# Imbricated scales in granular materials: from grains to homogeneous continuum.

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**Abstract**

The mechanical behavior of granular materials is governed at the microscale by cohesive-frictional forces acting at contact points between elementary particles. At the macroscale, the overall constitutive behavior results from a complex combination between the particle shape, the geometrical arrangement between particles and the nature of contact laws acting between particles. In addition to the complex fabric topology, it has been widely reported in the literature that only a small fraction (typically 20 %) of the elementary particles actually participate in the stress transmission. As a result, preliminary to the use of micro-macro homogenization techniques applied to granular materials, there is a need to define an intermediate scale to account for this heterogeneous stress transmission. Thanks to the use of the concepts of force chains (Peters et al., 2005) and autocorrelation functions (Kanit et al., 2003, Matheron, 1967), such an internal length scale can be introduced between the grain scale and the specimen scale (Wautier et al., 2017). This intermediate scale provides a quantitative definition of the concept of Representative Elementary Volume (REV).
The interplay between loose particles and particles belonging to force chains is then studied at this scale to explain the micro origin of plastic strains observed at the macroscale.

## References

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