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ACCELERATING FAILURE PREDICTIONS THROUGH ADVANCES IN SCIENTIFIC MACHINE LEARNING AND SCIENTIFIC COMPUTING

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MINISYMPOSIUM

Fracture and damage mechanics play a pivotal role in understanding material behavior and ensuring the reliability of engineering structures across various industries. Traditionally, fracture models have relied on theories involving simplifications and empirical correlations, limiting their accuracy. Furthermore, numerical simulations involving fracture models can be laborious, demanding an efficient discretization framework as well as a reliable (non-)linear solution strategy. These challenges restrict the applicability of existent fracture models when addressing complex real-world scenarios.

Concurrently, the rapid advancement of scientific machine-learning techniques and scientific computing presents unprecedented opportunities for enhancing the predictive capabilities of fracture models by improving simulation efficiency and accuracy. This mini-symposium aims to explore the synergistic integration of traditional fracture mechanics principles with cutting-edge research in scientific machine learning and scientific computing. The goal is to exchange ideas, methodologies, and challenges at the intersection of fracture mechanics, data science, high-performance computing (HPC), and large-scale solution strategies.

Contributions will cover topics including, but not limited to:

1. Scientific Machine-Learning: Leveraging novel scientific machine-learning techniques to investigate fracture and failure phenomena across multiple scales, as well as to quantify the uncertainties, enable model discovery, and allow for anomaly detection and damage identification using sensor data and non-destructive evaluation techniques.
2. Scientific Computing: Leveraging scientific computing tools to elevate the efficiency and scalability of fracture simulations. This involves the development of novel, efficient, and scalable strategies for solving both linear and nonlinear systems in fracture mechanics. Additionally, we are keen on exploring the integration of HPC techniques to boost the performance of the fracture simulation frameworks.