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METHODS FOR IDENTIFICATION, MACHINE LEARNING, AND UNCERTAINTY QUANTIFICATION OF REDUCED ORDER MODELS OF COUPLED SYSTEMS

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MINISYMPOSIUM

Coupled systems as they appear often in the form of e.g. fluid structure interaction or control of complex systems pose particular challenges already in solving the forward problem, as they often require the coupling of discretisations, solution algorithms, and software. These challenges are even larger if inverse problems like identification are tackled, or if one wants to perform an uncertainty quantification or optimisation for such a system, or if it is intended to design a control algorithm to achieve some desired optimal outcome. To reduce the computational burden, in such cases reduced order models (ROMs) or proxy models, sometimes combined with machine learning -- lately often in the form of deep neural networks -- are used. Due to the intended use in optimisation, uncertainty quantification, control, or deterministic or stochastic identification, such models are necessary parametric models, often involving large numbers respectively dimensions of parameters.

For coupled systems, the use of such ROMs is even more desirable, but they are often produced for each system component separately, and the problems of coupling then transfers to these ROMs. The questions which arise and should be addressed in this mini-symposium are then on how to produce such parametric reduced order models, and how to couple or combine models from different sub-domains to perform one of the afore mentioned tasks for the whole system. Of particular interest are new fast and computationally effective and accurate algorithms, as well as contributions to their formulation and analysis, computational procedures, understanding, error estimation.

The mini-symposium is to bring together researchers in these fields and offer a look at the problems alluded to above, contribute to the computational, physical, engineering and mathematical insight, and offer vistas and perspectives at the formulation, analysis, and computational solution.