FINITE ELEMENT MODELLING OF INTERFACES IN GEOTECHNICS

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According to the Encyclopaedia Britannica, interfaces are surfaces separating two phases of matter, that can be solid, liquid or gaseous. They exist in most of the geotechnical problems as they are the boundary between man-made structures (e.g. foundations, tunnel lining or retaining walls) and the environment, or they represent discontinuities within a natural medium (e.g. rock joints). The mechanical contact problem is the most fundamental, as contact properties affect the transfer of normal and shear forces from one medium to the other. However, discontinuities also constitute preferential paths for fluid flows.

Interface finite elements have been used in LAGAMINE for more than 30 years in many mechanical and geotechnical studies. They were initially developed to simulate mechanical contact, but were progressively extended to incorporate fluid flows (along the interface and transversally) and hydro-mechanical couplings. The element formulation allows the implicit solution of the problem and the simulation of purely transient geotechnical problems.

In this lecture, the mathematical formulation and the practical implementation of the finite element of interface will be presented. The potential of interface elements and the importance of hydro-mechanical couplings will be described through some geotechnical applications. The modelling of a suction caisson in sand (Figure 1) and the sealing of technical gaps with swelling bentonite (Figure 2) are particularly representative of the need for hydro-mechanically coupled finite elements of interface.

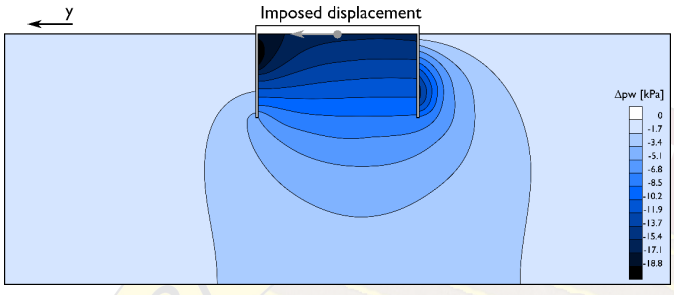

Figure 1

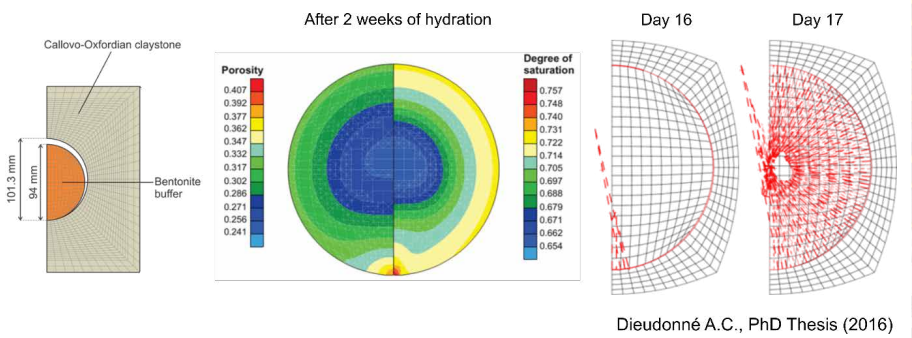

Figure 2

Guests are welcome!

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