

Design of wave-energy converter systems for both coastal protection and power generation

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Abstract

Many classes and designs of Wave-Energy Converters (WECs) have been developed since a WEC was first patented in 1799 [3]. Since WECs inherently remove energy from ocean waves in order to convert this energy into electricity, they offer the opportunity to control wave damage such as coastal erosion or harbour seiching. Meanwhile, revenue from the electricity generated could cover the cost of the machines.

A fast numerical model was developed enabling the design of an array (a farm) of WECs for coastal-protection purposes [2]. The model uses simplified mathematical representations of the operation of the machines and of the inter-machine interactions. It was found to run $10^3 - 10^4$ times faster than the standard computational fluid-dynamics model it was validated against. The fast model enabled an optimal layout of WECs for the minimisation of beach erosion to be determined. The optimal layout was then checked in a large laboratory wave basin with model sand transport.

Applications to specific issues of coastal erosion and harbour seiching due to infragravity waves [4, 1] are discussed.

References

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