

# Single sand particle breakage mechanics: X-ray CT investigation and DEM modeling

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## ABSTRACT

Particle breakage is of fundamental importance to understand the mechanical behaviour of sands and is related to many geotechnical-engineering problems. Despite considerable research dedicated to the micromechanics of sand associated with particle breakage, the fracture process of natural sand particles is not well understood. In this paper, we combine X-ray computed tomography (CT) with DEM modeling to investigate the failure mechanism of individual sand particles. A mini-loading apparatus which is suitable for examining the initiation and propagation of microcracks in a single sand particle with nanofocus X-ray CT ( $\mu$ CT) is developed. Preliminary results have been obtained from the in-situ scanning of the fracturing processes of natural sand particles. The  $\mu$ CT images are processed using a 3D median filter and thresholding segmentation to reduce the noise and separate the regions of interests. The fracture patterns of these particles are presented and discussed through the CT images taken at the three states. The spatial distribution of the fractures is complex and different kinds of fracture mechanics could be observed. It is shown that the fracture behaviour of these two particles is mainly influenced by the loading conditions and their morphology.

The DEM modelling work involves the reconstruction of natural sand particle morphology using spherical harmonics analysis (SHA) and the application of a probabilistic method to the simulation and prediction of sand particle breakage.

## REFERENCES

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