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Efficient prediction of aerodynamic interaction effects including optimised controls for wind propulsion

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ABSTRACT

The power savings obtained from a configuration of wind propulsors on a vessel is affected by the location of the wind propulsor in the atmospheric boundary layer, the interaction of the wind propulsor with the ship and superstructure and the interaction between the wind propulsors. In additions the controls of the wind propulsors should be adapted to these interactions. Inclusion of these interaction effects is required for the EEDI (IMO, 2020) and all but the lowest fidelity performance predictions (ITTC, 2024). Some guidance is available on generating data for a specific condition (ITTC, 2024), but no methodology is specified to generalise data to all the wind and operational conditions covered in a performance prediction. Such a methodology is especially relevant when using numerical methods instead of wind tunnel tests.

MARIN developed the “effective wind model” for this purpose (Garenaux and Schot, 2021), using a combination of the standalone performance of the wind propulsor, CFD for the interaction between the wind propulsor and ship and superstructure and a non-linear lifting line method (Schot and Garenaux, 2023) for the interaction between the wind propulsors. The “effective wind model” is described together with the integration of the aerodynamic interaction effects in a performance prediction. Finally, the predicted aerodynamic performance is validated using CFD for a configuration or rotor sails and rigid wing sails on a bulk carrier as shown in Figure 1.

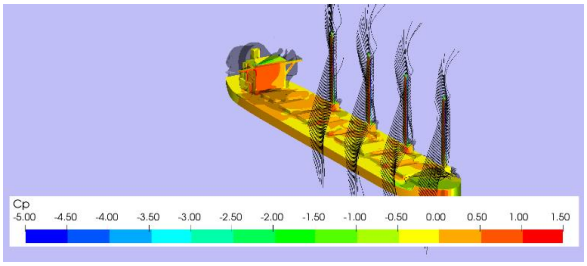

Figure 1: Results from the validation using CFD for a configuration of rigid wing sails.

References

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