Uncertainty quantification of the dynamics of a wave energy converter

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ABSTRACT

We will analyse how the power take-off of a wave energy converter influences its dynamics (motion, average power, loads) and obtain confidence intervals for these quantities. However, because prototype and small scale test data is scarce, and a sufficient number time-domain simulations is expensive to run, we will resort to general Polynomial Chaos (gPC) to obtain the relevant statistical data. Using gPC we are able to generate the equivalent results of a large number of simulations, with a relatively low number of actual seed simulations. The case study is a variation of WEC-Sim's RM3 set-up: a two-body axisymetric heaving point-absorber, moored by three catenaries, with a linear power take-off. WEC-Sim, a time-domain multi-body dynamics model solving Cummins's equation, developed by NREL and Sandia, will be used for the simulation of the floating wave energy converter. To simulate the mooring system we will use MooDy, a *hp*-adaptive discontinuous Galerkin (DG) model for mooring cables. The coupling between WEC-Sim and MooDy has been validated in [1]. The stiffness and damping of the power take-off will be the random input variables, while the average power and maximum mooring loads in the cables will be the desired random output variables.

REFERENCES

[1] Guilherme Moura Paredes, Claes Eskilsson, Johannes Palm, Jens Peter Kofoed, and Lars Bergdahl. Coupled BEM/hp-FEM Modelling of Moored Floaters, 2018.