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HIGH-FIDELITY SIMULATIONS IN MARINE ENGINEERING PROBLEMS

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ABSTRACT

The growing computing power of supercomputers during the last few years allowed scientists to exploit the predictive capabilities of eddy-resolving methodologies in marine engineering, including, for example, naval hydrodynamics and marine energy problems [1,2]. In particular, parallel computing and GPU accelerators enabled the simulation of practical flow problems on grids consisting of hundreds of millions or billions of points to resolve the Navier-Stokes equations by means of Large-Eddy Simulation (LES), Detached-Eddy Simulation (DES) or wall-modeled LES. Many times these methodologies are adopted in the framework of multi-fidelity approaches, where, for instance, eddy-resolving techniques are coupled with models mimicking the action of the bodies immersed within the flow using actuator disks or actuator lines models. The latter are utilized, for instance, to simulate propellers working on ships and submarines as well as turbines in hydrokinetic farms, where the flow problem involves a wide range of scales. Although the solution of marine engineering problems in full scale by geometry-resolving LES or DES is still very challenging, the information provided by high-fidelity techniques at model scale is a critical reference for tuning lower-fidelity approaches and, more in general, to develop an improved insight on the complex flow phenomena.

In this session we invite the submission of works dealing with relevant marine engineering problems (such as marine propulsion and hydrokinetic energy, among others) where the predictive capabilities of eddy-resolving techniques are utilized in the framework of high-performance computing to demonstrate the state-of-the-art of computational fluid dynamics in this field.

REFERENCES

[1] Posa, A., Broglia, R., *Flow over a hydrofoil at incidence immersed within the wake of a propeller*, Physics of Fluids, Vol. 33(12), p. 125108, 2021.

[2] Posa, A., Broglia, R., Balaras, E., *Instability of the tip vortices shed by an axial-flow turbine in uniform flow*, Journal of Fluid Mechanics, Vol. 920, A19, 2021.