

PHYSICALLY-BASED PART-SCALE SIMULATION

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ABSTRACT

In recent years, additive manufacturing has proven to be a competitive technology for producing parts with a high degree of design freedom. This technology comprises different generative production methods – each with a specific area of application and unique resulting part characteristics. Predicting these properties through numerical simulations is highly desirable, as this approach allows for a first-time-right production of the parts.

Over the course of this Invited Session (IS), the audience will be given an overview of different additive manufacturing technologies: the Powder Bed Fusion of Metals using a Laser Beam (PBF-LB/M), the Wire and Arc Additive Manufacturing (WAAM), and the wire-based Directed Energy Deposition (DED) process. The process-specific challenges, for example form deviations due to an uneven heat input or shrinkage effects, will be addressed. The participants will be introduced to the various ways of describing the physical cause-effect relationships and the numerical modeling approaches, which are necessary to predict the part qualities during the manufacturing process.

The IS topics can be specified as follows:

- keynote lecture: Overview of industrial relevant additive manufacturing technologies and challenges in the physically-based part-scale simulation
- invited lecture 1: Temperature-based Trajectory Optimization with Mixed-integer Programming for Layered Geometries in WAAM
- invited lecture 2: Mixed-Integer Approach to the Optimization of Trajectories in PBF-LB/M
- invited lecture 3: Modelling tools and use for digital quality control in wire-based DED additive manufacturing

The goal of the IS is to bring together experts from various additive manufacturing domains, which allows for an exchange concerning the different process-specific challenges. By this, thematical overlaps can be identified and discussed. Participants with a dedicated research field in a specific additive manufacturing technology get the opportunity to widen their field of view concerning physical modeling techniques and numerical approaches on the part-scale.