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CFD verification and validation of added resistance and seakeeping response in regular oblique waves with varying wave length

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ABSTRACT

The importance of CFD is increasing in marine hydrodynamics in studying seakeeping and added resistance of ships. While extensive numerical studies have been reported for various ships in head seas in the literature, much fewer CFD studies are found for oblique waves, which in practice is very important in, for instance, estimating required power and manoeuvrability of ships in realistic sea states. In this paper, the added resistance and motion responses for the KCS container ship in regular waves are studied and validated systematically for five wave headings and six wavelengths using CFD. The ship is free to heave, pitch, and roll. Implementations to the commercial CFD code are made to fix the yaw and surge motions. Extensive verification of the CFD model finds the estimated spatial and temporal discretization errors to be less than 5%. Results of the verified CFD model are compared with up to three sets of experimental data sets, Potential Flow (PF) and existing CFD results from the literature. In general, the present CFD results show significantly better agreement with the experiments than previously published CFD results. The agreement between the present CFD model and experiments is better for the headings, where the uncertainties of the experiments are smallest. Present CFD results confirm previous published numerical findings that the experimental roll motion is excessive for the 45° heading.

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