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SCIENTIFIC MACHINE LEARNING FOR HIGH-FIDELITY SIMULATIONS IN ADDITIVE MANUFACTURING

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ABSTRACT

Additive Manufacturing (AM) has emerged as a disruptive technology for producing complex-shaped components with remarkable precision and innovative applications. A thorough quantitative understanding of the AM processes can be established through insights from various types of computer simulations. Scientific Machine Learning (SciML) holds great promise in enhancing the efficiency of these simulations, which are crucial for the design, optimization, and certification of AM processes and the components they produce. This MS aims to provide a platform for discussing recent advancements in SciML techniques tailored for high-fidelity simulations in AM, emphasizing both theoretical developments and practical applications.

The session will cover a range of topics, including:

- SciML and data-driven approaches to accelerate simulations across time and length scales
- Data-driven and multi-fidelity modeling techniques that leverage large datasets to train models capable of simulating AM processes with high precision and reduced computational cost
- SciML-based predictive model for microstructure and defects in AM
- Data-driven and computational alloy development for AM
- Optimization algorithms and feedback control mechanisms supported by SciML and high-fidelity process simulations
- Integration of in-situ monitoring data, simulation and ML for qualification and process control purposes (Digital Twins)