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UNCERTAINTY QUANTIFICATION FOR COUPLED MULTI-PHYSICS, MULTI-SCALE AND MULTI-FIDELITY MODELING

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Credible modeling, prediction and design of coupled systems requires identifying all sources of uncertainty and quantifying their impact on model outputs. The computational and experimental costs of Uncertainty Quantification (UQ) are often immense for high-fidelity complex systems. The goal of this mini symposium is to (1) discuss state-of-the-art methods that reduce the cost of UQ by exploiting the coupled nature of complex systems and (2) demonstrate the challenges and successes of applying UQ to coupled systems.

We are particularly interested in talks focusing on the intersection of multi-physics, multi-scale and multi-fidelity modeling. Multi-fidelity modeling is a growing field that quantifies uncertainty-induced variability of the system by combining large amounts of data from cheap low-fidelity models (simplified physics, coarse meshes, etc) with a small number of high-fidelity data. If suitably devised, these methods allow for substantial computational savings, in some cases up to several orders of magnitude. Multi-fidelity methods are particularly well-suited for UQ of coupled systems. Successful strategies include considering a mixture of different fidelities for each component of the coupled system, for example varying micro and macro scale resolutions, and devising stochastic domain decomposition methods that reduce the coupling between system components.