

WAVE ENERGY EXTRACTION IN THE NORTH SEA BY A HEAVING POINT ABSORBER

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Ocean and sea waves contain a lot of unexploited energy. This energy can be absorbed by wave energy converters (WECs). Wave energy is a renewable energy type that is becoming more and more important. Several systems have been invented, among them point absorber systems which are wave energy converters consisting of small (floating) bodies oscillating with one or more degrees of freedom. They can either operate with respect to a fixed reference, or with respect to a floating reference. The latter principle has been adopted in a novel way in the wave energy converter that is studied in the SEEWEC project, where multiple point absorbers are combined in a floating, moored platform [Seewec web site].

The performance of such a heaving point absorber in a floating platform is analysed in a linear way. The boundary element method (BEM) package Wamit [Wamit manual] is used to determine the hydrodynamic behaviour of both the platform and the oscillating point absorbers. The equation of motion of the point absorber is solved, taking into account the Response Amplitude Operators (RAO) of the platform, calculated by Wamit. Different buoy geometries are evaluated to obtain the ideal values of size, draft and shape with regard to power absorption for different sea states. The natural frequency of the point absorber is changed by adding supplementary mass in order to tune the point absorber to the wave climate (Vantorre, Banasiak *et al.*). In waves characterized by $H_s = 1\text{-}2\text{m}$, which have a high occurrence frequency on the Belgian Continental Shelf, a point absorber with a diameter of 4m can absorb about 20 to 30kW.

Two different restrictions are applied to the heave motion of the point absorber. The first one is imposed by the limited stroke of the mechanical system connecting the point absorber to the platform; the second condition is required to decrease the probability of occurrence of slamming.

References

Falnes J. 2002. Ocean waves and oscillating systems: linear interactions including wave-energy. Cambridge University Press, p.1-275.

Seewec website: <http://www.seewec.org/>

Vantorre M., M. Banasiak and R. Verhoeven. 2004. Modelling of hydraulic performance and wave energy extraction by a point absorber in heave. Applied Ocean Research 26:61-72.

Wamit manual: <http://www.wamit.com/>