



Discrete Element Modeling on Deformation Pattern of Composite Strata Induced by Repeated Thrust Faulting: Case Study of Chushan Site, Central Taiwan

Chien-Hui Hung, Cheng-Han Lin, and Ming-Lang Lin

Department of Civil Engineering, National Taiwan University, Taipei, Taiwan (r07521106@ntu.edu.tw)

In 1999, Chi-Chi earthquake hit Taiwan and caused severe damage to the infrastructures along the Chelungpu fault because of overburden deformation. Previous study excavated several trenches near the Chelungpu fault to study the fault characteristics and the fault deformation zone. The most important trench, Chushan site, records the Chi-Chi earthquake with 1.7m vertical offset and other four large paleoseismic events. This fault trench was now retained in the Chelungpu Fault Preservation Park, Taiwan that greatly contributes to observing the deformation pattern of overburden layer induced by repeated thrust faulting. For the north wall of the Chushan trench, the east-dipping basal thrust with a dip angle of 24° splits into two branches and the sedimentary layer, which consists of silt layer and gravel layer, is deformed into an asymmetric anticline fold. This observation indicates that the overburden layer in natural is the composite strata and the presence of gravel layer in the composite strata could be an indicator for the coseismic deformation.

In this study, three-dimensional DEM simulations are conducted to identify the deformation pattern of composite strata under repeated thrust faulting. The numerical model was constructed based on the Chushan trench. Silt layers are made by balls and the gravel layer is composed of balls and ellipsoid particles. Results show that a fault-propagation fold forms during the initial stage of the deformation, and an asymmetric anticline fold with one limb slightly overturned forms in the Chi-Chi earthquake. The rotation of ellipsoid particles in the numerical model indicates the evolution of folding, which conduces to understand the deformation progress in the full faulting process.