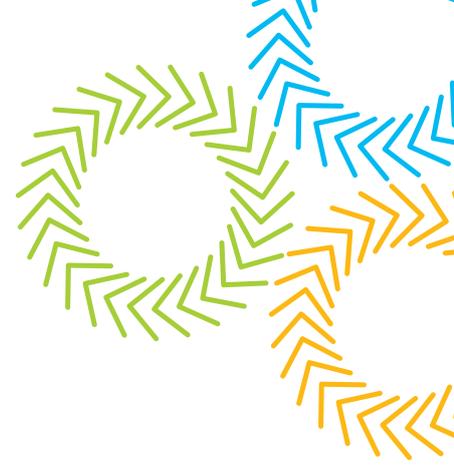
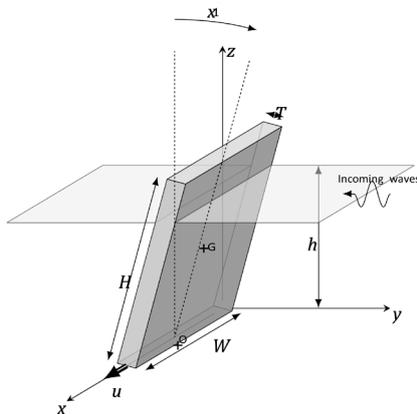


A real-time controller for wave energy devices



Unmet need:

To maximise the energy capture of a wave energy converter (WEC) device, it would be useful to have a controller that reacts quickly and optimally to changes in the wave climate. Doing so is a complex and computationally expensive task given the dynamic nature of the ocean and physical displacement and force constraints of the device. We see a need for an efficient controller implementation that would support that wider deployment of WEC devices.



Our Solution:

Maynooth University has developed a new algorithm allows the implementation of a computationally efficient real-time controller. The controller is based on the idea of pseudospectral representation, where the system signals are defined as a sum of basis functions. The main effect of this is that fewer terms are required to represent the signals (i.e. the number of basis function coefficients, rather than each sample point) and the

resulting control optimisations problem is easier to solve computationally.

The invention makes the key choice of a half-range Chebyshev-Fourier (HRCF) as a basis to develop a control algorithm. The controller then acts in a receding-horizon fashion, as follows:

1. Based on future wave excitation which will be incident on a wave energy converter (WEC) over a specific time horizon (the prediction horizon), the future behaviour of the system can be simulated based on a HRCF-based WEC model.
2. The optimal velocity profile for the WEC device is solved (using signals represented in HRCF form) by numerically minimising (optimising) a performance function which is the converted energy for the WEC over the prediction horizon.
3. The optimal velocity profile is then controlled, using the solution in step 2 over the prediction horizon by adjusting the power take-off (resisting) force of the device.
4. At the end of the prediction horizon, or earlier, if computational resources allow, the process is repeated.

The core advantage of our algorithm is the optimal representation of the system signals is attained, which minimises the number of pieces of information to retain in the optimal control computation. The choice of the HRCF, and the solution of the receding horizon control problem in the HRCF framework, are the key innovations in the algorithm. An additional advantage of

Maynooth University Opportunity

Energy Capture

our method is that the number of basis functions used can be reduced where computational resources are very limited. This means that a (relatively continuous) trade-off between computational requirements and control solution accuracy can be achieved to suit a variety of WEC control applications

Development Stage:

Stage3: Prototype demonstrated (in simulation).

What is sought:

We are looking to attract potential licences to productise the technology.

Intellectual Property:

Patent application filed with the USPTO (US20190128236A1) and in progress. Details can be found here: <https://patents.google.com/patent/US20190128236A1>

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Development Stages of Opportunities

