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Low Reynolds Number Effect on CFD Prediction of Bio–Inspired Aerodynamics

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Abstract

This work is motivated by the need for the implementation of the best numerical models for low Reynolds flows and presents the state–of–the–art of the implemented models for the transition of the laminar-turbulent predictions. The numerical models are applied to investigate the aerodynamic characteristics and flow behavior around bird–like airfoils. Two Dimensional Reynolds Averaged Navier Stokes (2D RANS) and Three-Dimensional Unsteady (3D U-RANS) methods are applied at a Reynolds number of 10^5, whereas two-dimensional laminar simulations and three-dimensional Large Eddy Simulation are employed for the known Owl-like airfoil at Reynolds number of 2.3×10^4. The numerical results of flow fields around Owl-like airfoil at the latter Reynolds number using two-dimensional laminar and 3DLES predict correctly the unsteadiness of the aerodynamic coefficients. The 2D and 3D RANS methods are predicting well the aerodynamics characteristics for the man-made-bird-like airfoil at Reynolds number of 10^5.

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