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MULTI-SCALE AND COMPUTATIONAL SCALE BRIDGING

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ABSTRACT

In recent years, considerable progress has been made in bridging the mechanics of materials to the structural engineering level supported by advances in multi-scale modelling. Different classes of computational scale bridging methods have been developed to this purpose, spanning different disciplines, e.g. engineering, computational mechanics, mathematics, physics, chemistry etc. Although these methods have usually been equipped for a specific research problem, from a methodological point of view, similarities and distinctive features can be identified.

This invited session intends to serve as a forum for bringing together scientists from different disciplines working on scale bridging problems (both spatial as well as temporal) in materials and structures. The topics addressed in this invited session will include, but are not limited to:

- homogenization based methods, e.g. mathematical homogenization, computational homogenization etc.
- embedded domain methods, domain decomposition methods, global-local techniques
- heterogeneous multi-scale method (HMM), equation-free method
- (non-equilibrium) thermodynamics based coarse graining methods
- methods for bridging distinct models, e.g. atomistics-to-continuum
- methods for phenomena with (partially) non-separating scales, e.g. localization, damage and fracture or transient phenomena
- methods for bridging temporal scales
- methods for coupled multi-field phenomena
- methods for interfaces and contact conditions
- model reduction techniques and reduction of computational costs associated with multiscale algorithms and complex microstructures

- methods for integration of experimental data (e.g. imaging) into multi-scale numerical algorithms
- validation methodologies for multiscale approaches
- data-driven and machine learning based multi-scale approaches
- quantum-accelerated multiscale strategies