

عنوان مقاله:

Kinematic Optimization of Energy Extraction Efficiency for Flapping Airfoil by using Response Surface Method and Genetic Algorithm

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خلاصه مقاله:

In this paper, numerical simulations have been performed to study the performance of a single fully activated flapping wing serving as energy harvester. The aims of the paper are predicting and maximizing the energy extraction efficiency by using optimization methodology. The metamodeling and the genetic algorithms are applied in order to find the optimal configuration improving the efficiency. A response surface method (RSM) based on Box–Behnken experimental design and genetic algorithm has been chosen to solve this problem. Three optimization factors have been manipulated, i.e. the dimensionless heaving amplitude h_0 , the pitching amplitude θ_0 and the flapping frequency f . The ANSYS FLUENT ۱۴ commercial software has been used to compute the governing flow equations at a Reynolds number of ۱۱۰۰, while the flapping movement combined from heaving and pitching of the NACA۰۰۱۵ foil has been carried out by using an in house user-defined function (UDF). A maximum predicted efficiency of ۳۴.۰۲% has been obtained with high accuracy of optimal kinematic factors of dimensionless heaving amplitude around the chord, high pitching amplitude and low flapping frequency of ۰.۳۰۴ hertz. Results have also showed that the interaction effect between optimization factors is important and the quadratic effect of the frequency is strong .confirming the great potential of the applied optimization methodology

کلمات کلیدی:

Numerical simulation, Flapping wing, Energy extraction, Efficiency, Box–Behnken

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