INVITED SESSION

Particle and mesh-graph-network based models for 4D materials

ORGANIZERS
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ABSTRACT

New materials and material transformations are the key to innovation in Energy, Life and Medical Sciences, and Sustainable Production. Interdisciplinary research on materials and material transformations (4D Materials) by an integration of engineering, natural sciences, life sciences, data and simulation sciences constitutes a sustained driver for disciplinary technology advances. 4D Materials include property variations as response to material processing into the material-design objective. The recent notion of 4D materials mostly is still restricted to morphodynamic solid materials[1] and often related to production through 4D printing.

In this session we address the latest achievements of Lagrangian methods for matter and matter transformation. We explicitly include classical physics-driven paradigms such as DPD, SDPD, and SPH, together with their data-driven notions of mesh-graph networks, in order to help bridging the two communities. We are open for a broad range of material classes, ranging from active soft-matter to condensed matter, but focus on their precision engineering application and the according needs for multi-fidelity simulation at scale, such as laser-melting additive processes or biomanufacturing applications of active matter. We invite both pure methodological developments and novel macroscopic process simulations exploiting the unique capabilities of particle dynamics.

[1]The 3D shape is able to morph between different forms in response to external factors like temperature, humidity, etc.