Abstract for Dynamics Days Crete 2006
Topic: Granular Materials

Numerical study of the force network in a random granular packing during compaction

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The granular materials present a large variety of complex behaviours like segregation, dilatancy, avalanche, intermittency. The compaction of granular packings [1, 2] is a particular problem in which both static (contact forces) and dynamical (inelastic collisions) properties of the grains play a role. In order to consider compaction, we propose a numerical study of the complex network of contact forces in dense granular piles when there are slowly driven by an external force. The numerical model [3, 4] is based on the Non Smooth Contact Dynamics [5]. The main difference between this model and the usual Discrete Element Method (DEM) models is the way for the calculation of the contact forces. The model computes a complete force network in the pile at each time step, in opposition to DEMs which condier a force at each contact as a function of the local parameters. The model we consider needs high computing pow but descibes precisely the compaction dynamics at the microscopic (grain) scale.

Some important micro-macro parameters have been observed during compaction. The packing fraction η is the main parameter measured at the macroscopic scale. The grain mobility μ which can be defined as the average displacement of the grains between two successive taps is a key microscopic parameter. Some recent experimental studies [6] have linked this mobility to the behaviour of the packing fraction. We study the influence of the force network on the dynamics of mobility during compaction in granular materials. At the macroscopic scale, numercial results are consistent with experimental ones.

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