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Circulation Produced by a Flapping Wing During Stroke Reversal[1] MATTHEW BURGE, MATTHEW RINGUETTE, State University of New York at Buffalo — We investigate the circulation behavior of the 3D flow structures formed during the stroke-reversal of a 2-degree-of-freedom flapping wing in hover. Previous work has related circulation peaks to the unsteady wing kinematics and forces. However, information from experiments detailing contributions from the multiple, 3D flow structures is lacking. The objective of this work is to quantitatively study the spanwise circulation as well as the spanwise flow which advects vorticity in the complex loop topology of a flapping wing during stroke reversal. We analyze the flow features of a scaled wing model using multi-plane stereo digital particle image velocimetry in a glycerin-water mixture. Data plane locations along the wing span are inspired by the time-resolved behavior of the 3D vortex structures observed in our earlier flow visualization studies. As with our prior work, we vary dimensionless parameters such as the pitching reduced frequency to understand their effect on the circulation. This research provides insight into the vortex dynamics produced by the coupled rotational and pitching wing motions during stroke reversal, when lift generation is challenging.

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