Development of 3D Particle Method for Calculating Large Deformation of Soils

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Abstract : In this study, a three-dimensional (3D) Particle method without using grid was developed for analyzing large deformation of soils instead of using ordinary finite element method (FEM) or finite difference method (FDM). In the 3D Particle method, the governing equations were discretized by various particle interaction models corresponding to differential operators such as gradient, divergence, and Laplacian. The Mohr-Coulomb failure criterion was incorporated into the 3D Particle method to determine soil failure. The yielding and hardening behavior of soil before failure was also considered by varying viscosity of soil. First of all, an unconfined compression test was carried out and the large deformation following soil yielding or failure was simulated by the developed 3D Particle method. The results were also compared with those of a commercial FEM software PLAXIS 3D. The developed 3D Particle method was able to simulate the 3D large deformation of soils due to soil yielding and calculate the variation of normal and shear stresses following clay deformation.

Keywords : particle method, large deformation, soil column, confined compressive stress

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