

M4B, a Tool for the Analysis of THQM Behavior of Soils and Its Interaction with Building Foundations

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Abstract

The prediction of the behavior of soils during excavation and construction processes, or its interaction with building foundations should deal, in some circumstances, with coupled physical and chemical complex processes, such as dissection, evaporation, or expansive or volume change processes related to suction variations, mineral dissolution or precipitation, or changes in the chemical activity. This paper describes the tool M4B, a series of databases containing the equations for the modelling of the thermo-hydraulic-chemical-mechanical (THQM) behavior of soils under COMSOL Multiphysics® environment. The databases include, among others, an extensive relation of reaction rates and thermodynamic parameters for the prediction of dissolution and precipitation of mineral phases. It also includes several hydraulic and mechanical constitutive models, with some innovative numerical strategies for the prediction of stress-strain behavior under elastic-plastic trajectories. This tool is being successfully used in different issues related to the storage of nuclear waste, such as the modeling for the prediction of the movements of the foundation of the temporary centralized storage facilities "ATC" in central Spain. The simulation of an excavation, considering short and long term behavior under a changing hydro-thermal-mechanical and chemical environment is shown.