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NUMERICAL METHODS THAT ENABLE THE HETEROGENEOUS COUPLING OF CONVENTIONAL AND DATA-DRIVEN MODELS FOR MULTI-SCALE AND MULTI-PHYSICS PROBLEMS

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ABSTRACT

Recent years have seen an exponential growth in the development and deployment of data-driven models, which can improve not only efficiency (by replacing expensive high-fidelity simulations), but also predictiveness (through data-driven discovery of hidden physics). As a result, there is an emerging need for computational approaches that enable the seamless and structure-preserving integration of data-driven models into modeling and simulation toolchains based on traditional discretization methods (finite elements, finite volume, etc.). This invited session will feature new advancements towards enabling the rigorous and agile coupling of arbitrary combinations of data-driven and traditional models in the context of both multi-scale and multi-physics problems. We anticipate submissions featuring a broad range of data-driven models, including projection-based reduced order models (ROMs), neural networks, dynamic mode decomposition (DMD) models, Operator Inference (OpInf) models, etc. We encourage submissions in the following areas: heterogeneous domain decomposition-based methods; interface/multi-physics problems; optimization-based coupling; coupling via the Schwarz alternating method or other iterative techniques; on-the-fly adaptation of data-driven models within a heterogeneous coupling workflow; structure-preserving coupling methods; software frameworks that enable heterogeneous coupling.