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Controlled Dynamic Stall using Pulsed Fluidic Actuation[1]
GEORGE T.K. WOO, ARI GLEZER, Georgia Institute of Technology — Controlled attachment of transitory stall over an oscillating airfoil is investigated in wind tunnel experiments using a spanwise array of surface-integrated pulsed jet actuators such that the characteristic actuation time scale is an order of magnitude shorter than the convective time scale of the base flow. Earlier work showed that single-pulse actuation results in a rapid [O(1TCONV)] attachment of the separated flow followed by a slower [O(10TCONV)] detachment. These dynamics are exploited for controlled mitigation of pre- and post-stall dynamics during the oscillation cycle and the interaction between the actuation jets and the evolution of the dynamic stall vortex. The transitory effects of the actuation can be extended and exploited for trapping and regulation of the dynamic stall vorticity concentrations by using staged, multiple actuation pulses during the cycle. These interactions are investigated using high-resolution phase-locked PIV measurements in the cross stream plane (including the near wake). The temporal changes in the vorticity flux results in significant changes in circulation, and consequently in the time-dependent aerodynamic forces and moments.

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