High-fidelity Numerical Modelling of a Wave Energy Converter

For the validation tests of a Wave Energy Converter, high-fidelity simulations are necessary to have an accurate description of the WEC dynamics, which is characterized by high non-linearity and unsteadiness. OpenFOAM is a CFD open-source software, well-known in the research community and used for the simulation of multi-physics phenomena presenting such characteristics.

This thesis aims at developing a numerical parametric wave tank in OpenFOAM, applicable to different kinds of WECs: ISWEC, PeWEC, Point Absorbers. The model should also take into account the mooring system and the control law of the device. It will be validated against experimental results and compared to other low and high fidelity models.

Objectives:

- Analysis of the different numerical methods applied to wave energy
- Development of a sensitivity to WEC numerical simulations
- Development of an expertise in CFD simulations with OpenFOAM

Tasks:

- Development of an empty wave tank with parametric characteristics
- Development of a complete simulation of a WEC, with mooring system and control law
- Validation of the models against experimental results
- Comparison with low-fidelity simulations

Required skills:

- Computational Fluid Dynamics
- Basic knowledge of OpenFOAM (not stricly necessary)

[1] `https://www.openfoam.com`
[2] Folley, M., Babarit, A., Child, B., Forehand, D., O'Boyle, L., Silverthorne, K., Spinneken, J., Stratigaki, V., Troch, P., *A review of numerical modelling of wave energy converter arrays*, ASME 2012 International Conference on Ocean, Offshore and Artic Engineering (OMAE2012), 2012