OPTIMAL ENERGY PRODUCTION OF INTERACTING WAVE POWER DEVICES

Beels Charlotte, Peter Troch and Julien De Rouck

Universiteit Gent, Vakgroep Civiele Techniek, Afdeling Weg- en Waterbouwkunde,
Technologiepark Zwijnaarde 904, B-9052 Zwijnaarde, Belgium
E-mail: Charlotte.Beels@UGent.be

The need for renewable energy is rising at light-speed. The increasing energy demand, the greenhouse effect and the approaching exhaustion of conventional energy resources, forces humanity to use energy more economically and to develop alternative energy supplies, a.o. wave energy. A Wave Energy Converter (WEC) converts the kinetic and potential energy in ocean waves into electricity. A single WEC, with a capacity comparable to a classic power plant (e.g. 400MW), is technologically impossible. Therefore arrays of smaller devices, placed in a geometric configuration or 'farm', are needed.

WECs in a farm interact and the overall power absorption is affected. An optimal pattern of WECs in order to maximise the power absorption is of major importance in the design of a wave farm.

At Ghent University, a mild-slope wave propagation model MildWAVE has been developed (Troch, 1998), e.g. to study diffraction patterns in a harbour (Geeraerts *et al.*, 2003) or to study the effect of short-crested waves on wave penetration (Caspeele, 2006). The phase-resolving model is able to generate linear water waves over a mildly varying bathymetry and to calculate instantaneous surface elevations (and velocity potential) throughout the domain. Wave transformation processes such as refraction, shoaling, reflection, transmission and diffraction are simulated intrinsically. The existing model is adapted by simulating the energy extraction and radiation of a WEC through sponge layers (Beels *et al.*, 2006).

The adapted numerical model MildWAVE, as presented in this poster, is used to study the optimal lay-out and electricity production of a farm.

Acknowledgements

Research funded by Ph.D. grant of the Institute for the Promotion of Innovation through Science and Technology in Flanders (IWT-Vlaanderen), Belgium.

References

Beels C., P. Troch, G. De Backer, J. De Rouck, T. Moan and A. Falcão. 2006. A model to investigate interacting wave power devices. Proceedings International Conference Ocean Energy, Bremerhaven:94-101.

Caspeele R. 2006. Generation of irregular long-crested and short-crested waves in a numerical model for wave propagation: implementation, validation and application. Thesis (in Dutch). Department of Civil Engineering, Ghent University.

Geeraerts J., L. De Doncker, P. Troch, J. De Rouck, L. Van Damme and T. Verwaest. 2003. Numerical simulation of wave penetration in the planned harbour entrance of Oostende: a comparison between numerical models. Proceedings 13th International Harbour Congress Engineering, Environment and Safety, Antwerpen:363-370.

Troch P. 1998. MildWAVE – A numerical model for propagation and transformation of linear water waves. Internal report, Department of Civil Engineering, Ghent University.