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AI-DRIVEN ADVANCES IN TOPOLOGY OPTIMIZATION AND METAMATERIALS DESIGN

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ABSTRACT

This session is focused on the integration of Artificial Intelligence tools, such as Deep Learning (DL) with classical computational mechanics techniques such as Finite Elements (FE) with the aim of implementing more efficient models, specifically in the fields of mechanical metamaterials and topology optimization. The complexity of modern structural design in application like aerospace, automotive and civil engineering industry, require high accuracy and reduced computational times to generate a framework suitable for design, computation, and optimization of structures. This session aims to generate discussion by presenting research on how hybrid AI-based methods in solid mechanics can accelerate these processes, making them more efficient and scalable.

We especially welcome contributions on surrogate model building for prediction of complex materials and systems, data-driven prediction of mechanical behaviours, material design and topology optimization, accelerated by model reduction. The techniques of interest in this session range from the use of purely Data-Driven techniques to Scientific Machine Learning frameworks e.g., Physics-Informed Neural Networks (PINNs). The session encourages both theoretical advancements and practical applications, aiming to bring forward a step into the future of the hybridizing classical and AI-driven methods for scalable and efficient structural design.