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(Research Article)
Acoustic analysis of behavior in marine propellers-A numerical study

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Abstract

The emitted sound from ships is one of the most important sources of noise in the ocean, and the propeller sound is the main component of this sound. In this study, the numerical investigation of the functional sound level of a marine propeller has been carried out based on Computational Fluid Dynamics (CFD) and Fox Williams-Hawkings (FW-H) acoustic Analogy. In this research, in order to validate the solution method, first the fluid field around the DTMB4119 propeller was simulated, and then its sound pressure level compared with experimental results. Then the new propeller is numerically investigated. The acoustic performance of this propeller is evaluated in two permanent and non-permanent modes. First, a steady-state hydrodynamic simulation was created, and then the flow field is simulated by adopting the unsteady equations of Improved Delayed Detached Eddy Simulation (IDDES). According to the propeller diameter (D=2m), this simulation was done for the scale of the model, then ITTC87 equations are used to generalize the noise results to the actual size of the propeller. The sound level of the propeller is drawn at distances of 1 and 4 meters and at angles of 30, 60, 90, 120 and 150 degree and analyzed.

Keywords: Marine propeller, Computational fluid dynamics, Fox-Williams-Hawkings (FW-H) equations, Improved Delayed Detached Eddy Simulation (IDDES).

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