Title of Diploma Thesis

Performance Investigation of a Submerged Oblate Spheroidal Heaving Wave Energy Converter

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ABSTRACT

Wave energy is a very promising form of energy even though its development is at an early stage. However, the energy crisis that has been taking place in the world in recent years due to the depletion of fossil fuel reserves and their environmental footprint, as well as due to the ever-increasing demand for energy, have led researchers to turn the search for optimal ways of exploiting wave energy.

Motivated by this, the objective of this Diploma thesis is to investigate the performance of a submerged Wave Energy Converter (WEC) of a particular geometry, that of the oblate spheroid. The converter in all cases moves only along the vertical axis (heave motion) and produces energy in the specific degree of freedom. Initially, the submerged WEC is examined in three different submergence depths and its performance (hydrodynamic behavior and absorbed power) is evaluated in each case. It is concluded that the submergence depth equal to three times the semi-minor axis of the cross-section leads to better power efficiency of the device.

Subsequently, a semi-submerged heaving WEC of the same geometry is modeled and its performance is assessed, for the same environmental characteristics. Results are then compared with those of the submerged WEC, and it is concluded that the submerged converter shows a better power absorption ability, as its amplitudes of oscillation have a larger range and its damping factor takes mostly larger values.

In order to achieve the simulation of the aforementioned, modeling and analysis of the hydrodynamic behavior of all geometries in the frequency domain is carried out by applying the WAMIT software.

Keywords: Wave energy, Submerged Wave Energy Converter, Numerical modeling.