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ADVANCED TECHNIQUES FOR DATA ASSIMILATION AND DATA-BASED ENRICHMENT OF SIMULATION MODELS

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ABSTRACT

The use of experimental data in association with simulation models as become a very active research topic. Indeed, new sensing facilities (such as those related to image-based or optic fiber-based technologies) now enable to collect a large and diversified amount of data from a physical system, and these may be advantageously used to identify and validate complex models, or to enhance predictions made by simulations tools using learning algorithms. Furthermore, these activities represent most of the "physical-to-virtual" leg of a digital twin framework. However, many challenges dealing with data selection/filtering, uncertainty quantification, management of computational cost, or numerical robustness, need to be addressed in order to incorporate data efficiently in practical applications.

The goal of the mini-symposium is to present, in both deterministic and stochastic (Bayesian) contexts, some recent fundamental advances in data assimilation, inverse methods, and hybrid modeling. With regards to innovative and powerful numerical approaches which emerged recently, we anticipate contributions on the following topics:

- use of model reduction or adaptive/multi-fidelity strategies for high dimensional parameter/state spaces;
- real-time sequential model updating for DDDAS, requiring fast inference algorithms;
- applications in multiscale or multi-physics contexts;
- physics-informed algorithms for deep learning from data;
- analysis of full-field measurements and large data;
- representation and propagation of modeling and measurement errors;
- goal-oriented ("fit-for-purpose") model updating;
- optimal experimental design.

This list is of course non-exhaustive, and all contributions dealing with the broad topic of data assimilation are welcome.