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Vortex dynamics of a rapidly pitching elliptical airfoil exhibiting dynamic stall at low Reynolds number JOHN HRYNUK, US Army Research Lab, MINGJUN WEI, Kansas State University — The flow features and effects of dynamic stall have been traditionally studied for rotorcraft and in small bio-flyers. In rotorcraft focused dynamic stall studies a sinusoidal pitching motion is commonly used, while a perching maneuver for small vehicles is better represented by a constant pitch-and-hold motion. For pitch-and-hold motions the interaction of Dynamic Stall Vortex (DSV) and Trailing Edge Vortex (TEV) appear to have a significant impact on vortex circulation and convection. To expand the understanding of the interaction of DSV, TEV, and basic vortex shedding phenomenon, an elliptical airfoil shape was pitched about mid-chord with a constant dimensionless pitch rate. Flow fields were captured using PIV at a Reynolds number of Re = 12,000. Results show that depending on the phase angle of the airfoil, the flow is dominated by the DSV, TEV, or traditional bluff body shedding. These regions of phase angle will be delineated and vortex tracking methods will be used to evaluate convection behavior of the trackable structures.

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