

Research Project

CO-SIMULATION OF HYDRODYNAMICS AND POWER TAKE-OFF DYNAMICS FOR WAVE ENERGY CONVERTERS

Motivation

Ocean waves present a very promising source of clean, renewable energy that, due to their being out of phase with the wind, would facilitate the delivery of a constant supply of sustainable electricity. Much work is being done across the wave energy field to maximise device efficiency, with a focus on minimising the cost per watt of installed capacity. Significant research effort has been made to model and optimise power take-offs (PTOs) and control strategies; work has also been done to develop highly accurate computational fluid dynamics (CFD) models of the wave energy converters (WECs) themselves. However, very little work has been done to date combining detailed modelling of both aspects. This is the motivation for the research described here, aiming to ascertain where modelling simplifications can safely be made without impacting upon the validity of any results.

Co-Simulation

It is proposed that a full numerical wave tank (NWT) is developed using the open-source CFD toolbox OpenFoam®, then coupled with a full hydraulic model of the PTO circuit incorporating any control strategy that might be implemented. Once validated and coupled, simplifications to both the hydrodynamics and the PTO dynamics found in other work will be applied, and their impact assessed. This will provide a useful benchmark of modelling approaches to inform future research.

Future work

At present the NWT is under development, with a strategy for partial coupling in place. Once complete, the coupled simulation will then be used as described above, and to compare PTO designs and control strategies.

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