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Close-loop Dynamic Stall Control on a Pitching Airfoil IAN GILES, THOMAS CORKE, University of Notre Dame — A closed-loop control scheme utilizing a plasma actuator to control dynamic stall is presented. The plasma actuator is located at the leading-edge of a pitching airfoil. It initially pulses at an unsteady frequency that perturbs the boundary layer flow over the suction surface of the airfoil. As the airfoil approaches and enters stall, the amplification of the unsteady disturbance is detected by an onboard pressure sensor also located near the leading edge. Once detected, the actuator is switched to a higher voltage control state that in static airfoil experiments would reattach the flow. The threshold level of the detection is a parameter in the control scheme. Three stall regimes were examined: light, medium, and deep stall, that were defined by their stall penetration angles. The results showed that in general, the closed-loop control scheme was effective at controlling dynamic stall. The cycle-integrated lift improved in all cases, and increased by as much as 15% at the lowest stall penetration angle. As important, the cycle-integrated aerodynamic damping coefficient also increased in all cases, and was made to be positive at the light stall regime where it traditionally is negative. The latter is important in applications where negative damping can lead to stall flutter.

Thomas Corke
University of Notre Dame

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