

# $\delta$ -SPH and S-PIM coupled method for fluid-structure interaction problems

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## Abstract

In this work, a delta smoothed particle hydrodynamics ( $\delta$ -SPH) and smoothed point interpolation method (S-PIM) coupled method is proposed to simulate fluid-structure interaction (FSI) problems. The S-PIM is of the advantages of both traditional finite element method (FEM) and meshless methods and has been used for structure dynamics. By introducing the density diffusion term into the continuity equation based on weakly compressible SPH (WCSPH),  $\delta$ -SPH is able to reduce numerical noise and get smooth pressure field. In order to alleviate the oscillation of the FSI force during transmission, a particle interpolation scheme is used. The coupled method is applied to the dam break flow and sloshing flow with elastic structures, which represent the impact problem and the long-term simulation, respectively. By comparing the obtained results with experimental data or numerical results by other scholars, the present method been proved to be able to provide accurate and stable results for the FSI problems involving free surface.

**Keywords:** delta smoothed particle hydrodynamics ( $\delta$ -SPH); smoothed point interpolation method (S-PIM); fluid-structure interaction (FSI); dam break flow; sloshing flows