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NONLOCAL MODELS IN COMPUTATIONAL MECHANICS: CHALLENGES AND APPLICATIONS.

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ABSTRACT

The use of nonlocal models in scientific and engineering applications has been steadily increasing over the past decades. The ability of nonlocal theories to accurately capture phenomena that are difficult or impossible to represent by (local) partial differential equations motivates and drives the interest in nonlocal models. As an example, nonlocal continuum mechanics models can describe microstructure-dependent mechanical response, due to the incorporation of length scales in governing equations, as well as represent material discontinuity, such as evolving cracks leading to material failure, through the use of spatial integration rather than differential operators. However, these models present several computational and modeling challenges that are still subject of open research. These challenges include computational expense of numerical solution of nonlocal problems; prescription of nonlocal boundary conditions; accurate and higher-order discretization of nonlocal models; formulation of physically-consistent nonlocal interface problems; and estimation of nonlocal model parameters from experimental data. Advances in these topics would unlock the full potential of nonlocal models for their application in computational mechanics and several other fields. The goal of this minisymposium is to bring together experts on the mathematical, computational, and engineering aspects of nonlocal models to discuss the state-of-the-art in nonlocal modeling, establish new research guidelines, identify promising research advances, and create synergies between participants.

Topics of interest include but are not limited to:

1. Mathematical and numerical analysis of nonlocal models.

2. Mesh-based and mesh-free discretizations of nonlocal models.

3. Efficient solvers for nonlocal problems.

4. Multi-scale modeling of nonlocal problems, such as local/nonlocal coupling.

5. Multi-physics modeling of nonlocal problems, such as thermo-mechanical coupling.

6. Inverse nonlocal problems under sparsity or uncertainty.

7. Scientific, engineering, and industrial applications of nonlocal models, such as subsurface flow, material failure and damage, image denoising, wave propagation, and stochastic processes.