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MORTAR METHODS FOR COUPLING NON-CONFORMING GRIDS IN MULTI-PHYSICS AND MULTI-DOMAIN SIMULATIONS

100 - ADVANCED DISCRETIZATION TECHNIQUES

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ABSTRACT

In modern computational science and engineering, the ability to solve complex multi-physics and multi-domain problems has become essential across a wide range of applications, from fluid-structure interaction and geomechanics to biomedical modeling and additive manufacturing. A common challenge in such simulations is the need to couple independently generated computational grids that may differ in resolution, structure, or discretization schemes. The mortar method has emerged as a powerful and flexible approach for enforcing weak continuity across non-conforming interfaces, enabling accurate and stable coupling between subdomains without requiring mesh conformity. By enabling flexible grid generation and facilitating the coupling of different physical models across subdomains, mortar methods play a critical role in advancing the scope and fidelity of computational simulations.

This minisymposium provides an overview of recent advancements in the mortar finite element method as a robust framework for domain decomposition and grid coupling. The mortar approach supports heterogeneous discretizations, making it particularly well-suited for applications such as contact problems in solid mechanics, reservoir modeling in subsurface flow, and coupling structured and unstructured grids in large-scale fluid dynamics simulations. The focus is both on the mathematical formulation and on representative examples that demonstrate the versatility and effectiveness of mortar methods in practical engineering problems. Special attention is given to the role of mortar spaces, projection operators, and interface integrals in ensuring numerical accuracy and stability.