

Artificial Intelligence-Enhanced Nanomanufacturing

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Abstract: As a research discipline, nanomanufacturing involves the design, characterization, and fabrication of nanostructures that exploit the physical and chemical phenomena at nanoscale. It is critical to various industrial and commercial applications such as energy storage, flexible electronics, and health care. However, manipulation of materials at nanoscale faces multiple challenges. At the design stage, tailoring the structure topology and composition to produce the desired functional properties has long been relying on expert knowledge. At the manufacturing stage, nanomanufacturing processes involve multiple factors that affect the reproducibility, reliability, and quality of the final products. In recent years, artificial intelligence (AI) has been increasingly considered as having the potential in complementing physical domain knowledge and better resolving the aforementioned challenges. By leveraging data from process sensors and advanced computational infrastructure, AI enables optimization in material design, high-fidelity process-structure-property modeling and effective product quality assurance.

This talk presents an overview of the basic building blocks of AI and highlights AI's applications to material design, manufacturing process modeling, and quality assurance. It demonstrates the potential of AI in enhancing physical science with data science to facilitate the design, monitoring and optimization in nanomanufacturing.

Bio: Prof. David Hoelzle is an Associate Professor in the Department of Mechanical and Aerospace Engineering at the Ohio State University. He received his MS and PhD from the University of Illinois at Urbana-Champaign in 2007 and 2011, respectively, in Mechanical Science and Engineering and his BS from the Ohio State University in 2005 in Mechanical Engineering. Between his PhD and current position, he completed a post-doc in the Department of Integrative Biology and Physiology at the University of California, Los Angeles and held the position of Assistant Professor in the Department of Aerospace and Mechanical Engineering at the University of Notre Dame. His research interests lie in applied control theory and dynamics for applications in additive manufacturing robotics and microsystems for mechanobiology research. Prof. Hoelzle is a recipient of the 2016 CAREER Award, the 2016 Society of Manufacturing Engineers Outstanding Young Manufacturing Engineer Award, and 2019 Lumley Research Award.

