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Unsteady Aerodynamics Effected by Controlled Trapped Vorticity Concentrations[1] DANIEL BRZOZOWSKI, ARI GLEZER, Georgia Institute of Technology — The transitory response of the flow-about a free-moving airfoil to time-dependent fluidic actuation that yields aerodynamic forces and moments in the absence of conventional control surfaces is investigated in wind tunnel experiments. Desired maneuvers are achieved using a 2-DOF feedback-controlled traverse that is programmed for trim and dynamic characteristics. Bi-directional changes in the pitching moment are effected by controllable, nominally-symmetric trapped vorticity concentrations on both the suction and pressure surfaces near the trailing edge. Actuation is independently applied on each surface by hybrid actuators that are each comprised of a miniature [O(0.01c)] obstruction integrated with synthetic jets which manipulate and regulate vorticity flux near the surface. Simultaneous measurements of the unsteady forces and moments and of the associated velocity field above and in the near wake of the airfoil are used to asses the coupling between the flow and vehicle dynamics with emphasis on control authority and optimal actuator placement and operating parameters. Flow control effectiveness is demonstrated by closed-loop response to a momentary force disturbance analogous to the response to a sudden gust in free flight.

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