

## COMPUTATIONAL DESIGN WITH CONSIDERATIONS OF AM OPPORTUNITIES, CONSTRAINTS, AND UNCERTAINTIES

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### ABSTRACT

The substantial geometrical design freedom and control over material properties that additive manufacturing (AM) offers, are key advantages over conventional manufacturing processes. Moreover, the ability to deposit graded/multi-materials or microstructures further widens the design space. However, manufacturing constraints such as overhangs, accessibility, thermal management, dimensional accuracy, and residual stress also require due account. Additionally, manufacturing variations and uncertainties pose an extra design challenge. Fully exploiting these advantages while accounting for constraints and uncertainties is a complex task in which intuition-based design approaches fall short. To systematically address this challenge, increasing efforts are made to develop AM-oriented computational design approaches. This includes techniques such as topology optimization and generative design, in which specific aspects of AM are integrated into the design process via process simulations while maintaining computational tractability. This also draws attention to the utilization of machine learning to analyze vast amounts of data and rapidly predict process conditions. Additionally, robustness of computational methods towards manufacturing uncertainties is another avenue of recent efforts.

This session aims to provide a forum for exchanging ideas and the latest developments in computational design techniques for AM. The topic is meant in a broad sense and includes contributions focusing on new aspects of:

- Topology optimization / generative design in combination with AM design rules
- Robust Topology optimization / generative design methods including AM uncertainties
- Development and integration of computationally efficient physics-based AM process simulations into the computational design process
- Design for spatial distribution of material properties under AM process considerations
- Optimization of support structure layout for AM parts
- Computational design of lattice structures, including AM considerations
- Deposition sequence or laser trajectory optimization
- Recent advances in machine learning and AI for AM-oriented process modelling
- Industrial AM case studies and/or identification of new design and simulation challenges