Evaluation of ESD's Performance Prediction Methods Using Full-Scale CFD Simulation

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ABSTRACT

Many ship owners consider performance improvement techniques for their fleet to comply with new IMO energy efficiency standards. Equipping vessels with Energy Saving Devices (ESD) is one of the methods to achieve this goal. ESDs can be designed uniquely for each ship, or some advertised as general-purpose solution. Consequently, a reliable prediction of the energy savings is important for ship owner as investment. Both model test and CFD computations have been used to estimate the performance of a given device, but each method has had shortcomings. Improvement in simulation methods, together with increasing computational power, has promised new opportunities for studying in detail the augmentation of flow entering propeller by ESD, but for such a complex computation, uncertainties are abundant. This project aims to investigate the capability of commercial CFD softwares used for predicting the energy efficiency of ESDs. To generalize the application, two different types of ESD was considered in this study for two types of vessels. First vessel was a tanker (KVLCC2), equipped with pre-swirl stator and duct in front of the propeller. Second vessel was a car-carrier vessel (PCTC), equipped with a rudder bulb after the propeller. The ESD for the tanker was designed and a model was manufactured for towing tank test. Together with performing full-scale CFD simulations, for both vessels, self-propulsion model tests were performed with and without ESD. The importance of the surface roughness for ESD simulations was demonstrated in all full-scale simulations.

Keywords*: Energy Saving Device (ESD); Pre-Swirl Stator (PSS); Scale effect; Computational Fluid Dynamics CFD; Experimental Fluid Dynamics (EFD); Self-Propulsion.*

REFERENCES

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