Efficient implementation and performance of SPH code on heterogeneous many-core processors towards energy efficient disaster simulation

*Natsuki Hosono[1,2], Mikito Furuichi[1]

1. Japan Agency for Marine-Earth Science and Technology, 2. Advanced Institute for Computational Science, RIKEN

Smoothed Particle Hydrodynamics (SPH) method is one of the attractive methods for simulating large deformations of fluid surface geometry.
In SPH, fluid is represented by a collection of hypothetical particles (SPH particles) and governing equations for the fluid are converted into the sum of interactions surrounding particles.
Lagrangian nature of SPH method offers advantages in a flexibility for simulating 3D free surface motion over mesh-based method.
Especially, the large-scale simulation utilizing High Performance Computing (HPC) is a promising tool for damage estimation of disaster events such as Tsunami runup and landslide which system size and complexity are over the capacity of a laboratory experiment.
However, SPH requires relatively high computational cost than mesh code.
Thus, practical runs of SPH simulation for simulating the city size event using HPC have difficulties in the computational time and associated electrical energy cost.
Recently, new types of heterogeneous many-core architecture, such as PEZY-SC* are available for HPC to solve such problems with massively parallel many-core computation with very high energy efficiency.
However, efficient implementation techniques and performance of the SPH code on heterogeneous many-core architecture are not well understood.
We have programmed an SPH code which worked on multiple numbers of heterogeneous many-core processors.
We will report the speed-up efficiency of our code.

Keywords: numerical hydrodynamics

