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Microstructure Evolution of Saturated Fine-Grained Soil Consolidation Based on Data-Constrained Modelling

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The Saturated Fine-Grained (SFG) soil, as one type of important materials of dredger mud, is related closely to bearing capacity of foundation in consolidation progress of reclamation engineering. It is necessary to research the quantitative mechanism between micro and macro mechanics by microstructure evolution of SFG soil consolidation. However, it is difficult to obtain the 3D microstructure characterisation in Micro-Nano scales by image segmentation approach. The Data-Constrained Modelling (DCM) method incorporates Multispectral Energy in Synchrotron Radiation of X-ray micro-Computed Tomography (ME-SR-CT) was applied to the 3D distribution of SFG soil in Micro-Nano scales. Based on DCM technology, quantitative parameters were obtained. With the increasing of loading pressures, 3D data was shown as follows. The correlation indexes between 3 groups changed. Especially the pores which were saturated with water migrated with organics significantly. The quantity and volume percentage of clusters of pores and minerals were varied with mechanics in 3 phases including obvious consolidation, aggregation yield consolidation and particle yield consolidation. Combined with e-p curves of macroscopic mechanical characteristics, it was found that particle yield as 400 kPa of SFG soil was smaller than conventional particle yield 800kPa in soft soil. It consolidated the importance of creep mechanics in the process of bearing capacity increasing. And an effective 3D structures characteristics method was illustrated, which included 3 groups of SFG. It revealed that the distributions and evolutions of porosity and the minerals were in different consolidation phases which combined with micro and macro mechanical properties. Furthermore, loading velocity could be controlled by the mechanics result combined with engineering theory and engineering significance.

Keywords or phrases (comma separated)

Microstructure evolution; SFG soil consolidation; DCM; ME-SR-CT

Are you a student?

No

Do you wish to take part in the Student Poster Slam?

Yes

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

Yes

What is your gender?

Female

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