**Hydrodynamic Performance and Survivability of an Oscillating Water Column Wave Energy Converter Subjected to Steep and Breaking Waves**

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**Summary**

Wave energy is a renewable energy source that has immense potential for exploitation as clean energy. Among the different types of wave energy converters (WECs), the terminator-type of WEC, “Oscillating Water Column (OWC)” device is considered in this present study for the reason that it can be easily integrated with coastal structures as a multi-purpose system to reduce the total cost and also easy maintenance. This multi-purpose option made the OWC device installation integrated into the breakwater on a larger scale at ports in both the places Mutriku in Spain and Civitavecchia in Italy. As the development of OWC WEC technology has increased in detail and scope, developing design methods for wave loads is essential. Hence, this research aims to evaluate the nature and magnitude of the dynamic pressures exerted on different components of the OWC device and the total force on the structure with consideration of the performance of the OWC caisson breakwater through laboratory measurements subjected to both non-breaking and extreme waves.

**Objectives**

The evaluation of wave loads and performance of OWC WEC subjected to both non-breaking and extreme waves is planned to achieve through the following research activities.

1. Hydrodynamic optimization of power-take off damping (PTO) of OWC caisson breakwater by considering a trade-off between performance and wave loads subjected to regular and random waves.
2. Evaluation of wave loads on a conventional vertical caisson breakwater for the regular and random wave conditions used in step 1 to have a physical understanding of the difference between OWC caisson breakwater and conventional vertical caisson breakwater.
3. The optimized OWC caisson breakwater from step 1 is used to study the pressures and total forces subjected to steep and breaking waves.
4. Finally, based on the above comprehensive study, a science-based approach is developed in order to account for wave non-linearity in the design loads on the OWC caisson breakwater for different environmental conditions.

The physical model experiment was carried out to achieve objectives 1 and 2 though the manufacturing of the physical model and the access to the lab have been hindered by COVID-19 restrictions. The important objectives of 3 and 4 were not achieved yet and planning to work on that as soon as the lab facility is available. Meanwhile, with the available physical model data, the numerical work is in progress to improve the understanding of the wave loads on OWC WEC subjected to breaking and non-breaking waves. As part of the ECR fund, two load cells have been bought and utilized in the laboratory study.

Regarding career development, I had the opportunity to supervise the MSc student along with my line manager. I have improved my understanding of the loading mechanism of OWC WEC. It also helped to enlighten further research ideas that could be done to improve the OWC WEC system.

At the moment, I am working on the data generated through a physical model study, and I am hoping to publish the results in the Renewable Energy journal.