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Effects of compaction on pore structure and soil hydraulic properties

Thursday, 2 June 2022 15:15 (1h 10m)

The hydraulic properties of porous media extensively depend on their pore structure as described by the size, arrangement, and connectivity of pores. The current work aims to provide a numerical simulation of the evolution of the pore size distribution (PSD) during oedometric compaction of Zbraslav sand. Apart from the derived unsaturated hydraulic properties, we will be particularly interested in predicting its saturated permeability with respect to non-Newtonian (shear-thinning) fluids.

In this study, we will follow the discrete approach during the sand compaction process introduced by Mahmoodlu et al. [1] and later studies. Discrete element method (DEM) can directly trace the motion of individual particles and explicitly consider the particle–particle interactions without the need of macroscopic constitutive correlations. We will use this method to generate a packing of idealized particles for a certain porosity and particle size distribution, and simulate the movement of grains during the compaction process. It is desirable to derive pore networks from the imaged DEM soil samples and thus establish the relationship between the particle geometric features and the pore characteristics. Subsequently, the extracted pore networks can be used as the input for prediction of hydraulic properties of soil [2].

Further step will be the simulation of the flow of various shear-thinning fluids through the media [3, 4]. We are particularly interested in how the observed variations in pore structure will be represented by the effective PSD obtained by the method introduced by Abou Najm et al. [5], i.e. computed from the observed permeabilities with respect to shear-thinning fluids. Based on this method, we will present the experimental measurement of the effective PSD directly during the oedometric test.

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Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

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