

**Integrating experiments and data sciences for part quality improvement in additive manufacturing and welding**

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**Seminar on August 31<sup>st</sup>, 2023 at 11:00 AM in 2004 Black Engr.**

**Abstract**

Additive manufacturing and welding are two important metal fabrication techniques that share many similarities in their physical processes. In both processes, the reduction of defects such as porosity, lack of fusion, distortion, and surface roughness and control of microstructure and mechanical properties are needed to improve part quality, reliability, and serviceability and reduce cost. The use of emerging tools of data sciences such as physics-informed machine learning and deep learning supports experiments and helps in defect detection, process control, and the selection of appropriate processing conditions to improve structure and properties. Physics-informed machine learning takes advantage of the data generated using multi-physics models of manufacturing processes and reduces trial tests. The integration of experiments and data sciences minimizes the need for human intervention and significantly improves productivity and property, and lowers the cost. This seminar is aimed to provide several examples of integrating experiments and data sciences for reducing voids, tool failure, surface defect, and roughness, and improving material efficiency and part properties during friction stir welding and single and double laser powder bed fusion.

Dr. Yang Du is a Postdoctoral Research Associate in the Department of Mechanical and Aerospace Engineering at Princeton University. Before joining Princeton University, she was a Postdoctoral Researcher at The Pennsylvania State University. She received her Ph.D. in Materials Science and Engineering from Tianjin University. During her Ph.D. tenure, she was selected by The China Scholarship Council as a visiting scientist at The Pennsylvania State University. Her research interests include additive manufacturing, welding, machine learning, deep learning, advanced characterization methods, heat and mass transfer, residual stress measurement, and laser-material interaction. She has published several papers in leading international journals, including the International Journal of Machine Tools and Manufacture, Applied Materials Today, Acta Materialia, and npj Computational Materials. She served as a Session Chair for the International Manufacturing Science and Engineering Conference (ASME 2023).

***This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.***

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