Science Foundation (NSF) Career Award, the Air Force Office of Scientific Research (AFOSR) Young Investigator Program (YIP) Award, the Dean's Awards of Excellence: Faculty Fellow and Outstanding New Assistant Professor Awards at Virginia Tech, Frontiers of Materials Award by The Minerals, Metals and Materials Society (TMS), and the International Amelia Earhart Fellowship, as well as the recipient of the best paper award in Non-Deterministic Approaches field in AIAA SciTech Forum 2022. She is an elected member of technical committees in various professional societies, including the American Society of Mechanical Engineers (ASME), The Minerals, Metals & Materials Society (TMS), The U.S. Association for Computational Mechanics (USACM), and The American Institute of Aeronautics and Astronautics (AIAA).

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