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RECENT ADVANCES IN HIGH-ORDER METHODS FOR NONLINEAR MULTI-PHYSICS SYSTEMS

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ABSTRACT

Complex multiphysics systems appear in various critical real-life applications, including multiphase flows, computational geosciences, magnetohydrodynamics, fluid-structure interactions, etc. These highly nonlinear problems describe strongly coupled physical mechanisms that interact across a wide range of length and time scales, necessitating robust and efficient high-resolution numerical approximations. Therefore, developing accurate and effective methods that leverage parallel computation at extreme scales is crucial. Numerical discretizations and solvers for practical multiphysics simulations must meet the following criteria: (1) High-order accuracy in space and time; (2) Stability; (3) Conservativeness; (4) Minimal degrees of freedom for implicit solution approaches; (5) Suitability for unstructured meshes; (6) Compatibility with hp-adaptivity; (7) Effectiveness in handling disparate temporal and spatial scales; and (8) Optimization for fine-grain parallelism.

This minisymposium provides a platform for researchers to present novel high(er)-order numerical methods for solving nonlinear multiphysics systems. The talks will address theoretical, numerical, and computational issues critical to developing approaches that exhibit these desired properties.