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On The Flow Physics of Dynamic Stall Inception DUSTIN COLEMAN, FLINT THOMAS, KYLE HEINTZ, MICHAEL WICKS, THOMAS CORKE, University of Notre Dame — Despite being the focus of many previous investigations, dynamic stall inception is still not fully understood. In this study the flow physics regarding the initiation, growth, and convection of the dynamic stall vortical structure produced during unsteady pitching of a NACA 0015 airfoil are investigated using time-resolved particle imaging velocimetry (TR-PIV) and surface pressure measurements as the primary flow diagnostics. Experiments are conducted at freestream Mach and Reynolds numbers of $M_\infty = 0.1$ and $\mathrm{Re}_c = 2.75\mathrm{e}{+}05$, respectively, and over a reduced frequency range of $0.05 - 0.1$. The experimental measurements are input to a locally implemented control volume formulation in order to characterize the convection and wall-normal diffusion of spanwise vorticity near the leading edge. In this manner, the near-wall flow physics surrounding dynamic stall vortex (DSV) inception is characterized. Likewise, the evolution of the resultant DSV is characterized in terms of its growth rate, terminal strength, and wall detachment process.

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