

## Grain shape and permeability of sand: characterization and quantification

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Grain shape is an important parameter affecting the mechanical and conductivity properties of particulate systems, such as compressibility, void ratio, shear strength, and permeability of sand. While the traditional characterization of grain shape focuses on using two-dimensional (2D) measurements such as grains' projection area and perimeter, recent development in imaging techniques (e.g. x-ray CT) enables quantifying the geometry of sand grains three-dimensionally. This talk will introduce some of my works in quantifying grain shape and its influence on the permeability of sand. The talk will first introduce the background (sand crushing in hydraulic fracturing) that motivates the research, followed by the three-dimensional imaging of sand grains with x-ray CT scanning and three-dimensional (3D) grain shape analysis. The influence of grain shape on sand permeability is then discussed by creating sand packs using various grain shapes with discrete element modelling and then conducting flow simulations through the pore space of sand packs. The last part will link the 3D grain shape to the 2D grain projection, tempting to quickly estimate 3D shape parameters from easily-obtained 2D grain shape parameters.

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