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TOWARDS PREDICTIVE DIGITAL TWINS: INNOVATIVE ALGORITHMS FOR PHYSICS-, DATA-ASSISTED AND HYBRID MODELING

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MINISYMPOSIUM

On the path towards predictive modeling via digital twins, the need for rapid, accurate, and reliable information comes to the forefront. Despite the increase in the available computational power, standard discretization techniques still struggle to provide viable solutions fulfilling industry time constraints. This is particularly critical during conception, design, and operation of complex systems, where the need for accurate many-queries applications and real-time response arises. This minisymposium focuses on recent trends, innovative methodologies, and algorithms for the efficient construction and execution of digital twins describing complex, potentially large-scale, systems and processes, spanning from data assimilation to uncertainty quantification, optimization, monitoring, and control. Methodologies of interest include different types of surrogate and reduced-order models (based on projection approaches and machine learning techniques), nonlinear dimensionality reduction, and multi-fidelity models, with a particular emphasis on hybrid approaches that incorporate both physics and data assets, towards interpretable artificial intelligence. Relevant fields of applications include but are not limited to, fluid-structure interaction, nonlinear mechanics, turbulent flows, compressibility, multi-phase interfaces, and heat exchange. Contributions featuring digital twins for (large-scale) industrial problems are particularly welcome.