# ANGLED FLOW SIMULATIONS OF OSCILLATING FOILS FOR ENERGY HARVESTING

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Leading Edge (Brown University, BluSource Energy) tested a 2kW oscillating hydrofoil prototype in the Cape Cod Canal during summer 2016. Like a traditional turbine, the hydrofoils' motion is driven by the flow of water, which in turn powers a generator. However, rather than rotating, the foils oscillate in a linked vertical (heaving) and rotational (pitching) motion. The 2kW prototype consisted of four oscillating foils, linked in pairs, to evaluate the ability of the oscillating hydrofoils to operate in close packed array configurations. Another outcome of the prototype testing was the ability of the prototype to extract power in non-ideal flow conditions, including non-uniform flow angles and also in the presence of large disturbances in the flow. In this abstract, computational fluid dynamics (CFD) simulations that mimic the staggered configuration of the 2 kW device tested are performed under various flow conditions. The simulations are performed with two-dimensional direct numerical simulation (DNS) at a low Reynolds number using a dynamic mesh algorithm to simulate the moving foils in OpenFOAM. The power production of the four-foil system is computed under various flow conditions, in particular varying the inflow free-stream angle-of-attack. It is found that the wake-deflection in the angle-of-attack cases can be beneficial to the system, and may be beneficial to the future design of oscillating foil arrays. Evaluation of the flow fields show that at angle-of-attack of 15-20° there is constructive interference between the upstream wake and the downstream foils, leading to an increase in power of up to 44% compared to a non-angled free-stream flow.

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