

Abstract Submitted
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Lift and Drag on a NACA0015 Airfoil With Duty Cycle Active Flow Control¹ POOYA KABIRI, DOUGLAS BOHL, GOODARZ AHMADI, Clarkson University — Active flow control experiments were carried out over a NACA 0015 airfoil with a trailing edge flap. Two arrays of synthetic jet actuators were mounted in the airfoil with one on near the leading edge (0.1c) and the other on the main wing body near the wing/flap interface (0.65c). Characterization of the SJA's showed they produced their highest exit velocities at a frequency of 1100 Hz, which was near the natural frequency of the piezo membranes. When actuated at frequencies corresponding to the flow natural frequencies (10-100Hz) the jets produced no jet velocity. In order to control the flow using a frequency near the flow's natural shedding frequency the synthetic jets were actuated using a forcing frequency near the piezo natural frequency with a duty cycle frequency of 10-1000Hz. Force balance results showed that for a 0° flap deflection the active flow control delayed stall and lowered drag regardless of the duty cycle frequency. At flap deflections of 20° and 40° differences were observed between the continuously forced and duty cycles cases. For these cases continuous forcing increased the stall angle and reduced drag. Duty cycle forcing also delayed stall however it significantly increased drag near the stall AOA even compared to the no forcing case.

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