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Three-dimensional wake of a biologically-inspired propulsor[1]
MELISSA GREEN, CLARENCE ROWLEY, ALEXANDER SMITS, Princeton University — Digital Particle Image Velocimetry (DPIV) was used to investigate the wakes of rigid pitching panels with a trapezoidal planform geometry, chosen to model idealized fish caudal fins. Experiments were performed for Strouhal numbers of 0.17 and 0.23. The three-dimensional unsteady vortex wake downstream of the panel trailing edge was visualized using spatially- and temporally-resolved two-component data. A Lagrangian Coherent Structure (LCS) analysis was employed in addition to Eulerian vortex identification criteria to investigate the generation and evolution of the wake. A reverse von Kármán vortex street pattern was observed near the mid-span immediately downstream of the panel trailing edge, but the complexity and three-dimensionality of the wake increases away from the mid-span as streamwise vortices interact with the swept edges of the panel. Farther downstream of the trailing edge, the wake was observed to shrink in the spanwise direction at both Strouhal numbers. In addition, a quantitative bifurcation in the LCS coincided with a qualitative transition of the wake structure observed with increasing Strouhal number.

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