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ADVANCES IN FINITE ELEMENT METHODS FOR TRANSIENT, COUPLED INTERFACIAL PHENOMENA

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ABSTRACT

A variety of discretization techniques have been proposed for describing evolving, coupled interfacial phenomena using finite elements. These methods, including Generalized/eXtended FEM, Interface- and Discontinuity-Enriched FEM, cutFEM, Shifted Boundary Methods, and Conformal Decomposition FEM have been shown to be effective at capturing static and evolving interfacial discontinuities.

As these methods have matured, attention has been given to the conditioning, robustness, and performance of the methods and the associated coupling algorithms. Fully transient phenomena are being addressed with dynamic discretizations. Complex, coupled interfacial phenomena are being addressed with a variety of monolithic and iterative coupled strategies.

Software designs are being proposed for reducing the complexity and code development costs for implementing these advanced discretization techniques. Mixtures of commercial, open-source, and research codes are being developed and adapted to provide the end-user with cutting edge simulation and modeling capabilities not available previously.

This mini-symposium aims to bring together engineers, mathematicians, computer scientists, and national laboratory and industrial researchers to discuss and exchange ideas on new developments, applications, and progress in the discretization methods and algorithms for transient, coupled interfacial phenomena. While contributions to all aspects of these methods and their implementation are invited, topics of particular interest include:

- verification and validation; accuracy, computational efficiency, convergence, and stability of FEM discretizations and coupling algorithms for moving interfaces.
- new developments for immersed boundary or fictitious domain problems, flow and fluid-structure interaction, among others.
- applications to industrial problems exhibiting multiscale phenomena, localized non-linearities such as fracture, damage, or contact, and non-linear material behavior.
- acceleration techniques for coupling algorithms.