SMOOTHED PARTICLE HYDRODYNAMICS MODELING OF WAVE ENERGY DISSIPATION

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In this paper, smoothed particle hydrodynamics (SPH) method is applied for modeling dissipation of wave energy with horizontal perforated plate placed under water surface in a towing tank. Previous research using two-dimensional linear potential theory and Darcy's law is improved with Navier-Stokes equation. The developed SPH formulation applied to dam break and wave maker problems in order to validate the formulation. Validation achieves through comparison of numerical and experimental results presented in the literature. A new particle neighbor search is also developed and used for reduction of simulation time and the computational cost of model. Furthermore, parallel processing is used for decreasing time of simulation. The proposed algorithm is faster than other algorithms in the literature. If shared- memory parallelism (SMP) with increased in CPU is used for parallelism of calculations, the time efficacy of simulation enhanced significantly. With the use of parallel processing and new particle neighbor search, the simulation time decreases up to 10 times compared with the Linked Cell List (LCL) algorithm, reported in the literature. The simulation of dam break, wave maker, and wave reflection from a vertical wall are used to verify the parallel-processed two dimensional codes, written in C language. Variation of wave front position with respect to time shows a good agreement with laboratory data reported in the literature and indicates well-behaved characteristics compared to experimental data. Simulation of piston wave maker shows that the wave maker perfectly introduces regular wave, which is the indication of stability and accuracy of SPH method. Effect of artificial viscosity, frequency, and Mach number on reflection coefficient from a vertical wall is also investigated. The reduction of computational cost of modeling is important aspect in this study in order to be able to reduce the particle size or in another word increase the number of particles. As a result, the model was capable of handling up to one hundred thousand particles, small enough to pass the hole of perforated plate. The horizontal perforated plate with 40% porosity, located at the water surface close to the end wall of the towing tank, will be simulated and compared with experimental data using complete 2-D Navier-Stokes equations. Sensitivity analysis of reflection coefficient with respect to the dimensionless ratio of plate length to wavelength matches will be investigated.