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HIGH-FIDELITY CFD WITH APPLICATION IN SHIP HYDRODYAMICS

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ABSTRACT

Current state of the art CFD approaches for naval hydrodynamics are facing particular challenges like turbulence modelling for thick boundary layers, flows with strong pressure-gradients and separation, and high Reynolds numbers when predicting the flow around large ship hulls, like the JBC-case (Japanese Bulk Carrier), for example. Scale-resolving simulation approaches, such as wall-modelled Large-Eddy Simulation (WMLES) provide better predictive accuracy [1], but their application to large vessels requires solvers with excellent parallel scaling capable of taking advantage of exascale supercomputers and diverse compute backends. Furthermore, using higher-order discretization techniques would provide the benefit of better fidelity for a given grid size. The main focus of the proposed session is on applications of high-order CFD methods, including spectral and spectral-element discretisation [2] on large parallel computing systems onto problems of marine hydrodynamics. In addition to this, WMLES for high-order schemes and corresponding state-of-the-art wall-models, like machine-learning based models, are of particular interest for this session. In this regard, also WMLES results to common benchmark test cases like the flow over steps, curved surfaces or periodic hills are of interest to illustrate the progress in this field. One driver for this is the on-going EuroHPC Centre of Excellence CEEC, where exascale algorithms for current CFD problems are being developed, implemented and tested.

REFERENCES

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