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Transitory Control of Separation over a Pitching Airfoil using Spatially-Compact Pulsed Actuation[1] GEORGE T.K. WOO, ARI GLEZER, Georgia Institute of Technology — The dynamics of controlled three-dimensional attachment of transitory stall over a pitching 2-D airfoil is investigated in wind tunnel experiments using spanwise-compact (0.12S) pulsed actuation on time scales that are an order of magnitude shorter than the characteristic convective time scale. Actuation is effected using a surface-integrated pulsed, combustion-based fluidic actuators. The flow field above the airfoil and in its near wake is computed from multiple high-resolution PIV images in multiple cross stream planes that are obtained phase-locked to the actuation, and allow for tracking of vorticity concentrations. Transitory attachment spreads towards the outboard, unactuated flow domains and far exceeds the width of the actuator. The actuation results in the formation of 3-D vortical structures that are advected and shed into the near wake and induce spanwise variations in the sectional circulation. It is shown that coupling of the pulsed actuation to the airfoil's motion enhances the control authority of 3-D unsteady separation, can significantly mitigate the effects of dynamic stall and improve the unsteady aerodynamic lift and pitching moment.

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