CONTRIBUTIONS TO THE PENDULUM-TYPE WAVE ENERGY CONVERTER SYSTEM FOR OCEANIC DRIFTER APPLICATIONS

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Abstract: Lagrangian Drifters are autonomous floating passive devices that provide oceanographic surface data. They are low-cost, versatile and easy-deployable marine instrumentation used in climate research. One of the main challenges related to the drifter’s design is the power autonomy. Some studies explore the kinetic oscillatory movement of the waves as an Energy Harvesting (EH) source.

At [1] a novel pendulum-type wave energy converter (WEC) system was presented (Fig. 1). The WEC consists of an articulated pendulum arm with a proof mass. This mass moves relatively to the drifter with pendulum motion. Then, through a gear system, rotation is accumulated and increased in a flywheel which drives a dc electrical generator. Then, a first prototype of an oceanic drifter was designed to embed the WEC and was used to perform tests in real sea conditions [2]. The main purpose of this drifter is to measure its own motion and analyze how it translates into energy production. It contains an Inertial Measurement Unit (IMU) for the motion study and a measurement system for the estimation of the WEC power generation. Results from the first sea test show a useful mean power on the order of milliwatts, which can be used as an unlimited backup powering system to recover the unit.

An algorithm was developed to estimate wave parameters (height and period) from the IMU embedded on the drifter. Then, the effect of the WEC’s inertia on this estimation was assessed by deploying the drifter in a controlled wave flume. It was concluded that the WEC does not generate significant errors [3].

Finally, several maximum power point tracking (MPPT) techniques for maximizing the WEC harvested energy were evaluated. The designed WEC, together with a power management unit (PMU), was tested on a linear shaker to compare three MPPT techniques, the Constant Voltage versus two variants of the Fractional Open Circuit Voltage (FOCV). Results show a 25% improvement on the scavenged energy with one of the proposed FOCV techniques with respect to the other ones [4].

The purpose of this article is to review the contributions made on WEC systems for low-power marine environmental monitoring applications.
Key words: Lagrangian Drifter, Wave Energy Converter (WEC), Energy Harvesting (EH), Power Management Unit (PMU), Maximum Power Point Tracking (MPPT).

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