Dynamic modelling of high-speed motorboat fluid-structure interaction using a loosely coupled lattice Boltzmann – RANS approach.

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ABSTRACT

Modelling of high-speed planing boats is an inherently multi-phase problem: consideration must be made for the hydrodynamic phase, the non-negligible aerodynamic phase, and the free surface boundary at the interface. To accomplish this the lattice Boltzmann method [1] has been employed via Palabos [2] to capture the complex free surface boundary with a Volume of Fluid approach [3]. These hydrodynamic simulations have been coupled with results from a 3D RANS aerodynamic solver to provide a more complete description of high-speed hullform performance for analysis and optimisation. In doing so, tow-tank capabilities are sought in a virtual environment to accelerate the hullform design process before entering costly tow-tank analysis. Capabilities include response to wave perturbations, and automatic assessment of hullform trim position for a given speed and hullform mass properties. Validation of the hydrodynamic solution is made against comparable flume tank experiments, and the simulated dynamic response is compared to known hullform performance.

REFERENCES

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