The effect of shape in granular materials: Discrete Elements Modelling of geotechnical tests in dry sands

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ABSTRACT

It is widely recognised that particle shape influences the mechanical response of granular materials [1-2]. Rolling resistance elasto-plastic contact models are frequently used to approximate particle shape effects in simulations using the Discrete Element Method (DEM) [3-4]. Such contact models require calibration of several micro-parameters, most importantly a rolling resistance coefficient. In this work, the rolling resistance has been calibrated to reproduce the triaxial tests – in terms of mechanical and kinematic responses – of two different sands: Hostun and Caicos sands. The value of rolling resistance is directly linked to true sphericity, a basic measure of grain shape, as originally proposed in [5]. When shape measurements are performed [6], this link enables independent evaluation of the rolling resistance coefficient for each particle. It does also allow the characteristic shape variability of natural soils to be easily taken into account. Then, the effects of particle shape on the tip and shaft resistance of the cone penetration test performed in a virtual calibration chamber are investigated. It is shown, using realistic values of shape distributions, that particle shape and shape variability significantly affects the cone penetration resistance.

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