# Quasi-static rheology of highly polydisperse packings:

# effects of particle size and shape

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## ABSTRACT

A systematic investigation of the combined effects of size span and particle shape polydispersity (defined as the degree of shape irregularity) in quasistatic rheology of two-dimensional sheared granular media is performed by means of extensive contact dynamics simulations (See Fig. 1). We find that the shear strength is independent of size span but, unexpectedly, it declines with increasing shape polydispersity. At the same time, the solid fraction is an increasing function of both size span and shape polydispersity. Hence, the densest and loosest packings have the same shear strength. We also performed a detailed analysis of the microstructure. In particular, we show that the independence of shear strength with respect to size span is due to the falloff of geometrical anisotropy compensated by an increase of normal force and branch anisotropies. This behaviour is explained by the fact that strong force chains are captured by the largest particles. In a similar vein, the mean number of contacts around the largest particles increases with particle shape polydispersity, reflecting the fact that the sharp corners of very irregular particles allow for more contact neighbours than with regular particles. As result, the contact orientation anisotropy declines, thus leading to the decrease of shear strength.

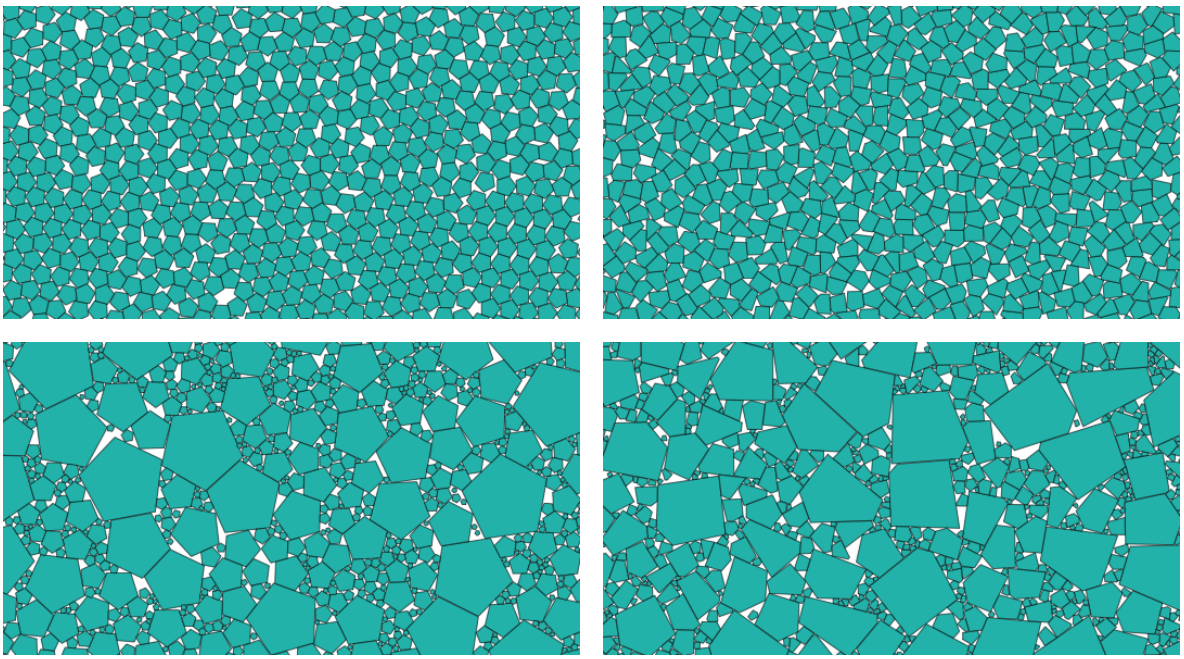

Figure 1 : Snapshots of dense packings obtained at the end of compression for differents values of the size span and shape polydispersity.