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3-D Separation Control using Spatially-Compact, Pulsed Actuation[1] GEORGE T.K. WOO, ARI GLEZER, Georgia Institute of Technology — The dynamics of controlled 3-D transitory attachment of stalled flow over a dynamically pitching 2-D airfoil are investigated in wind tunnel experiments. Pulsed actuation is effected over a spanwise fraction of the separated domain on a time scale that is an order of magnitude shorter than the airfoil's characteristic convective time scale using surface-integrated pulsed, combustion-driven actuator jets. The formation, evolution, and advection of vorticity concentrations over the airfoil and in its near wake are computed from high-resolution, phase-locked PIV measurements of the flow field in multiple cross-stream planes. It is shown that transitory attachment spreads toward the outboard, unactuated flow domains and exceeds the spanwise width of the actuation. The attachment is preceded by the formation of 3-D vortical structures that are advected and shed into the near wake. The effect of the actuation on the variation of the lift and pitching moment during the pitching cycle is altered significantly with its phase delay relative to the airfoil's pitching motion and can significantly mitigate the adverse aerodynamic effects of the dynamic stall.

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