USER MEETING 2016
24-25 NOVEMBER
National Centre for Synchrotron Science

Contribution ID : **215** Type : **Oral**

Synchrotron Tomography in Geotechnical Engineering Applications

Thursday, 24 November 2016 12:15 (15)

Synchrotron Radiation-based X-ray Micro-Computed Tomography (SR-μCT) is a leading edge technology allowing unprecedented grain-scale observations helping with a better understanding of geomaterial behavior. The higher energy level used in this technique allows rapid scanning of geomaterials under high stress levels to study the progress of crushing and crack propagation. This paper demonstrates and discusses application of synchrotron tomography of geomaterial in two different applications in field of energy geotechnics.

A new loading apparatus was developed to conduct compression tests of up to 61 MPa on geomaterials including assemblies of different particles. The equipment allows for studying particle breakage in granular assemblies under different loading sequences to be monitored and analyzed. Experiment results completed at Imaging and Medical BeamLine (IMBL) suggest particle shape as a noteworthy factor controlling degree of crushing in a granular assembly. Test results also indicate the changes in particle-scale characteristics such as morphology evolution of sand specimens due to breakage.

The apparatus was later equipped with a contact thermal conductivity sensor enabling measuring thermal conductivity properties of a range of geomaterials under different states of stress and crushing. Heat conduction is of critical importance in geotechnical engineering applications such as geothermal systems. Though largely overlooked, microstructural properties govern heat flow in geomaterials. A numerical heat flow simulation is highly desirable because it reveals the intimate relation between microstructure and the bulk macro-scale thermal (conductivity) properties used in engineering design applications. Development of such a model, however, has historically been hampered by lack of access to image data of real geomaterials and the effect of imperfect real grain contacts. The equipment developed and test results conducted at IMBL in the Australian Synchrotron addresses these shortcomings through the use of high-resolution 4D imaging and a new grain contact correction factor.

Test results suggests how synchrotron tomography can be used to study the change in micro structure of soils and aggregates and how it can help in bridging the knowledge gap between micro and macro behavior of geomaterials.

Keywords or phrases (comma separated)

Synchrotron tomography, Granular assembly, Particle breakage, Particle shape, Thermal Conductivity

Are you a student?

No

Do you wish to take part in</br>the Student Poster Slam?

No

Are you an ECR? (<5 yrs</br>since PhD/Masters)

Yes

What is your gender?

Male

Primary author(s) : Dr DISFANI, Mahdi (Senior Lecturer in Geotechnical Engineering)

Co-author(s) : Dr NARSILIO, Guillermo (Australian Research Conuncil Future Fellow, The University of Melbourne); Mr VAN DER LINDEN, Joost (PhD Candidate, The University of Melbourne); Ms AFSHAR, Tabassom (PhD Candidate, Swinburne University of Technology)

Presenter(s) : Dr NARSILIO, Guillermo (Australian Research Conuncil Future Fellow, The University of Melbourne); Dr DISFANI, Mahdi (Senior Lecturer in Geotechnical Engineering)

Session Classification : Concurrent Session 1: Earth & Environment

Track Classification : Earth and Environment