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Dynamic Stall Patterns[1] PHILLIP DAVIDSON, ASHLI BABBITT, ANDREW MAGSTADT, POURYA NIKOUEEYAN, JONATHAN NAUGHTON, University of Wyoming, JONATHAN NAUGHTON TEAM — The performance of helicopter and wind turbine blades is affected by dynamic stall. Dynamic stall has received considerable attention, but it is still difficult to simulate and not fully understood. Over the past seven years, many airfoils for helicopter and wind turbine use ranging from 9.5 to 30% thick have been experimentally tested and simulated while dynamically pitching to further characterize dynamic stall. Tests have been run at chord Reynolds number between 225,000-440,000 for various reduced frequencies, mean angles of attack, and oscillation amplitudes. Characterization of stall has been accomplished using data from previous studies as well as the unsteady pressure and flow-field data available from our own work. Where available, combined surface and flow-field data allow for clear identification of the types of stall observed and the flow structure associated with them. The results indicate that thin airfoil stall, leading edge stall, and trailing edge stall are observed in the oscillating airfoil experiments and simulations. These three main stall types are further divided into subcategories. By improving our understanding of the features of dynamic stall, it is expected that physics-based simulations can be improved.

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