

عنوان مقاله:

Energy Extraction Performance Improvement of a Flapping Foil by the Use of Combined Foil

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خلاصه مقاله:

In this study, numerical investigations on the energy extraction performance of a flapping foil device are carried out by using a modified foil shape. The new foil shape is designed by combining the thick leading edge of NACA۰۰۱۲ foil and the thin trailing edge of NACA۰۰۰۶ foil. The numerical simulations are based on the solution of the unsteady and incompressible Navier-Stokes equations that govern the fluid flow around the flapping foil. These equations are resolved in a two-dimensional domain with a dynamic mesh technique using the CFD software ANSYS Fluent ۱۶. A User Define Function (UDF) controls the imposed sinusoidal heaving and pitching motions. First, for a validation study, numerical simulations are performed for a NACA۰۰۱۲ foil undergoing imposed heaving and pitching motions at a low Reynolds number. The obtained results are in good agreement with numerical and experimental data available in the literature. Thereafter, the computations are applied for the new foil shape. The influences of the connecting area location between the leading and trailing segments, the Strouhal number and the effective angle of attack on the energy extraction performance are investigated at low Reynolds number ($Re = 10\ 000$). Then, the new foil shape performance was compared to those of both NACA۰۰۰۶ and NACA۰۰۱۲ baseline foils. The results have shown that the proposed foil shape achieves higher performance compared to the baseline NACA foils. Moreover, the energy extraction efficiency was improved by ۳۰.۶۰% compared to NACA۰۰۰۶ and by ۱۷.۳۲% compared to NACA۰۰۱۲. The analysis of the flow field around the flapping foils indicates a change of the vortex structure and the pressure distribution near the trailing edge of the combined foil compared to the baseline foils.

کلمات کلیدی:

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