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ADVANCES IN MESH REDUCTION METHODS FOR MULTI-SCALE, MULTI-INTERACTION, AND SOLID-FLUID PROBLEMS: EXPLORING BOUNDARY ELEMENTS, MESH-FREE, AND PARTICLE-BASED TECHNIQUES

1700 - NUMERICAL METHODS AND ALGORITHMS IN SCIENCE AND ENGINEERING

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ABSTRACT

This mini-symposium aims to showcase and discuss recent advancements in mesh reduction methods, specifically focusing on boundary element methods (BEM), mesh-free methods, and particle-based methods such as smoothed particle hydrodynamics (SPH) and discrete element methods (DEM). The primary objective is to address complex problems associated with multi-scale phenomena, multi-interaction scenarios, and the interaction between solids and fluids.

The mini-symposium will cover a wide range of topics, including but not limited to hybrid approaches that combine BEM, mesh-free methods, particle-based methods, and molecular dynamics for multi-scale simulations. Sophisticated frameworks based on BEM for studies of the micro-mechanics of heterogeneous materials [1, 2]. Multi-scale couplings between BEM and other approximations such as molecular dynamics (MD) or coarse-grain models [3, 4]. Development and enhancement of SPH and DEM for modelling solid-fluid and fluid-fluid interactions, with a focus on high-strain morphology changes, soft materials and complex fluids [5, 6]. Mesh reduction techniques specifically designed for simulating multi-scale phenomena in coupled solid-fluid systems using molecular dynamics [7, 8]. Modelling multi-interaction scenarios involving particles, interfaces, and fluid-solid boundaries, particularly addressing fluid-fluid capillary interfaces and surface deformations [9]. Parallel computing and optimisation techniques for accelerating simulations in mesh reduction methods, like in the BEM open source software [10]. Also, in in-house developments on SPH and DEM,

enabling efficient 3D modelling of different phenomena. Applications in various fields including, additive manufacturing [11], granular materials [12], bio-mechanics [13], microfluidics, and fluid dynamics [14].

We invite researchers and practitioners actively working on these mentioned applications and methods to present their latest research findings at this mini-symposium. The aims are to provide a platform for meaningful discussions, exchange of ideas, and potential collaborations among experts in the field. Also, address challenges, explore novel methodologies for future developments.

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