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DATA-DRIVEN APPROACHES IN MECHANICS

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ABSTRACT

This minisymposium provides a platform to discuss current developments in data-driven methods and scientific machine learning, which are transforming material modeling, computational mechanics, and solid mechanics more broadly. It continues the effort of bringing together researchers working on advancing these approaches to model and simulate complex mechanical problems. In that regard, several promising directions have emerged, ranging from directly exploiting data for computational mechanics without constitutive laws, applying deep learning including manifold learning and autoencoders for reduced-order modeling of nonlinear high-dimensional mechanics problems, integrating data-driven machine learning techniques with physics- and thermodynamics-based and models for various forward and inverse problems, to leveraging experimental measurements with artificial intelligence techniques towards fundamental solid mechanics models. Contributions are invited on a wide range of topics, including but not limited to: the development of machine learning-based surrogate and large-scale foundation models, physics-informed machine learning models for linear and nonlinear solid mechanics, model-free data-driven computational mechanics, data-assisted modeling of heterogeneous materials, data-driven discovery of constitutive laws and governing equations, the development of interpretable and explainable machine learning models, reduced-order real-time simulation of solids, inverse problems with machine learning, neural-enriched computational methods, as well as probabilistic and uncertainty quantification techniques. We finally invite researchers to contribute their findings in application-focused studies in solid mechanics, biomechanics, geomechanics and related disciplines. The minisymposium aims to foster an interdisciplinary discussion on the future of data-driven modeling and its potential to complement and transform traditional approaches in mechanics.