Grain scale parameters in dissipative driven constitutive models

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Abstract

Soil has generally been treated as a continuum from as early as the eighteenth century [2]. As Davis and Selvadurai [2] note, Coulomb used the continuum description of soil for engineering purposes and since then the analysis of soil behaviour in practical engineering analyses and development of constitutive models has depended on a continuum assumption. However, in order to gain a deeper understanding of the behaviour of soils and their particulate nature, there is a need to move from continuum mechanics to discrete models. Such modelling is possible using the Discrete Element Method (DEM) originally introduced by Cundall and Strack [1]. In this paper an open source DEM particle simulation software, LIGGGHTS developed by Kloss et al. [4] is used to study the relationships between grain scale parameters and energy dissipation in granular media through one-dimensional compression and triaxial tests. The influence of particle size distribution, voids ratio, friction coefficient, and confining pressure on energy dissipation are studied and discussed. Observations are made on the variation of the number of particle contacts at different energy levels. In order to measure the dissipated energy, changes in energy terms are traced at every time step and the principle of energy conservation applied. It is hoped that the knowledge gained of the relationship between grain scale parameters and energy dissipation will help in the formulation of constitutive relationships within the hyperplasticity framework [3]. It is envisioned that relating grain scale parameters to constitutive models will allow the formulation of models that are purely based on the micro mechanics of granular media.

Key Words— DEM, energy dissipation, compression, triaxial tests, hyperplasticity

References

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