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Unsteady Aerodynamics on a Pitching Plunging Flat Plate ADAM HART, LAWRENCE UKEILEY, University of Florida — Biology has shown that natural fliers utilize unsteady flow mechanisms to enhance their lift characteristics in low Reynolds number flight regimes. This study will investigate the interaction between the leading edge vortices (LEVs) and tip vortices over a low aspect ratio flat plate being subjected to a pitch-plunge kinematic motion. Previous studies have shown the creation of stable vortices off the leading edge at the three quarter span location between times 0.25 and 0.50 in the kinematic motion. This study furthers previous knowledge by mapping the flow field around these vortex cores. This will allow for an understanding into the interaction of the LEV with tip vortices and how the LEVs convect downstream. Specifically we look to validate the interactions between these vortex systems leading to enhanced lift as has been demonstrated in very low Reynolds number numerical simulations. A combination of two dimensional and stereo Particle Image Velocimetery (PIV) is used to measure the flow field around the flat plate at various spanwise and chordwise locations. The PIV measurements are triggered by the dynamic motion rig allowing for phase averaging at key locations throughout the motion cycle.

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