Short Term Scientific Mission on WEC modelling in DualSPHysics

Nicolas Quartier[1], Timothy Vervaet[1], Vasiliki Stratigaki[1], Peter Troch[1], Alejandro J. C. Crespo[2]

[1] Civil Engineering, Ghent University, Technologiepark 60, 9052, Ghent, Belgium
[2] EPhysLab Environmental Physics Laboratory, Universidade de Vigo, As Lagoas, 32004, Ourense, Spain
E-mails: Nicolas.Quartier@UGent.be, Timothy.Vervaet@UGent.be, Vicky.Stratigaki@UGent.be, Peter.Troch@UGent.be, alexbexe@uvigo.es

This Short Term Scientific Mission was carried out by two applicants from Ghent University (Belgium) Nicolas Quartier and Timothy Vervaet from 25/02/2019 to 17/03/2019 at the EPhysLab in Ourense and fits in the objectives of 'Working Group 1: Numerical hydrodynamic modelling for WECs, WEC arrays/farms and wave energy resources'. The main objectives of the STSM were to acquire the skills to perform basic simulations of Wave Energy Converters (WECs) in DualSPHysics [1] as well as more advanced simulations using the coupling techniques with Project Chrono [2] for the modelling of mechanical constraints, MoorDyn [3] for the modelling of mooring tensions and the wave propagation model OceanWave3D [4] for modelling WEC array/farm effects. The STSM started with the basis of the Smoothed Particle Hydrodynamics (SPH) method by looking into the governing equations, their numerically treatment and (dis)advantages of SPH. The workflow of DualSPHysics, the input and output files and the pre- and post-processing tools were treated.

Firstly, basic simulations were carried out with DesignSPHysics, which is the Graphical User Interface (GUI) allowing the design of simple DualSPHysics cases. The GUI was specifically useful for visualization of the considered cases and importing ".stl"-files of objects into the DualSPHysics domain. Special attention was given to wave generation, propagation, reflection and passive and active absorption. Post-processing tools for the representation of motion data of floating objects, data of water surface elevation and data of acting forces were used. Results were visualized in Paraview.

The recently developed coupling between DualSPHysics and Project Chrono [2] allowed the addition of mechanical constraints (hinges, springs, joints, etc.) to the domain, which can be used to study Power Take-Off systems of WECs. After the introduction with the DualSPHysics-Chrono coupling, the basics of the DualSPHysics-MoorDyn coupling were explained and trained by solving cases involving moored floating objects [3]. This STSM provided the applicants an intensive training in DualSPHysics, which allows them to apply this numerical tool on their own wave energy converter research cases.

References

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COST is supported by the EU Framework Programme Horizon 2020. COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. COST Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers.

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