

Distributed Parallel Large-Scale MPS-FE Fluid-Structure Interaction Coupled

Analysis for Tsunami Analysis on Urban Area

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Abstract

Ishinomaki city was severely damaged by the tsunami of the Great East Japan Earthquake on 2011. Our target is to simulate impact by the tsunami run-up on a coastal areas and an urban area of Ishinomaki. Zoom up analysis by three analyses stages is adopted to solve a large area from an epicenter to an urban area. In the first stage, the 2-dimensional shallow-water analysis is solved in the area of 667km×525km from the epicenter to the coastal areas. In the second and third stages, the 3-dimensional tsunami run-up analyses are solved for the coastal areas using the hierarchical domain decomposition explicit MPS (Moving Particle Simulation) method [1]. Since our target is the tsunami run-up analysis in the urban area in the third stage, we consider that estimations for buildings such as houses and factories are important and perform the elastic analysis for their buildings by fluid pressure. Since we assume the infinitesimal deformation for structures because structures are only building, our fluid-structure interaction analysis becomes one-way coupling analysis from fluid to structure.

We use the ADVENTURE_Solid ver.1.21 [2] for the structure computation and the LexADV_EMPS ver.0.1b [1] for the fluid computation. The number of elements in the finite element mesh for the structure computation is 10 million DOFs and the number of particles for the fluid computation is 40 million particles. This analysis time is 200 seconds. The coupling algorithm is controlled by our script code written by the Perl. The two analysis softwares are not merged. In this research, all process of the mesh generation, particle generation, the FSI analysis and visualization are done on the CX400 of Information Technology Center, Nagoya University.

Keywords: MPS method, Distributed memory parallel computing, Tsunami, FSI analysis

References

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