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Aerodynamic Control of a Dynamically Pitching Airfoil using Transitory Pulsed Actuation YUEHAN TAN, THOMAS CRITTENDEN, ARI GLEZER, Georgia Inst of Tech — Transitory control and regulation of trapped vorticity concentrations are exploited for control of the aerodynamic loads on an airfoil that is dynamically pitching beyond the dynamic stall margin in wind tunnel experiments. Actuation is effected using a spanwise array of integrated miniature chemical (combustion based) high impulse actuators that are triggered intermittently relative to the airfoil's motion on characteristic time scales that are an order of magnitude shorter than the airfoil's convective time scale. The effects of the actuation on the aerodynamic characteristics of the airfoil are assessed using time-dependent measurements of the lift force and pitching moment coupled with time-resolved particle image velocimetry that is acquired phased-locked to the motion of the airfoil. The aerodynamic loading can be significantly altered by a number of actuation programs using multiple actuation bursts during the pitch cycle. While actuation during the upstroke primarily affects the formation, evolution, and advection of the dynamic stall vortex, actuation during the downstroke accelerates flow attachment. Superposition of such actuation programs leads to enhancement of cycle lift and pitch stability, and reduced cycle hysteresis.

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