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A Hybrid Stabilization Technique for Simulating Water Wave – Structure Interaction by Incompressible Smoothed Particle Hydrodynamics (ISPH) Method

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ABSTRACT

The Smoothed Particle Hydrodynamics (SPH) method is emerging as a potential tool for studying water wave related problems, especially for violent free surface flow and large deformation problems. The incompressible SPH (ISPH) computations have been found not to be able to maintain the stability in certain situations and there exist some spurious oscillations in the pressure time history, which is similar to the weakly compressible SPH (WCSPH). One main cause of this problem is related to the non-uniform and clustered distribution of the moving particles. In order to improve the model performance, the paper proposed an efficient hybrid numerical technique aiming to correct the ill particle distributions. The correction approach is realized through the combination of particle shifting and pressure gradient improvement. The advantages of the proposed hybrid technique in improving ISPH calculations are demonstrated through several applications that include solitary wave impact on a slope or overtopping a seawall, and regular wave slamming on the subface of open-piled structure.

Keywords:

Hybrid stabilization; ISPH; minimum pressure; particle shift; wave impact

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