

Abstract Submitted
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Controlled Transitory Flow Attachment over a Stalled Airfoil¹

GEORGE WOO, ARI GLEZER, Georgia Institute of Technology — Controlled attachment of transitory stall over a pitching airfoil is investigated in wind tunnel experiments using an array of surface-integrated pulsed jet actuators. The actuation has a characteristic time scale that is an order of magnitude shorter than the convective time scale of the base flow and results in momentary flow attachment with significant temporal changes in circulation and consequently in the aerodynamic forces and moments. The flow field in the cross stream plane above the pitching airfoil and in its near wake is investigated using high-resolution PIV phase-locked to the actuation. A single actuation pulse results in transitory flow attachment that is manifested by rapid increase in the global circulation and aerodynamic forces and persists for about ten convective time scales before the flow becomes fully stalled again. Large-scale changes in vorticity accumulation that are associated with repetitive, burst-modulated actuation pulses are exploited for significant extension of the streamwise domain and duration of the attached flow that is coupled with an increase in the peak circulation. Measurements of the interaction between the pulsed jets and the cross flow reveal details of the severing and collapse of the separated flow domain, and the dynamics of vorticity accumulation within the attaching boundary layer.

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