Numerical study on hydrodynamic effect of flexibility in a self-propelled plunging foil

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31 August 2000

The present study is a numerical investigation of the hydrodynamic effects of passive flexibility on a self-propelled plunging foil. In the model problem, the flow is two-dimensional, incompressible and inviscid. The foil is assumed to be made of an elastic sheet which is articulated at its two ends. The kinematic of the foil is governed by the inextensible Kirchhoff plate equations. The fluid-structure interaction is modeled using Arbitrary Lagrangian-Eulerian (ALE) formulation. The hydrodynamic forces and moments are calculated through the integration of the fluid stress over the deforming foil surface. A CFD code was developed specifically for this study. Results are presented for different bending stiffnesses in terms of lift and drag coefficients.