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Deep Ocean Wave Cancellation Using a Cycloidal Turbine STEFAN SIEGEL, TIGER JEANS, THOMAS MCLAUGHLIN, US Air Force Academy — We investigate the use of a cycloidal turbine for deep ocean wave termination for the purpose of converting wave energy to shaft power. Cycloidal turbines consist of one or more hydrofoils that rotate around a central shaft and can be pitched during rotation. In the present investigation, the shaft is parallel to the wave crests, and the turbine operates in sync with the wave frequency by means of feedback control. The approach differs from traditional approaches in that it is a lift based system and therefore has the potential to be more efficient than existing drag based converters. It also allows for feathering of the blades in order to survive storms. We present two-dimensional inviscid results of potential flow simulations modeling the turbine blades as single point vortices of constant circulation rotating under a linearized free water surface. With suitable parameter choices for the turbine radius, blade number, submersion depth and airfoil circulation up to 97% of the incoming deep ocean Airy wave energy can be converted to shaft power. For a typical North Atlantic deep ocean wave this corresponds to 100 kW of power per meter of wave crest. The remaining energy is lost to harmonic waves travelling both in the up- and down wave directions.

Stefan Siegel
US Air Force Academy

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