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Characterizing Prescribed Surface Morphing for Aerodynamic Flows: Mechanistic Insights for Control KEVIN TRINER, ANDRES GOZA, University of Illinois at Urbana-Champaign — Robust and efficient flow control is key to improving the maneuverability and disturbance rejection of micro- and unmanned aerial vehicles. Previous and current actuation strategies to achieve this aim include zero-net mass flux (synthetic), plasma, and combustion actuators. We investigate an alternative actuation framework in which prescribed deformations are imposed along the suction surface of the airfoil. This prescribed surface morphing, which is a variant of the actuation methodology suggested by Jones *et al.* (2016), is designed to take the form of a traveling wave. This actuation strategy is promising because it has the ability to affect flow over the entire suction surface of the airfoil, and is not limited to specific streamwise locations. We use high-fidelity nonlinear simulations to quantify the effect of the surface morphing wave speed, frequency, and wave length on the aerodynamic performance of a 2D airfoil. The effect of morphing parameters is characterized in terms of the relationship between morphing kinematics, flow structures, and aerodynamic forces. These relationships are then used to synthesize surface morphing behavior that is beneficial to aerodynamic performance.

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