Quantifying the micro-structure of granular materials and its impact on constitutive behaviour

Xia Li

[1] Faculty of Engineering, University of Nottingham, Nottingham, UK
[2] School of Civil Engineering, Southeast University, Nanjing, China

Email: xia_li@hotmail.com

ABSTRACT

Granular materials are assemblies of discrete particles, which interact with each other and displace in terms of contact sliding and particle rotation. They demonstrate a wide range of interesting phenomena, including memory effect, self-organisation et al. The mathematical formulation of their stress-strain relationship is however challenging. Due to its ubiquitous existence in nature as geo-materials, it has attracted long-term interest and efforts, and become increasingly active promoted by recent developments in numerical simulation capacities and particle-scale experimental techniques. Microstructure has long been identified as the key missing factor in the mathematical formulation.

This talk will present a tessellation system, which serves as the mathematical description of the micro-structure of granular materials [1]. Building upon it, it will elaborates the homogenisation theory of granular materials, which establishes the analytical connection between continuum scale stress and strain tensors with their particle-scale counter-parts, contact forces and relative particle displacements[2]. It will also cover observations on the internal structure formed by granular particles with different friction coefficients and extended discussions on various definitions of fabric tensor and their potential to be used as internal state variable for constitutive modelling[3].

References:

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3. Li, X., *Internal structure quantification for granular constitutive modeling.* Journal of engineering mechanics, 2017.