

Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Transient Response of a Separated Flow over a Two-Dimensional Wing to a Short Duration Pulse¹ DAVID WILLIAMS, Illinois Institute of Technology, THOMAS ALBRECHT, TOM WEIER, G. GERBETH, Helmholtz-Zentrum Dresden-Rossendorf Germany — A Lorentz force actuator located at the leading edge of a two-dimensional wing at 16 degrees angle of attack was used to introduce short-duration disturbances into a separated flow. The transient response of the separated region at $Re = 10,000$ was documented using time-resolved PIV measurements. The direction of the Lorentz force was changed between downstream and upstream directed disturbances, and details of the resulting flow field structures and lift measurements were studied. Saturation of the peak lift amplitude occurs as the actuation amplitude is increased from $0.0054 < C\mu < 0.21$ percent with the pulse duration fixed at 0.1 convective time. The effect of the pulse duration time on the lift response was examined using a fixed pulse amplitude, which showed that saturation occurred when pulse durations exceed 0.5 convective times. Differences in the coherent structures resulting from the upstream/downstream directed actuation were identified using the FTLE method. The initial development of the disturbed shear layer was strongly dependent on the direction of actuation, but the larger-scale separation did not show much difference. The relaxation of the separated region to the original flow state was essentially independent of the direction of actuation.

¹Support by the Deutsche Forschungsgemeinschaft SFB 609 and AFOSR Grant FA9550-09-1-0189 is gratefully acknowledged.

David Williams
Illinois Institute of Technology

Date submitted: 31 Jul 2012

Electronic form version 1.4