Physics-based AI-accelerated Simulations for co-Designing of Materials and Additive Manufacturing Processes

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ABSTRACT

Current research efforts at my manufacturing group aim to advance the capability to co-design materials and manufacturing processes using hybrid physics-based and data-driven approaches. In this talk, I will demonstrate our work in the development of differentiable simulation tools, sensing, and process control to achieve effective and efficient predictions and control of a material's mechanical behavior in metal additive manufacturing processes. Furthermore, I will show how we use machine learning to accelerate the physics-based simulations and to realize active sensing with the goal of effective in-situ local process control. Our solutions particularly target three notoriously challenging aspects of the process: long history-dependent properties, complex geometric features, and the high dimensionality of their design space.

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