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MODELING OF MANUFACTURING AND MATERIAL PROCESSING WITH PARTICLE METHODS (including PFEM, SPH, DEM, PIC, MPM…)

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Dedicated to the memory of Prof. Carlos Agelet de Saracibar

ABSTRACT

This Invited Organized Session aims to provide a forum for researchers and scientists to present and discuss recent advances in the computational modeling of manufacturing and material processing using particle-based and meshless methods. The session will focus on state-of-the-art mathematical formulations, numerical methodologies, computational strategies, and industrial applications involving large deformations, complex multiphysics couplings, and evolving material interfaces.

The objective of the session is to foster interdisciplinary exchanges and promote the development of robust and predictive computational approaches capable of addressing both fundamental and industrial challenges encountered in modern manufacturing and material processing technologies.

Topics of interest include, but are not limited to:

- Particle-based, meshless, and hybrid computational methods, including PFEM, SPH, DEM, MPM, PIC, LBM, FCM, EFG, and coupled FEM–particle approaches.
- Computational modeling of manufacturing and material processing operations such as additive manufacturing, casting, solidification, forging, rolling, extrusion, stamping, deep drawing, leveling, superplastic forming, thixoforming, welding, friction stir welding, friction melt bonding, high-speed forming, metal deposition, and automated fiber placement.
- Advanced mathematical formulations and numerical discretization techniques.

- Nonlinear and multiphysics solution strategies and implementation aspects.
- Stabilization techniques and multiscale computational approaches.
- Constitutive modeling at the macro-, meso-, micro-, and multiscale levels, including high strain-rate and high-temperature behavior.
- Contact mechanics, friction, and lubrication modeling.
- Damage, fracture, failure, and crack propagation simulations.
- Coupled thermomechanical, metallurgical, and multiphysics models.
- Simulation and optimization of manufacturing process chains.
- Large-scale computing, parallel algorithms, and high-performance computing for manufacturing simulations.

The session welcomes contributions addressing theoretical developments, algorithmic innovations, verification and validation procedures, as well as industrial applications and benchmark studies demonstrating the capabilities of advanced computational methods for manufacturing and material processing problems.