Large-Scale Tsunami Simulation Based on Three-Dimensional Parallel SUPG-VOF Method

***Taiki Fumuro[1], Seizo Tanaka[2], and Kazuo Kashiyama[1]**

[1] Department of Civil and Environmental Engineering, Chuo University, Japan
[2]Earthquake Research Institute, University of Tokyo, Japan

*Corresponding author: fumuro@civil.chuo-u.ac.jp

This paper presents a large-scale tsunami simulation based on the three-dimensional parallel SUPG-VOF method. The three-dimensional Navier-Stokes equation and continuity equation are employed for solving velocity and pressure. The advection equation is employed for solving interface function between air and water. The stabilized finite element method based on unstructured grid is employed for the discretization for governing equations. In order to express the interface clearly, the interface-sharpening/mass-conservation algorithm is employed. In order to handle the large-scale tsunami simulations, a parallel implementation is designed by using MPI, OpenMP and hybrid MPI+OpenMP. The presented method is applied to several tsunami wave problems to show the validity and efficiency. The present method is shown to be a useful planning and design tool for tsunami disasters.

Keywords: Tsunami simulation, Stabilized finite element method, SUPG-VOF method, Parallel computing, Three-dimensional Navier-Stokes equation