Large deformation analysis of geomaterials based on continuum modeling considering soil skeleton structure

H. Nonoyama*, M. nakano†, T. Noda† and Y. Miyata

* Department of Civil and Environmental Engineering, National Defense Academy
1-10-20 Hashirimizu, Yokosuka, 239-8686, JAPAN
e-mail: nonoyama@nda.ac.jp

†Department of Civil Engineering, Nagoya University
Furo, Chikusa, Nagoya 464-8603, Japan

ABSTRACT

Recently, the frequency of geo-disasters, including embankment failures and slope failures due to the heavy rainfall or earthquakes, has increased. Many of these disasters exhibit the large deformation behavior. The smoothed particle hydrodynamics (SPH) method has been used to solve large deformation problems of geotechnical structures. The SPH method is a particle method based on the mesh-free Lagrangian scheme, which can be used to solve large deformation problems without distortion of the mesh. Moreover, it can handle governing equations and existing constitutive models for geomaterials based on continuum mechanics; however, it is generally said that inaccuracies in analytical method are a problem with this conventional method.

Here, we describe a comparison between the symmetric SPH (SSPH) method [1] and the conventional SPH method in terms of numerical accuracy. Simple shear problems of elastic and elasto-plastic materials were simulated using both methods. The Green-Nagdhi stress rate was used as the objectivity. To implement the elasto-plastic analysis, the SYS Cam-clay model [2] was used in both mesh-free methods. The simulated results of the SSPH method were good agreement with the theoretical solutions in comparison with the conventional method.

Also, excavation problems with loose to dense sand were analyzed to discuss the application of the SSPH method. We found that the differences in the behavior of the geomaterials were due to the differences in the development of the structure and overconsolidation.

REFERENCES

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