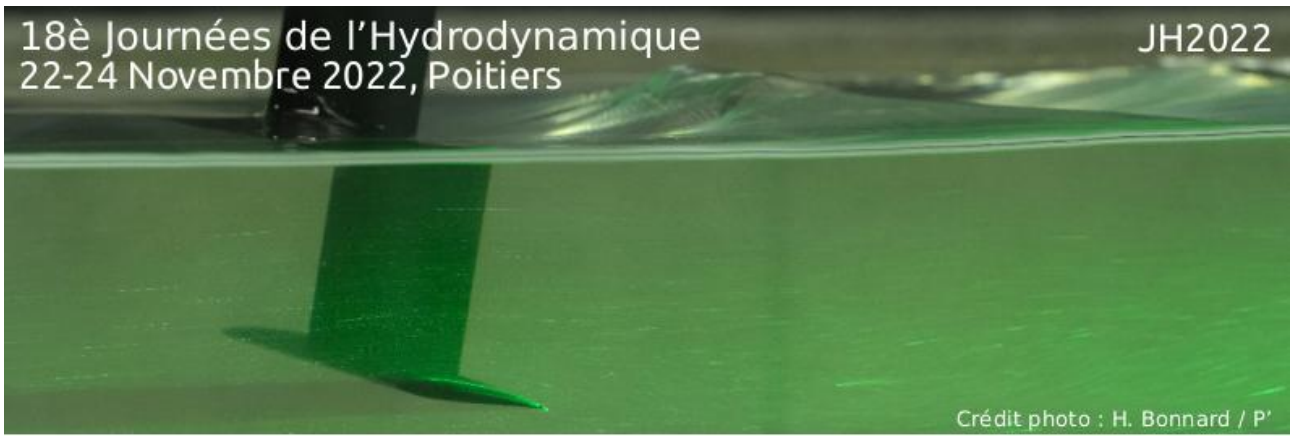

A GLOBAL MODEL FOR A LIFT-BASED WAVE ENERGY CONVERTER: LiftWEC

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Summary

LiftWEC is a European project aimed at developing lift-based wave energy converters (WECs). The foreseen advantages of lift based WECs are a high hydrodynamic efficiency, the avoidance of cyclic loads and end stops issues compared to other type of WECs, and the possibility to manage loads in extreme sea states by simply stopping the rotor as in wind turbines control strategy.

To support the engineering of the concept, several layers of numerical modelling are built, from analytical model to detailed CFD analysis of the foil hydrodynamics. Part of this effort is the development of a global model, which should efficiently combine the rotor hydrodynamics, the loads on the support structure, the mooring system and a PTO representation.

This study describes the global time-domain numerical model of a SPAR floating concept developed within the LiftWEC project (cf. Figure 1). The device is constituted of a main shaft parallel to the wave direction and connected to two hydrofoils in opposition of phase. The rotor support structure is floating, on a compliant mooring. The numerical model aims to provide a tool with coupled analysis of the rotor (shaft + hydrofoils) and the support structure dynamics, in order to be able to integrate advanced control strategies and to obtain design inputs (loads) at different point of the device. The forces acting on the hydrofoils are computed considering wave radiation effects and viscous losses [1]. The wave loads on the support structure are considered through linear potential theory. The system dynamics and the mooring loads are solved within the OrcaFlex framework in the current version of the model. The impact of the support structure on the incident flow potential seen by the rotor is considered.

Results regarding the validation of the model against an analytical tool in simplified cases are presented, and simulation of the global model in regular and irregular waves are included. A discussion about the design implication of the results is included, and future improvement to the

model are presented.

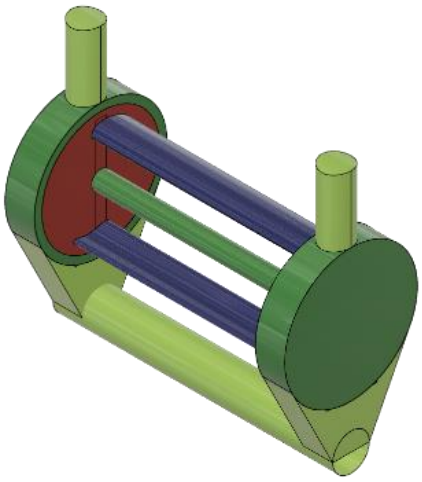

Figure 1 – 3D view of the SPAR concept for LiftWEC

References

[1] Siegel, S. G. (2019). Numerical benchmarking study of a cycloidal wave energy converter. Renewable Energy, 134, 390-405.