Realistic applications of moored floating structures under waves using OpenFOAM

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ABSTRACT

In recent years, there has been an increasing interest in modelling floating structures in marine environments. A considerable amount of research has been done in the fields of renewable energy, naval engineering and oil-gas industry. Movable structures like wave energy converters (OWC) or floating offshore wind turbines (FOWT), moored ships or floating platforms have been widely analysed by means of numerical models. In the past decades a number of researchers have sought to determine the most accurate hydrodynamics conditions on these structure as well as the dynamic of the devices. In recent years several Navier-Stokes based models have been developed thanks to the increasing of the computational resources. However, although Navier-Stokes based codes are quite when reproducing wave fields, several problems arise when dealing fluid-floating structure interaction under large motions. In finite volume method models, extreme dynamic mesh motion leads to instabilities of the numerical solution. Di Paolo et al., 2019 (submitted) presented a numerical model for fluid-floating breakwater interaction using two techniques for handling mesh motion in OpenFOAM. It is shown that the most accurate methodology when calculating floating body response is the Overset mesh despite of the high computational cost.
In this work, we extend the analysis to more complex floating structures, including advanced numerical features. A newly implementing technique for sharp interface advection (Roenby et al., 2016 [1]) are also used and stabilized turbulence models (Larsen and Fuhrman 2018 [2]) are applied for reducing the over production of turbulence levels. Moreover, recent advances in IHFOAM (Higuera et al., 2013 [3]) suite are presented. A two-phase solver that couples the Overset, the iso-advector and the stabilized turbulence libraries has been implemented in OpenFOAM-v1812.

REFERENCES

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