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The effect of wall proximity on energy harvesting using a pitching and heaving hydrofoil[1] YUNXING SU, MICHAEL MILLER, SHREYAS MANDRE, KENNETH BREUER, Brown University — Measurements of energy harvesting using a heaving and pitching hydrofoil with an aspect ratio 4.5 were taken in three different situations: unconfined, in close proximity to one wall and in close proximity to two walls. Measured lift and torque forces were used with the hydrofoil positions to calculate the efficiency of energy extracted from the flow. There was a modest increase in efficiency with one-wall proximity, while a pronounced increase in efficiency (up to 50%) was realized when the hydrofoil operated between two walls with strong confinement. The lift coefficient of the hydrofoil experienced a noticeable increase in two-wall proximity cases with the strong confinement, which directly contributed to the increase in efficiency of energy harvesting. In the case of two-wall confinement, we found that the optimal frequency and pitch amplitude were higher than those for both the free stream and the one-wall proximity cases. The power extracted from the heaving motion was greatly enhanced by two-wall proximity at high frequencies and high pitch amplitudes and these gains exceeded the additional power required to execute the pitching motion, resulting in the net increase in energy harvesting effectiveness.

[1]ARPA-e

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None

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