ADVANCED METHODS FOR SYSTEM IDENTIFICATION AND OPTIMAL SENSOR PLACEMENT IN COMPLEX ENGINEERING APPLICATIONS

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ABSTRACT

Throughout their lifecycle, structures experience changes in their properties due to factors such as damage, corrosion, and fatigue. With advancements in sensor technology and numerical simulation methodologies, it has become increasingly feasible to develop a digital representation, or "Digital Twin," of these complex structures. A key component of Digital Twin development is system identification, which involves assessing the current condition of a structure and identifying areas of weakness or deterioration. This process requires solving an inverse problem through effective parameterization of the structure, often framed as an optimization task. The system identification is complemented by having the sensors at optimal places, thus requiring optimal sensor placement methodologies further improve the efficiency and accuracy of the system identification.

This mini-symposium focuses on advanced methods for system identification and sensor placement in engineering applications. We will delve into cutting-edge optimization techniques—such as gradient-based methods, genetic algorithms, and Bayesian optimization—that improve the accuracy and efficiency of system identification processes and optimal sensor placement methodologies.

Participants are encouraged to share case studies showcasing the application of these methodologies across diverse engineering fields, including civil, aerospace, and mechanical engineering. The symposium aims to foster collaboration and drive innovation in leveraging Digital Twin technology to enhance structural performance, safety, sustainability, and resilience. Discussions will address current challenges, best practices, and novel approaches to system identification, providing insights into proactive maintenance and informed decision-making for sustainable engineering design.

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