

PARTICLE-BASED SIMULATIONS IN ADDITIVE MANUFACTURING

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ABSTRACT

Additive manufacturing has revolutionized manufacturing processes and opened new possibilities for design, customization, and production across various industries. Aerospace companies, such as GE Aviation, use it to create lightweight components like turbine blades and fuel nozzles, improving fuel efficiency. In medical engineering, it enables the fabrication of tailored implants and customized prosthetics, enhancing patient outcomes. The automotive industry leverages it for rapid prototyping, tooling, and component production, as demonstrated by Bugatti's brake calipers. Although additive manufacturing has the potential for the realization of intricate designs previously impossible to execute, the manufacture efficiency (e.g., printing speed and labor cost) and quality (e.g., strength, toughness, and surface texture) are still far from ideal. Quantitative optimization of the manufacturing processes requires a deeper level of understanding and modeling for the interplay of process design and material properties.

This dedicated invited session on additive manufacturing will provide valuable insights and perspectives on this rapidly evolving field. It will serve as a prominent platform for researchers to explore the diverse and intricate intersections between particle technology and additive manufacturing. By highlighting the latest developments, challenges, and opportunities of particle-based simulations in additive manufacturing, our session aims to foster a deeper understanding of this emerging technology within the field of granular systems. The session will cover a range of topics important to additive manufacturing, including but not limited to:

- Powder spreading and material structure
- Particle sintering and phase change dynamics
- Enhanced computational approaches for particle simulations
- Powder rheology, and flow behavior
- Experimental calibration and validation of particle-based simulations
- Post processing, industrial implementation, and case studies

We will invite experts from both the academia and industries to share their research and insights, contributing to the advancement of knowledge and practice in particle-based simulations and their applications in additive manufacturing.