Hydrodynamic Performance of Flapping-foil Propulsion in the Influence of Vortices(PDF)

Title: Hydrodynamic Performance of Flapping-foil Propulsion in the Influence of Vortices

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摘要: Fish are able to make good use of vortices. In a complex flow field, many fish continue to maintain both efficient cruising and maneuverability. Traditional man-made propulsion systems perform poorly in complex flow fields. With fish-like propulsion systems, it is important to pay more attention to complex flow fields. In this paper, the influence of vortices on the hydrodynamic performance of 2-D flapping-foils was investigated. The flapping-foil heaved and pitched under the influence of inflow vortices generated by an oscillating D-section cylinder. A numerical simulation was run based the finite volume method, using the computational fluid dynamics (CFD) software FLUENT with Reynolds-averaged Navier-Stokes (RANS) equations applied. In addition, dynamic mesh technology and post processing systems were also fully used. The calculations showed four modes of interaction. The hydrodynamic performance of flapping-foils was analyzed and the results compared with experimental data. This validated the numerical simulation, confirming that flapping-foils can increase efficiency by absorbing energy from inflow vortices.

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