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ADVANCING PREDICTIVE SIMULATIONS UNDER UNCERTAINTY: AI AND UQ FOR COMPUTATIONAL MECHANICS

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ABSTRACT

Partial Differential Equations (PDEs) are central to the simulation and understanding of complex physical phenomena in Computational Mechanics. However, traditional numerical methods have difficulties coping with the computational cost of solving these PDEs due to the small spatiotemporal scales that need to be resolved. The recent advances in Artificial Intelligence and machine learning have offered promising avenues by introducing novel strategies. For instance, reduced order-models based on non-linear variational auto-encoder architectures or neural operators to directly solve forward and/or inverse problems have shown promising results. In these methods, the quantification of uncertainty plays a crucial role as incomplete models, the information loss due to the dimensionality reduction as well as uncertain input parameters have to be taken into account.

This mini symposium will be discussing how data- or knowledge-based strategies can be used for Computational Mechanics to increase both speed and accuracy of obtain a solution to a given forward or inverse problem. Given the aforementioned uncertainties in both model and data, a special focus is given to probabilistic modeling approaches as well as the algorithmic tools that enable those innovative approaches.

We are inviting researchers to share their research findings, challenges, and potential applications of machine learning and Uncertainty Quantification in solving high-dimensional PDEs. The symposium will foster an interdisciplinary environment where researchers from the fields of Computational Mechanics, Artificial Intelligence, and Statistics can exchange ideas, collaborate, and explore new directions in this evolving domain.