Application of wave induced thrust on a submerged foil

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ABSTRACT

Submerged flapping foils can directly convert wave energy into thrust through Wave Devouring Propulsion (WDP) [1,2]. This green propulsion technology has been shown to improve the efficiency of both manned and unmanned vessels by reducing wave resistance, heave and pitch responses and providing additional propulsion support while reducing fuel consumption. Springs are often used to connect the foil to the ship, but the effect of spring stiffness on the foil performance under different wave conditions has yet to be well studied. This study analyses the hydrodynamic performance of a wave-induced passive foil by constraining its heaving and pitching motions through spring force. Free-running tests were conducted in the wave tank, and the results were used to establish a CFD framework [3] for simulating digital twins. In addition, scaled-down model tests were performed with various types and dimensions of foils to assess the effects of waves on foil performance. The vortex flow pattern was used to observe the transition from drag to thrust. Based on these findings, the optimal wave conditions and pitch stiffness for future green marine systems design are presented.

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