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The Effect of Pitching Phase on the Vortex Circulation for a Flapping Wing During Stroke Reversal[1] MATTHEW BURGE, MATTHEW RINGUETTE, University at Buffalo, The State University of NY — We study the effect of pitching-phase on the circulation behavior for the 3D flow structures produced during stroke reversal for a 2-degree-of-freedom flapping wing executing hovering kinematics. Previous research has related the choice in pitching-phase with respect to the wing rotation during stroke reversal (advanced vs. symmetric pitch-timing) to a lift peak preceding stroke reversal. However, results from experiments on the time-varying circulation contributions from the 3D vortex structures across the span produced by both rotation and pitching are lacking. The objective of this research is to quantitatively examine how the spanwise circulation of these structures is affected by the pitching-phase for several reduced pitching frequencies. We employ a scaled wing model in a glycerin-water mixture and measure the time-varying velocity using multiple planes of stereo digital particle image velocimetry. Data-plane positions along the wing span are informed by the unsteady behavior of the 3D vortex structures found in our prior flow visualization movies. Individual vortices are identified to calculate their circulation. This work is aimed at understanding how the behavior of the vortex structures created during stroke reversal vary with key motion parameters.

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