MACHINE LEARNING METHODS FOR INELASTIC/MULTISCALE/MULTIPHYSICS MATERIAL MODELING

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ABSTRACT

The advent of advanced manufacturing and materials technologies now provides the capabilities to architect microstructured materials such as 3D printed lattice structures, fiber-reinforced or multiphase composites, foams, electro- or magneto-active polymers. The mechanical and multifunctional behaviors of these metamaterials can be tailored to their specific engineering applications and are often highly nonlinear, anisotropic, inelastic, and multiphysical. Thus, classical constitutive models are typically not flexible enough to model their effective material behavior in multiscale and multiphysics simulations, while concurrent multiscale approaches are inherently computationally expensive and slow. Thus, in recent years, the formulation of constitutive models using highly flexible machine learning and surrogate modeling methods such as artificial neural networks and deep learning, Gaussian processes, radial basis functions, clustering methods, etc. has gained momentum. Nevertheless, many challenges remain to be addressed for machine learning-based material models, such as their accuracy, reliability and physical soundness, their efficiency, the consideration of parametric dependencies or uncertainties, etc.

This minisymposium welcomes contributions on the state-of-the-art of machine learning methods for inelastic, multiscale and multiphysics materials modeling. It is intended as a fruitful moment of interdisciplinary exchange of ideas.

KEY WORDS: Machine Learning, Computational Mechanics, Multiscale, Multiphysics, Material Modeling.