Effect of surface roughness on numerical modeling of full-scale self-propulsion

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Effect of surface roughness on numerical modeling of full-scale self-propulsion[1] HENRIK MIKKELSEN, JENS HONORE WALTHER, Technical University of Denmark — When predicting the full-scale performance of a vessel, the resistance from surface roughness is important, since it can account for up to 15 % of the total resistance for a newly built vessel. We compare full-scale computational fluid dynamics (CFD) simulations with speed trial measurement from six sister ro-ro vessels. The study includes extensive validation and verification of both resistance, open-water and self-propulsion simulations. Full-scale resistance and open water as well as model scale self-propulsion simulations show good agreement with towing tank measurements and predictions. However, the full-scale self-propulsion simulations using the traditional approach of including the roughness estimated by the empirical formula of Townsin significantly underestimates the power from the speed trials. By including the effect of hull and propeller roughness directly into the CFD simulation, by modifying the wall functions, the discrepancy between CFD and speed trial measurements now reach an acceptable level. As a result, full-scale CFD simulations is becoming a viable and accurate alternative to transitional towing tank experiments.

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