Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Three Dimensional Simulation of Dynamic Stall on a Dynamically Pitching Airfoil at Re = 12,000 HARRY WERNER IV, DOUGLAS BOHL, BRIAN HELENBROOK, CHUNLEI LIANG, Clarkson University — Dynamic stall (DS) is a flow separation phenomenon affecting airfoils that experience dynamic changes in Angle of Attack (AOA) beyond the airfoil's static stall angle. Passive control of DS could extend the lifespan and efficiency of rotors, wind turbine blades, and turbo machinery, improve the performance and stability of micro air vehicles, and increase the performance and maneuverability of fixed wing aircraft during high AOA maneuvers. The development of effective methodology for passive control of dynamic stall requires in-depth understanding of the fundamental flow physics governing DS phenomena. This work examines the fundamental flow phenomena of dynamic stall through Large Eddy Simulation (LES) of a dynamically pitching NACA 0012 airfoil at low Reynolds Number (Re = 12,000) and a constant nondimensional pitch rate of Ω^*=0.1. The simulation is a pitch and hold scenario, whereby the airfoil is rotated from 0 to 50AOA at a non-dimensional pitch rate of 0.1. The airfoil is held static at 50AOA for an additional 10 chord times to observe vortex formation and convection. Results are compared to experimental measurements.

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Date submitted: 01 Aug 2019 Electronic form version 1.4