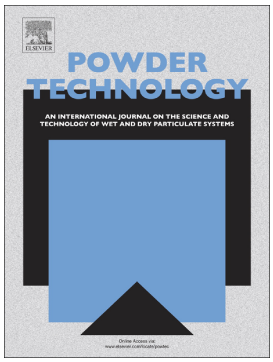

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Revisiting the confined comminution of granular materials with the consideration of the initial particle size distributions and repetitive loadings

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Abstract:

The initial particle size distributions (PSDs) and cyclic loading effects for the confined comminution tests are studied by using discrete element method (DEM). Three typical PSDs, i.e. the uniform, bimodal and fractal, respectively, are used to explore the general correlations from microscopic quantities to macroscopic quantities during the loading-unloading-reloading procedure. For the initial bimodal packing, it cannot easily generate an ultimate fractal packing. And for the initial uniform and fractal packings, the ultimate fractal dimension of PSD would gradually increase during the reloading procedure. Moreover, the coordination distribution of particles (CNP) is insensitive with the initial PSDs and cyclic loadings. Furthermore, the fractal analysis of the network of force chains is also studied by the box method to evaluate the fractal features of force chains from the general, strong and weak perspectives. Additionally, a new descriptor for interpreting the relationship between the force chains and the composed particles (C_{FC}) is proposed to evaluate the packing geometrical topologies and force chains. It can be used to evaluate the inter-particle structure feature of the granular assemblies. It is interesting to find that C_{FC} is gradually increased with the increasing loading stress, and reaches a peak value in the unloading stage for the same stress state and decreases with the increasing number intensity of force chains.

Keywords: crushable grains; particle size distribution; repetitive loading; fractal feature; coordination number

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