

# ASTM INTERNATIONAL CONFERENCE ON ADVANCED MANUFACTURING

## Research to Application through Standardization

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### Industry 4.0: Modeling, Simulation, and Digital Twins

This symposium focuses on recent advances in modeling, simulation, and digital twins that support qualification and certification of higher criticality parts built by an additive manufacturing (AM) process, e.g., powder-bed fusion, direct energy deposition, etc. Here, we will focus on state-of-the-art models and simulations that are firmly in the middle of the technical readiness level (TRL) scale and, upon further maturation, which will enable industry and government to continue expanding their use for practical applications, including qualification and certification, of AM components. To build credibility for their models and simulations, researchers should invoke best practices, including verification, validation, uncertainty quantification, uncertainty reduction, sensitivity studies, and demonstration problems. Symposium topics include probabilistic methods, integrated computational materials engineering (ICME), digital twins, process modeling, machine learning (ML)/artificial intelligence (AI), surrogate modeling, and insights gained from physics-based and data-driven simulations.

#### Topics of interest include but are not limited to:

- Development of validated uncertainty-quantified process-structure-property (UQ/PSP) relationships or elements thereof
- Microstructure characterization directly linked to material property estimates
- Methodologies that unlock insights in large statistical models, ML, and AI
- Performance modeling to quantify performance and risk in higher-criticality parts and assemblies
- Certification approaches that demonstrate safe usage
- Rapid qualification/re-qualification procedures to reduce testing efforts and to maintain process stability
- Approaches, frameworks, standards, and interfaces to guide data transfer in digital twins
- Examples of using modeling, simulation, and digital twins in the context of the Q&C environment
- Knowledge generated from physics-based process, properties, and/or performance simulations



#### Symposium Organizers

- Nicolas Mulé, Boeing, USA
- Shuai Shao, Auburn University, USA
- James Sobotka, Southwest Research Institute (SwRI), USA
- Soheil Soghrati, The Ohio State University, USA
- Wei Xiong, University of Pittsburgh, USA



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