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Experimental Investigation of a Yawed Airfoil in Reverse Flow Dynamic Stall LUKE SMITH, DR. ANDREW LIND, DR. ANYA JONES, University of Maryland, College Park — When a rotating blade enters high advance ratio flight, a significant portion of the blade is subject to reverse flow, where flow travels from the blade's geometric trailing edge to the geometric leading edge. The purpose of this work is to determine the influence of spanwise flow on a blade undergoing dynamic stall in reverse flow. Without spanwise flow, an oscillating sharp trailing edge airfoil in reverse flow experiences separation about its sharp aerodynamic leading edge, leading to the formation of a dynamic stall vortex at low angles of attack. With spanwise flow, an airfoil experiences a delay in lift stall, possibly due to the convection of a vortex along the freestream. This work characterizes the three-dimensional flow field of an oscillating airfoil at static yaw angles in reverse flow. Time-resolved velocity fields and chordwise pressure distributions are presented for several span locations, reduced frequencies, and Reynolds numbers. The unsteady velocity fields allow for the identification of dynamic stall vortex locations, and the unsteady pressure distributions allow for the analysis of spanwise variation in aerodynamic forces. By comparing the yawed and un-yawed cases, this work illustrates the relative importance of spanwise flow in reverse flow dynamic stall.

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