

Conceptual Design of Arrayed WEC Platform and Mooring Buoy

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ABSTRACT

This paper presents conceptual design of an Arrayed Wave Energy Converter (WEC) platform and mooring buoy. The rated total power of the WEC system is 1MW. The platform consists of two long slender leg structures with 120 degree opening leg angle. Each leg structure is a truss-shape structure with pontoons, vertical and horizontal braces, rotors, power take off (PTO) systems, generators, hydraulic pipes and other appurtenances. The pontoons are designed to create sufficient buoyancy to support the structure weight and environmental loadings. Appropriate water ballasting is also taken into account to provide the platform draft adjustment for transit or repair condition. The platform dimensions and configurations are determined iteratively based on the dimensions and component weights of rotors, PTOs, and generators. The platform is moored to the mooring buoy with one or two hawsers with a proper length. The mooring buoy will have a weathervaning capability to allow the WEC platform to rotate 360 degrees around the buoy toward the incident wave directions, which enables consistent power generation. The buoy and mooring system is sized to moor the WEC platform and buoy itself for the various environmental conditions of operating, extreme and survival complying with ABS design criteria. The buoy system consists of non-rotating (earth-fixed) and rotating buoy structures, buoy bearings, power cable swivel and mooring fairlead. The mooring buoy is moored at a water depth of 80m with catenary mooring legs. The power cable connected from the platform to the buoy runs through the buoy center to the sea floor. The buoy bearing is considered to let the buoy to rotate but withstanding the external loadings, whereas the swivel is designed for the cable to transfer the electricity with no twisting of the cable inside the buoy. The cable will be properly configured to mitigate the loadings on it due to the buoy motions and the environments.

Keywords : WEC, Floating Platform, Mooring Buoy, PTO, Rotor, Weathervane,
Catenary Mooring, Power Cable, Bearing, Swivel