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SCIENTIFIC MACHINE LEARNING AND REDUCED ORDER MODELING IN NAVAL ENGINEERING

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ABSTRACT

In the last years scientific machine learning (SciML) and reduced order methods (ROMs) are emerged as a fundamental set of tools to tackle many-query problems such as optimization, uncertainty quantification and propagation, and inverse problems in a parametric context. Naval and nautical engineering represent a natural field of application of such methods due to the complexity of problems to solve, involving both structural and fluid analysis. Advances in parametric ROMs for computational fluid dynamics (CFD) for industrial applications can be found in [1, 2].

SciML and ROMs are enabling technologies to support decisions and devise more efficient hulls and propellers. The employment of such techniques has allowed indeed to overcome many limitations coming from more consolidated methodologies, mostly related to the computational demand and linearity constraints at the model level. ROMs and SciML propose the offline-online computational decoupling and the data-driven modelling in order to solve nonlinear problems, innovating the state of the art in many engineering fields.

The aim of this invited session is to stimulate the discussion on the applicability of scientific machine learning and model order reduction in naval engineering especially in the design phase of innovative vessels.

We encourage contributions regarding, but not limited to, surrogate based optimization, multi-fidelity methods, uncertainty quantification, parameter space reduction, inverse problems, physics informed machine learning, and ROMs for CFD and digital twins.

REFERENCES

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