Sub-domain based numerical modeling of ship hull propeller interaction

Viscous flow around the self-propelled hull is investigated at model scale with RANSE (Reynolds Averaged Navier stokes Equations) solver using realizable k-e turbulence model by coupling the flow around the model hull with the flow generated by the rotating propeller in time domain. The challenges involved in coupling of flow past ship hull with the propeller flow, have been brought out and addressed. The technique used is based on a sliding model method where the numerical tank is divided into two regions which are modeled separately.They are the propeller domain and the tank domain respectively. The latter includes the bulk of the liquid, the hull and the boundary regions of the domain. The grid in the propeller region rotates with the propeller. The grid in the tank remains stationary. The two grids slide past each other at a cylindrical interface. In the tank region the standard conservation equations for mass and momentum are solved. In the sliding mesh model motions of the propeller region is accounted for by a grid motion of the propeller domain, and the flow variables are interpolated across a sliding interface. Comparisons were made between the simulated results and corresponding experimental results for the hull-propeller interaction effects. It is shown that the flow field in the self-propelling condition is well reproduced in the simulation.

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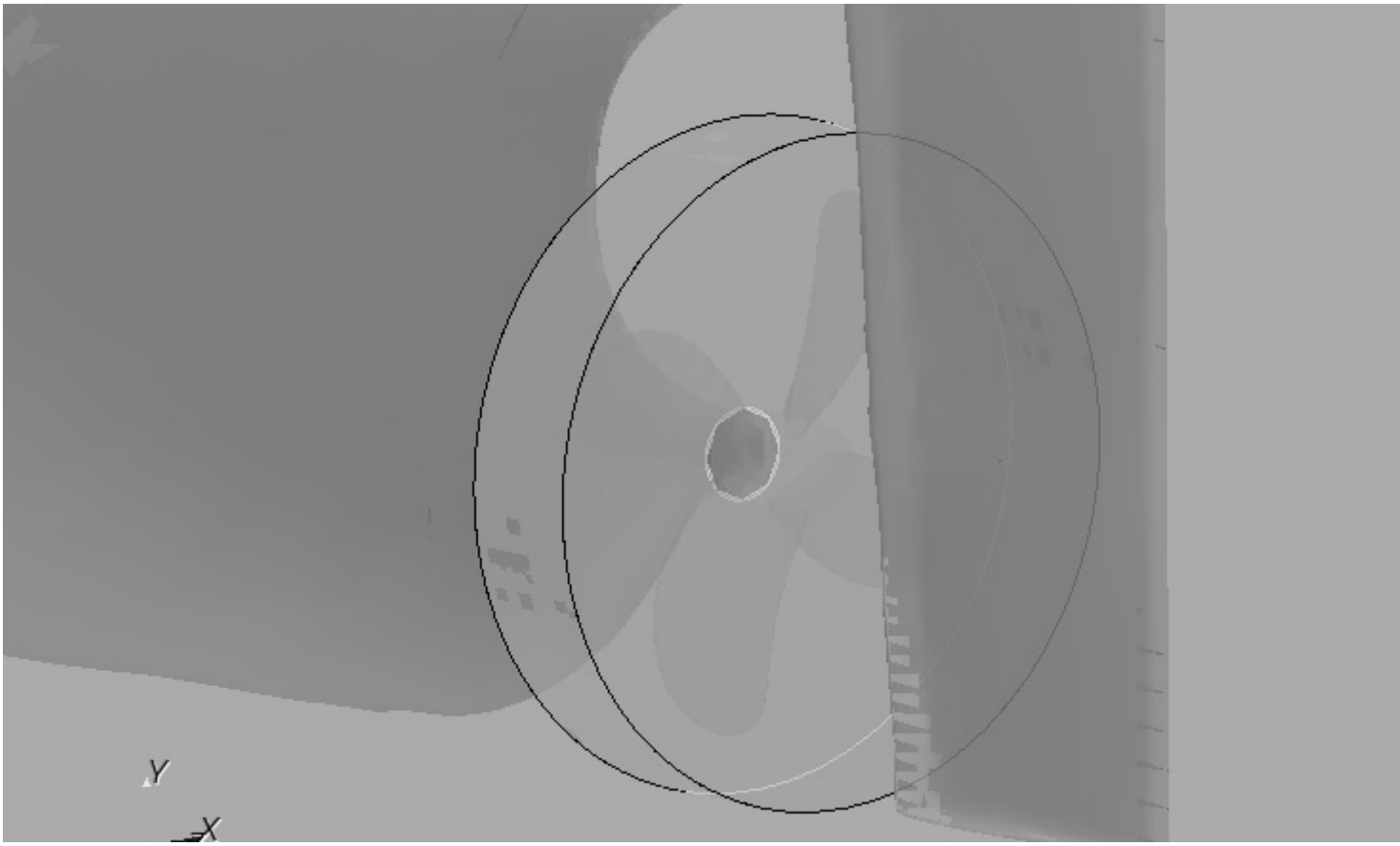

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