The Department of Mechanical Engineering
College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar

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Process Innovation, Understanding, & Control in Advanced Manufacturing
Friday, November 17, 2019 at 1:00 PM, Room 173 Light Engineering Building

Abstract

Significant progress in advanced manufacturing arises at the nexus of process innovation, understanding, and control. In this context, this talk will focus on three thrusts in my research group:

Innovations in additive manufacturing processes: I will discuss our work on scalable Intense Pulsed Light Sintering for additive manufacturing of high-performance planar, conformal, and 3D electronics. Then I will describe a novel multiplexing approach that enables new economies of scale and productivity in extrusion-based 3D printing by inexpensively overcoming the existing throughput-resolution-flexibility tradeoff.

Partial-physics-informed acceleration of intractable process modeling: Prediction of part attributes as a function of process parameters is required for process understanding and design. Existing approaches for such modeling are either difficult and time-intensive, and frequently impossible or incomplete, due to the complex physics involved and the limits of human intuition; or incur high experimental costs. I will discuss a machine learning approach that addresses this issue by concurrently eliminating the derivation of qualitatively accurate constitutive laws, using 50-60% lesser experimental data without sacrificing accuracy, and accelerating predictive process modeling by years to decades along the way.

Control for physical resilience to manufacturing cyberattacks: Increasing digitization of the manufacturing value chain within the Industry 4.0 paradigm creates a susceptibility of manufacturing processes to cyberattacks that can surreptitiously affect a part's material integrity by creating random and unexpected defects. Existing approaches focus on delineating the attack surface, defect detection, and traditional IT-based security. I will discuss a machine learning approach that goes beyond this state-of-the-art by using real-time parameter variation or in-process resilience to cyberattacks with high spatial resolution, thus allowing production to continue with high part quality even during a cyberattack.

Biography

Dr. Rajiv Malhotra obtained his PhD in Mechanical Engineering from Northwestern University. He joined Rutgers University in 2017, after a brief stint at Oregon State University, where he established the Advanced Manufacturing Sciences Laboratory funded by both federal and industry sources. He has published 45 journal articles in diverse journals including *Applied Materials and Interfaces, Advanced Functional Materials, Advanced Theory and Simulations, Nanotechnology, Additive Manufacturing, Journal of Materials Processing Technology, and Journal of Manufacturing Processes*. He has held positions as associate editor for SME Manufacturing Letters and *Journal of Manufacturing Processes*, guest-editor for ASME and SME journals, chair of Micro-Nanomanufacturing track chair in the ASME Manufacturing Science and Engineering Conference, and track chair in the International Symposium on Flexible Automation. His research efforts were recognized by the SME 2017 Young Manufacturing Engineer Award.

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