Seakeeping analysis of floating bodies using waves and current generation in DualSPHysics

Gael Verao Fernández[1], Ivandito Herdaynaditya[2], Iván Martínez-Estévez[3], Panagiotis Vasarmidis[1], José M. Domínguez[3],Vasiliki Stratigaki[1], Peter Troch[1]

[1] Department of Civil Engineering, Ghent University, Technologiepark 60, 9052 Zwijnaarde, Belgium
[2] Maritime Technology Division, Ghent University, Technologiepark 60, 9052 Zwijnaarde, Belgium
[3] Environmental Physics Laboratory, CIM-UVIGO, Universidade de Vigo, Spain
E-mails: gael.veraofernandez@ugent.be, ivandito.herdayanditya@ugent.be, ivan.martinez.estevez@uvigo.es, panagiotis.vasarmidis@ugent.be, vicky.stratigaki@ugent.be, peter.troch@ugent.be, jmdominguez@uvigo.es

Technical advancements in the offshore wind industry have led to new Floating Offshore Wind Turbine (FOWT) concepts that can be assembled on shore and towed to the installation location. However, there is a lack of experimental and numerical seakeeping analysis of fully mounted turbines when they are towed from the construction location to site.
The objective of this work is to study of the capabilities of the Smoothed Particle Hydrodynamics (SPH)-based code DualSPHysics (Domínguez et al., 2021) to perform seakeeping analysis of floating bodies to later by applied for studying towing of FOWTs. The simulation of a body moving with a certain forward speed in waves requires very large domains, which involves a very high computational cost in DualSPHysics due to the nature of the SPH method. Therefore, a different approach is taken: the seakeeping problem is modelled applying a constant current with a negative magnitude equal to the forward speed while keeping the floating object fixed in the x-direction, with the consequent reduction of domain in that direction.
The waves and current case are generated using the newly implemented inlet/outlet boundary conditions (Tafuni et al., 2018). DualSPHysics open boundaries consist of buffer layers near the open regions where waves can be generated and absorbed by imposing orbital velocities, surface elevation and pressure. To avoid wave reflection and to ensure a proper wave absorption at the outlet, a damping zone matching the current velocity has been imposed close to the outlet boundary. Figure 1 shows initial results of the two validation test cases that will be studied within this research: towing of the OrthoSpar FOWT (Büttner et al., 2022) (left) and sailing in shallow waters of the DTC Container Carrier at the towing tank of Flanders Hydraulics (van Zwijnsvoorde et al., 2019) (right).

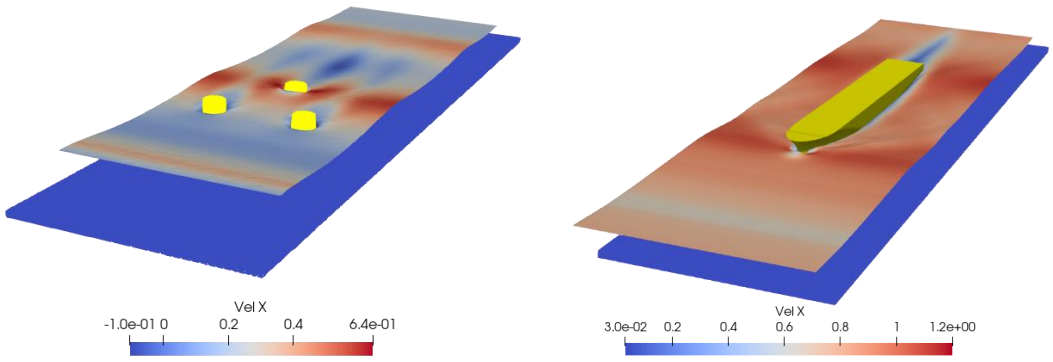

Figure 2. Sea-keeping analysis of the OrthoSpar FOWT Turbine (left) and the DTC Container Carrier (right) in DualSPHysics.

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