

MODEL ORDER REDUCTION FOR COUPLED SYSTEMS

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ABSTRACT

The numerical simulation of parametrized coupled multi-physics systems such as fluid-structure interaction to thermo-hydro-mechanical processes are computationally challenging. This complexity is amplified in outer loop applications where the high-fidelity model must be evaluated for several parameters instances. Examples of such applications are Uncertainty Quantification (UQ), optimization, inverse problems and parameters estimation. In these scenarios, traditional full-order models (FOMs) are often computationally prohibitive, necessitating the development of efficient and reliable surrogate models.

Model Order Reduction (ROM) bridge the gap between high-fidelity accuracy and real-time or many-query efficiency. This invited session focuses on recent algorithmic and theoretical developments in ROM specifically tailored for coupled systems. We seek contributions that address the unique challenges of coupling, including stability preservation, interface treatment, domain decomposition, and the preservation of physical constraints within the reduced-order manifold.

Key topics of interest include but are not limited to: ROMs for UQ and sensitivity analysis, inverse problems and data assimilation, optimization, Scientific Machine Learning and hybrid approaches integrating data-driven techniques with projection-based ROMs for enhanced robustness.

The goal of this session is to bring together researchers from various disciplines to exchange ideas on how reduced-order techniques can enable the next generation of predictive modelling for complex, coupled real-world problems. We welcome contributions demonstrating both fundamental methodological advances and impactful applications in engineering and the geosciences.