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Resonance wave pumping with surface waves REMI CARMIGNIANI, ENPC, MORTEZA GHARIB, Caltech, DAMIEN VIOLEAU, ENPC, CALTECH-ENPC COLLABORATION — The valveless impedance pump enables the production or amplification of a flow without the use of integrated mobile parts, thus delaying possible failures. It is usually composed of fluid-filled flexible tubing, closed by solid tubes. The flexible tube is pinched at an off-centered position relative to the tube ends. This generates a complex wave dynamic that results in a pumping phenomenon. It has been previously reported that pinching at intrinsic resonance frequencies of the system results in a strong pulsating flow. A case of a free surface wave pump is investigated. The resonance wave pump is composed of a rectangular tank with a submerged plate separating the water into a free surface and a recirculation rectangular section connected through two openings at each end of the tank. A paddle placed at an off-center position above the submerged plate is controlled in a heaving motion with different frequencies and amplitudes. Similar to the case of valveless impedance pump, we observed that near resonance frequencies strong pulsating flow is generated with almost no oscillations. A linear theory is developed to pseudo-analytically evaluate these frequencies. In addition, larger scale applications were simulated using Smoothed Particle Hydrodynamic codes.

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