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LARGE-SCALE PALALLEL FLUID-STRUCTURE INTERACTION SIMULATION USING MPS-FE PARTITIONED COUPLING METHOD

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Large facilities such as electric power plants built along coastal regions are vulnerable to tsunamis. The damage to the equipment and instruments due to inundation, water forces and impact forces by floating objects has the potential to cause catastrophic harm to human lives and devastate the locality. Simulation for fluid-structure interaction (FSI) problem involving free surface flow have great importance in terms of disaster mitigation design.

To solve such problems, we have developed a reasonable FSI method named MPS-FE method [1]. The method adopts the Finite Element (FE) method for structure computation and the Moving Particle Simulation/Semi-implicit (MPS) method [2], one of mesh-free particle methods, for fluid computation involving free surfaces. These two methods are coupled with a partitioned coupling approach, i.e. the Conventional Serial Staggered (CSS) scheme [3]. The method combines the advantages of both methods and achieves efficiency, robustness, and software modularity as a result.

In addition, We have improved the MPS-FE method [4] so that FSI computation can be performed requiring no cumbersome procedure to make especial data for the coupling. The improvement enable to compute easily using only initial particle and FE data.

In this study, we aim to realize a large scale MPS-FE analysis using two existing solvers for MPS method and FEM. Some of the present authors have developed a large-scale parallel FEM solver for structural analysis named ADVENTURE [5, 6] and a large-scale

parallel Explicit-MPS (E-MPS) solver for fluid analysis [7]. A coupler code couples these parallelized codes with software modularity, which is prominent merit of partitioned coupling approach. We solve benchmark problems for the verification of developed codes, and present some examples of FSI analysis to demonstrate the applicability and versatility of MPS-FE method.

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