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An investigation of surface wave rectification in a channel JOHN MEIER, DAEGYOUM KIM, MORTEZA GHARIB, California Institute of Technology — Extracting energy from oscillatory flows, such as ocean waves, is an important engineering challenge in fluid dynamics. In this study, we investigate a wave rectifying channel that converts a periodic disturbance normal to the free surface to unidirectional flow around a suspended plate. The experiment was carried out in a long, narrow channel with a total liquid volume of 3.3 L. The channel was excited at frequencies of 1 Hz to 2.8 Hz and flow behavior was investigated using dye visualization and DPIV. The system shows robust and repeatable flow behavior that is highly sensitive to excitation profile and system geometry. Numerous flow regimes, from purely oscillatory to unidirectional pulsatile flow, can be achieved through manipulation of the excitation frequency alone. In the channel, we observed average flow rates as high as 50 mL/s at an excitation frequency of 2.2 Hz. An excitation frequency change of only 0.2 Hz is enough to change the flow from unidirectional clockwise to unidirectional counterclockwise. We discuss system parameters such as channel geometry and excitation profile as they relate to wave reflections, wave interactions, and overall system performance.

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