Simulation study of the liquid-solid flow by a DEM-MPS method

Toshifumi Sakamoto[1]; Satoshi Yukawa[2]

[1] Earthsciences,Kyoto Univ.; [2] Dept. Earth Space Sci, Osaka Univ.

A lot of liquid-solid flow is observed in the nature world. For example, liquefaction at earthquakes and water flow in the basement are typical liquid-solid flows. Therefore, it is important to model, simulate and analyze multiphase flow. In this study, a moving-particle semi-implicit (MPS) method is used in order to deal with a motion liquid phase in a simulaiton. This method is based on Lagrangian picture of fluid.

First, we simulated Darcy's law as a benchmark of MPS method. The data supported Slichter's phenomenological theory of the relationship between hydraulic conductivity and effective porosity.

Next, we introduce solid components into the MPS hydrodynamics, which interact with each other by so-called 'DEM' interaction.It is expected that a discrete element method (DEM) force describes a friction and an effective adhesion among solid particles.Using this combined method, we simulate soil liquefaction phenomena in a shaken box.As a result we observe qualitative behavior of liquid-solid flow is consistent with experiments.

The above calculations have been done in a two-dimensional system.Three-dimensional calculations and quantitative analysis are now in progress.