

## WEC control strategies for the WECfarm project

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This abstract refers to an ongoing master's thesis at the department of Civil Engineering of Ghent University (Belgium) on control strategies of a wave energy converter which is being prepared for the upcoming WECfarm project. A new experimental campaign within the WECfarm project is planned in a new wave basin; the Coastal & Ocean Basin (COB) in Ostend. WECfarm will deliver a database for validation of new advanced numerical models which are worldwide employed for WEC array modelling. At the time of the 3rd Online WECANet General Assembly (November 2020), dry-testing of the first WEC is occurring.

The working principle of the WEC is the one of a point absorber operating in heave. The power take-off consists of a rack and pinion system in combination with a rotational Permanent-Magnet synchronous motor (PMSM). To control the WEC, a Simulink 'Real Time torque control' model is used. This model is built on a development computer and subsequently loaded on a Speedgoat Performance real-time target machine. In this context, real-time is the capability of the algorithm to execute within a prescribed update rate. The control model on the target machine processes the input signals from the laser sensor, accelerometer and load cells to provide, depending on the control strategy, the torque request as output to the drive.

Within this master thesis, the performance of a single WEC (the so-called "Master WEC") will be evaluated for different control strategies. The baseline strategy will be a passive controller, consisting of a force proportional to the velocity. A literature study will identify possible other advanced strategies. Model Predictive Control (MPC), Latching control, Reactive loading control and Linear Quadratic (LQ) Control are among the possibilities [1], [2]. Although the performance evaluation will be for the single Master WEC, the later extension to an array of five WECs will be taken into account as this is the WEC number that will be used in the WECfarm project. The passive control and the selected advanced control strategies will be implemented in the MATLAB Simulink model.

Firstly, the efficiency of the MATLAB Simulink control model will be evaluated in a dry set-up. Secondly, the passive controller will be evaluated in wave flume tests. Tests in a wave basin will allow to determine the power production for the passive control strategy. If possible, tests with the selected advanced control strategies will be executed to compare the power production relative to the baseline strategy. These consecutive steps will allow us to make recommendations for the control of the arrays of



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up to five WECs, to be experimentally tested at the COB in 2022. This part of the research is situated in the topics of “Working Group 3: Technology of WECs and WEC arrays”

### References

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[2] Beatty, S., Ferri, F., Bocking, B., Kofoed, J.P., Buckham, B., (2017). Power Take-Off Simulation for Scale Model Testing of Wave Energy Converters. Journal Article, Energies.

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