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Challenges in performance prediction of ships equipped with wind propulsion

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ABSTRACT

Facing the urgent need to decrease greenhouse gas emissions from shipping, the maritime industry has shown a growing interest in design and/or retrofitting various wind propulsion devices to assist the propulsion of ships recently. On the one hand, experience in design and operation of large cargo ships equipped with wind propulsion devices is still lacking. On the other hand, CFD methods have the potential to predict the performance of such ships (Kontos et al., 2023), however, not without issues at current stage. Challenges in predicting the aero- and hydrodynamic performance of ships equipped with wind propulsion systems (WPS) are discussed in this paper. It addresses the questions of scale effects from wind tunnel scale to full scale Reynolds number, influence of atmospheric boundary layer, flow separation, stall, and interaction between multiple propulsion units and hull superstructure.

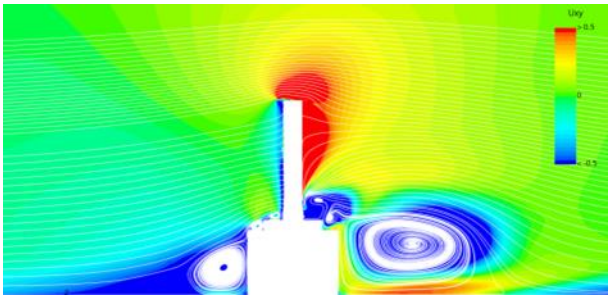

Figure 1: Flow feature on a transversal plane cutting the rotor install location (to be replaced)

To assess dynamic loads, roll motions and the manoeuvrability of WPS equipped vessels, the unsteady panel code SHIPFLOW MOTIONS was further developed to couple the aerodynamic and hydrodynamic forces for 6 DOF simulations. Example applications of SHIPFLOW MOTIONS, the pros and cons of the method are discussed.

Fig. 1 shows an example of flow pattern on a plane cutting through the rotor install location in beam reach condition from Kontos et al. (2023), highlighting the interaction effect between rotor and hull superstructure.

References

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