DEPARTMENT of INDUSTRIAL ENGINEERING
UNIVERSITY of HOUSTON

FRIDAY SEMINAR SERIES
BROADEN HORIZONS | EXTEND MINDS

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Date: Friday, Oct., 15, 2021

Time: 1 - 1:50 pm

Zoom Meeting ID: 970 7656 5407

Password: 477211

Toward the Digital Thread of Metal Additive Manufacturing: Melt Pool Modeling and Porosity Prediction

Abstract: Metal Additive Manufacturing (AM) offers tremendous freedom to create complex parts without the design constraints of traditional manufacturing routes. Despite its promise and potential, however, AM is still largely a solution that is used for rapid prototyping and small-batch production. While the process-structure-property-performance relationship is largely unknown for AM, it is further masked by the information-disconnected AM process chain. The silos of information hamper data exchange among the different steps in the AM process chain, causing manufacturing to be less efficient, prone to error, and lacking traceability. Digital thread is the seamless flow of data throughout the product development chain, including design concept, modeling, build plan, monitoring, quality assurance, the build process itself, and post-processing and inspection. By collecting and analyzing detailed logs of real-time data from process monitoring, it is possible to recognize patterns which reveal where potential defects might occur and where process adjustments may be beneficial. This talk will highlight our recent work toward the digital thread of AM by focusing on melt pool modeling and porosity prediction in laser metal deposition (LMD). Porosity produced in LMD hampers its application due to the absence of an effective prediction method. Measured thermal images of the melt pool provide a unique opportunity for porosity analytics. The first part of this talk will present a hierarchical spatial-temporal model for melt pool thermal images, which enables melt pool modeling and monitoring. On the other hand, a physical model may provide complementary rich data that cannot be measured otherwise. How to leverage both types of data to predict porosity is very challenging. The second part of the talk will present a physics-driven deep

learning model predict porosity by integrating both measured and predicted data of the melt pool.

Biography: Weihong "Grace" Guo is an Assistant Professor in the Department of Industrial and Systems Engineering. She earned her B.S. degree in Industrial Engineering from Tsinghua University, China, in 2010 and her Ph.D. in Industrial & Operations Engineering from the University of Michigan, Ann Arbor, in 2015. Her research focuses on developing novel methodologies for extracting and analyzing massive and complex data to facilitate effective monitoring of operational quality, early detection of system anomalies, quick diagnosis of fault root causes, and intelligent system design and control. She has collaborated with a domestic logistics/supply chain company, a university-affiliated health system and worldwide manufacturers of automobiles and personal care products. Her research has been funded by NSF, DOT, and Ford Motor Company. She received the Barbara M. Fossum Outstanding Young Manufacturing Engineer Award from the Society of Manufacturing Engineers in 2019. She also received several best paper awards from ASME. She is a member of INFORMS, IISE, ASME, SME, and Tau Beta Pi.