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Numerical and Experimental Investigation of Oscillating Flexible Foils with Application in Energy Harvesting KIANA KAMRANI FARD, PENGLEI MA, MICHAEL PRIER, JAMES LIBURDY, Oregon State University — The effect of relative leading edge motion of a flapping airfoil in energy harvesting regime is studied in reduced frequencies of k = fc/U = 0.06 – 0.14, pitching amplitude of θ = 70and heaving amplitude of h0/c = 0.5. A low order discrete vortex model with a vortex shedding criterion at the leading edge is used to estimate the transient lift force and the results are compared to 2-D CFD and direct force measurements via load cell. Positive leading edge motions in which the leading edge rotates in the same direction as the pitch angle and reduces effective angle of attack, are shown to improve the heaving power coefficient and efficiency compared to the rigid case by shifting the primary peak later in the stroke where the heaving velocity is higher. Whereas negative leading edge motions, in which the leading edge rotates in the opposite direction as the pitch angle and increases effective angle of attack, are shown to negatively influence the heaving power coefficient and efficiency compared to the rigid case, by reducing the primary peaks.

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