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Understanding the Response of Separated Flow over an Airfoil under a Single-pulse Actuation[1] ANDRE FERNANDO DE CASTRO DA SILVA, TIM COLONIUS, California Institute of Technology — Experiments have shown that short-duration pulses of actuation near the leading edge of an airfoil at high angle of attack produce a lift response that consists of an initial lift reversal followed by a larger lift increment that decays over about 10 convective time units. To investigate the physical mechanisms that lead to the observed forces, we consider a simple model of two-dimensional flow over a NACA 0009 airfoil at moderate Reynolds number. We model actuation as a momentum source that imposes a specified velocity in a small region near the leading edge. The actuation parameters are varied to determine how the instantaneous and phase-averaged lift scale with the strength and duration of actuation. The results are compared with instantaneous and phase-averaged PIV data from the experiments, and the flow structures responsible for the lift response are identified.

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