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Oscillatory Behavior of an Arc Airfoil in Low-Speed Airflow MAJID MOLKI, NEGIN SATTARI, Southern Illinois University Edwardsville — A computational investigation is conducted to study the oscillatory behavior of an arc airfoil situated in low-speed airflow. The present work is relevant to situations where the conventional rigid airfoils do not apply, such as the flight of bats. The outcome of this study is also beneficial in the design of micro air vehicles with flexible wings. The computations are performed using a deforming mesh to accommodate the airfoil oscillations. An unsteady, spatially second-order algorithm is employed to capture the time-variations of the lift and drag coefficients. A key feature of the present work is the flow response to airfoil oscillations. Fast Fourier Transform was applied to various parameters of the flow. For certain values of angle of attack for the non-oscillating airfoil, the flow has a dominant frequency and a well-defined vortex shedding. For other values of angle of attack, the flow around the non-oscillating airfoil contains many frequencies and has complex vortical structures. However, the oscillating airfoil in all cases makes the flow field periodic with well-defined patterns of vortex shedding. In this work, the flux of vorticity from the airfoil surface into the airflow is computed and compared with the pressure gradient along the surface of the airfoil. Effects of oscillations on magnitude and behavior of aerodynamic forces are also studied.

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