A Study of Principle Stress Rotation on Granular Soils Using DEM Simulation of Hollow Cylinder Test

Benyamin Farhang*, Ali A. Mirghasemi†

* School of Civil Engineering, College of Engineering, University of Tehran
Tehran, Iran
e-mail: b.farhang@ut.ac.ir

† School of Civil Engineering, College of Engineering, University of Tehran
Tehran, Iran
e-mail: aghasemi@ut.ac.ir

ABSTRACT

This study presents a numerical modeling of Hollow Cylinder test (HCT) using discrete element method by developing of TRUBAL code on granular soils. Due to high expenditures of HCT, a verified numerical modeling of this test was developed to save time and expenses. In addition, this numerical model can be used to address the gap in understanding the relationship between the particle-scale interactions and the overall material response.
In the introduced model, plane and cylindrical walls were defined to apply the boundary forces and an innovative method was presented to apply the torque. The displacements of inner and outer walls were interdependent while applying the torsion to control the intermediate principal stress parameter "b". It was shown that the shear strength was decreased by increasing the principal stress direction α. Also, it was observed that by increasing the confining pressure, the internal friction angle was reduced with a decreasing rate. To verify the model, the results of experimental hollow cylinder tests on Firoozkooh sand under monotonic loading and drained condition were employed. Comparing the presented model and experimental results, it was shown that there was a close association between this model and the experiments.

Keywords: Discrete element method, Granular soils, Hollow cylinder apparatus, principal stress rotation