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Boundary Layer Characterization of a NACA-0012 Airfoil Plunging in Uniform-Shear Flow using 1c-MTV[1] MITCHELL ALBRECHT, AHMED NAGUIB, MANOOCHEHR KOOCHESFAHANI, Michigan State University — Non-uniform approach flows can occur in environments through which aircraft navigate, such as the air wake of an aircraft carrier or aircraft formations. However, few studies have investigated the effects of viscous shear approach flow on airfoils. Our previous work shows that, in a Galilean reference frame, the lift coefficient on a NACA-0012 airfoil plunging in uniform-shear flow is greater than that of a stationary airfoil under the same flow conditions at near-stall positive angles of attack. To elaborate on this deviation from quasi-steady conditions, the current work examines the difference in lift behavior by characterizing the boundary layer around the plunging airfoil in uniform-shear flow. Single-component molecular tagging velocimetry is used to measure the streamwise velocity component of the flow on the suction side of the airfoil surface. Various boundary layer characteristics will be presented for the plunging airfoil as it traverses across the shear layer, and compared with the stationary airfoil at the same cross-stream position, flow conditions, and effective angles of attack.

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