Role of sliding contacts in shear banding of granular materials – PARTICLES 2019

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ABSTRACT

Shear banding is a widely concerned issue caused by shearing in the field of granular geomechanics. At the macroscopic scale, the constitutive models meet difficulties to describe how and why the shear band forms within the discrete granular assembly. The contact network inside the overall granular assembly helps us to understand the origin of some macroscopic features. Between contacting particles, sliding can occur, which is associated with the plastic dissipation. This local contact sliding may induce the rearrangement of local structures, and then contribute to the macroscopic failure characterized by larger patterns, such as shear banding. In this paper, we conduct DEM simulations using a dense specimen, and during the loading process an evident shear band appears. Then the contact sliding ratio, sliding index, and the relationship between the contact sliding and the mesostructural changes are investigated. Main conclusions are: sliding contacts firstly distribute randomly within the granular assembly, and will concentrate within the shear band after the stress peak; the sliding ratio and the sliding index show different evolution trend and distribution properties; sliding contacts are not within the strong contact network when the threshold to distinguish the strong and weak network is proper, but will be strongly influenced by the force chain buckling; considering the relation between the sliding and the meso loop exchanges, the topological dilations are related to the higher probability of contact sliding and plastic dissipation.

Key words: Granular Materials, DEM, Contact Sliding, Meso-Structures, Shear Banding