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FROM SURROGATE MODELS TO LEARNING IN MULTI-PHYSICS, MULTI-SCALE, MULTI-DISCIPLINARY OPTIMISATION

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ABSTRACT

Industrial design and optimisation processes entail the computation of many-queries of complex, possibly multi-physics and multi-scale, problems governed by partial differential equations (PDEs). This is particularly challenging when nonlinear models of large-scale systems are involved, with many design parameters and uncertain operating conditions. Moreover, in realistic scenarios of interest for the industry, such optimisation problems involve multiple, possibly competitive, objectives as well as geometric, physical, and manufacturability constraints.

This session aims to offer a platform for discussion on state-of-the-art and recent developments of computational science and engineering solutions for PDE-constrained optimisation problems involving complex phenomena. Topics of interest include high-fidelity adjoint-based shape and topology optimisation of coupled problems, PDE-constrained multi-objective optimisation, surrogate-based optimisation based on digital twin technologies, multi-fidelity surrogate models for optimisation, nonlinear dimensionality reduction for the exploration of high-dimensional design spaces, scientific machine learning for derivative-based and derivative-free optimisation, deep reinforcement learning as derivative-free optimisation strategies.

The primal focus of this session will be the development of frontier solutions to enhance shape, topology, and parametric optimisation strategies to meet industry time constraints. Contributions on state-of-the-art technologies to solve challenging problems in industry and sustainability (e.g., electromobility, energy harvesting, …) are particularly welcome.