ADVANCES IN SURROGATE AND REDUCED ORDER MODELS IN SIMULATION SCIENCE (PART 1)

FRANCESCO DELLA SANTA[*], MARIA STRAZZULLO[*]

[*] Politecnico di Torino,
Department of mathematics "Giuseppe Luigi Lagrange",
Corso Duca degli Abruzzi, 24, 10129, Torino, Italy.
francesco.dellasanta@polito.it, maria.strazzullo@polito.it

ABSTRACT

Accurately simulating complex physical phenomena is crucial in many areas of simulation science, from engineering, applied sciences, and industrial applications. However, many real-world problems involve high-dimensional models and uncertainties, making numerical simulations computationally intractable. Tasks such as control, uncertainty quantification, parameter estimation, and inverse modeling often require repeated evaluations of expensive numerical models, posing significant computational challenges.

To overcome these limitations, surrogate and reduced order models (ROMs) have emerged as effective tools to accelerate simulations while preserving accuracy. These methods include techniques based on statistical learning, dimensionality reduction, and deep learning, both data-driven and physics-informed, allowing efficient approximations of complex systems.

This minisymposium focuses on recent advances in surrogate and ROM methodologies, highlighting their role in reducing computational costs for various applications, including parametric and stochastic PDEs, optimization, and real-world challenges in the setting of simulation science.

The aim of the minisymposium is to bring together experts and researchers with different backgrounds, encouraging interdisciplinary discussions and bridging the gap between methodological advancements and practical implementations to showcase the potential of these methodologies in several real-case applications.