NATURAL DISASTER SIMULATION BY A MULTI-PHYSICS PARTICLE SIMULATION

Mitsuteru Asai[1,*]

[1] *Associate Professor, Department of Civil Engineering, Kyushu University, Fukuoka, Japan*

[*] *Corresponding author. Tel: +81 92 802 3373; E-mail address: asai@doc.kyushu-u.ac.jp*

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Abstract

Disasters, such as sediment disaster caused by heavy rain and Tsunami disaster caused by an earthquake, are multiphase flow phenomena of fluid, soil and structure (rigid body). For damage prediction and countermeasure, fluid-solid analysis method is necessary since there is a scale limitation for an experiment. In this study, we develop multiphase simulator utilizing the Incompressible Smoothed Particle Hydrodynamics method (ISPH method [1]) for fluid and Discrete Element Method (DEM) for soil particle and rigid body. The interaction between ISPH method and DEM for the small soil particles is implemented by considering an interaction force between fluid and soil with an empirical drug force model.

On the other hand, in the fluid-rigid body interaction simulation, fluid force is directly modeled by fluid pressure acting on the rigid bodies. During the fluid-rigid body interaction simulation, collision between rigid bodies may be occurred. In this paper, the impulse-based rigid body dynamics is applied to deal with the collision contact problem instead of the conventional penalty method for robust and faster computation [2].

Several validation tests including dam break flow of water and glass beads and fluid-rigid body interaction problem are simulated by our developing simulator.

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References

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