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Active Control of Aerodynamic Forces on a Rapidly Maneuvering Airfoil[1] DANIEL BRZOZOWSKI, JOHN CULP, ARI GLEZER, Georgia Insitute of Technology — The unsteady aerodynamic forces and moments on a rapidly maneuvering free-moving airfoil are investigated in wind tunnel experiments. The airfoil is mounted on a 2-DOF traverse and its trim and dynamic characteristics are controlled using position and attitude feedback loops that are actuated by servo motors. The motion of the airfoil is effected by bi-directional changes in the pitching moment using controllable trapped vorticity concentrations on both the suction and pressure surfaces near the trailing edge that are induced and regulated by hybrid synthetic jet actuators. The dynamic coupling between the actuation and the time-dependent flow field is characterized using simultaneous force and velocity measurements that are taken phase-locked to the commanded actuation waveform. The unsteady flow characteristics induced by the fluidic actuation during a prescribed maneuver are compared with the effects of a simple rigid-body motion of the airfoil when an external torque is used to achieve a similar maneuver. It is shown that the time-dependent aerodynamic forces and induced flow fields in the near wake of the moving airfoil are significantly different, emphasizing the role of the coupling between the flow control actuation and the model's unsteady aerodynamics.

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