

Hydromechanical behaviour of unsaturated soils

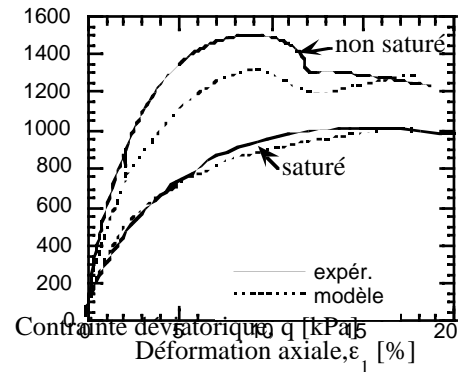
The design of geotechnical structures submitted to complex loading conditions involves effective calculation tools for technical and financial reasons. Most geotechnical problems are conditioned by the effects of coupling between deformation of the solid mass (arrangement of the grains) and fluid flow (water and air). This is the case, in particular, for construction in the vadose zone (execution of dams, stability of tunnels and excavations, cyclic hydric loading of roadway foundations, environmental engineering).

The objective of the research in progress can be summed up in two points: the contribution to the characterisation of the influence of desaturation on the mechanical behaviour of granular soils, and the development of a modelling tool which takes desaturation into account.

The first part of the project hinges on an experimental programme using sandy silt from Sion. This programme consists of hydromechanical tests using paths coupling the states of mechanical stress and suction. It includes the determination of the evolution of the loading surface and the plastic flow under the influence of the desaturation.

Using these experimental results, a constitutive model is in the process of being developed. This model is an extension to the unsaturated domain of a constitutive law valid in the saturated domain, taking into account the main characteristics of the desaturation: decrease of compressibility, increase in apparent preconsolidation pressure, increase in shear strength and stiffness, increase of the elastic domain and appearance of brittle failure (see figure).

The final stage of this research programme concerns the validation of the constitutive model and its implementation in a finite element code. Thus, it will be possible to study limit problems and to improve the design of structures located in partially saturated zones.



Influence of desaturation on the deviatoric behaviour (drained triaxial test)

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