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ACOUSTIC WAVES AND EFFECTIVE MECHANICAL PROPERTIES IN GRANULAR MEDIA - THE MICROMECHANICAL PERSPECTIVE TRACK NUMBER (1600)

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ABSTRACT

Understanding the effective mechanical properties of closely packed, dense granular systems is of interest in many fields, such as soil mechanics, materials science and physics. The main difficulty arises due to discreteness and disorder in granular materials at the particle scale which requires a multi-scale approach. The mechanical behavior of granular materials is highly nonlinear and involves plastic deformations also for very small strain due to rearrangements of particles. On the other hand, the concept of an initial purely elastic regime at small strains for granular assemblies is an issue still under debate in the community of soil mechanics. In addition, approaches that neglect the effect of elastic stored energy are also questionable, i.e., all the work done by the internal forces is dissipated. Features visible in experiments, like the propagation of acoustic waves, can hardly be described without considering an elastic regime. The study of wave propagation allows inferring many fundamental properties of granular materials such as elastic and dissipative mechanisms. In a general picture, both the deformations at contact and the inelastic rearrangements of the grains sum up to the total strain. The former represents the elastic, reversible contribution to the behavior of the material.

Numerical simulations, e.g. Discrete Element Method (DEM) on the particle scale or the Finite Element Method (FEM) on the continuum scale, have revealed the outmost role of the microstructure in characterising the elastic behaviour of granular soils. Especially, DEM is a powerful tool to inspect the influence of the microscopic contact properties of the individual constituents on the bulk behavior of granular assemblies.

The purpose of this mini-symposium is to improve the basic physical of mechanical properties in particle systems and to guide further developments for new constitutive models. In particular, we focus on the micromechanical approach to the topic.