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Kinematic Optimization of Energy Extraction Performances for Flapping Airfoil by Using Radial Basis Function Method and Genetic Algorithm

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Abstract : In this paper, numerical simulations have been carried out to study the performance of a flapping wing used as an energy collector. Metamodeling and genetic algorithms are used to detect the optimal configuration, improving power coefficient and/or efficiency. Radial basis functions and genetic algorithms have been applied to solve this problem. Three optimization factors are controlled, namely dimensionless heave amplitude h0, pitch amplitude θ0, and flapping frequency f. ANSYS FLUENT software has been used to solve the principal equations at a Reynolds number of 1100, while the heave and pitch motion of a NACA0015 airfoil has been realized using a developed function (UDF). The optimal kinematic factors detected are a dimensionless heave amplitude of 0.831c, a high pitch around 80°, and a low flapping frequency of 0.327 hertz.

Keywords : numerical simulation, flapping wing, energy extraction, power coefficient, efficiency, RBF, NSGA-II
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