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Vortex trajectory and wake structure behind an energy harvesting hydrofoil[1] WALKER LEE, MAXIMILIEN DE ZORDO-BANLIAT, YUNXING SU, MICHAEL MILLER, KENNETH BREUER, Brown University — Detailed knowledge regarding the wake structure behind a pitching and heaving hydrofoil is important for optimizing multi-foil energy harvesting systems. Here we report on measurements of the large vortices shed from the hydrofoil. An acoustic Doppler velocimeter is positioned in a water flume, downstream of a flapping hydrofoil (chord, $c = 10$ cm) and traversed across the wake, measuring three components of velocity at 25 Hz over at least 20 cycles. The phase-averaged velocities are used to identify the primary vortex structures and to assess their trajectory, intensity and coherence as functions of frequency, f, pitching amplitude, θ, and Reynolds number, Re. Different methods for identifying the vortex structures are developed and their utility and weakness are compared. It is found that the transverse distance between the shed vortices (i.e. the width of the wake) decreases as the reduced frequency (fc/U) rises, but is not sensitive to the pitching amplitude. The time at which a vortex arrives at a fixed downstream position is affected by both the time at the vortex separates from the foil and the vortex convection speed in the wake. These two quantities are assessed as functions of pitch amplitude, reduced frequency and Reynolds number.

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