A thermo-hydro-mechanical model for unsaturated soils based on the effective stress concept

Matthieu Dumont, Said Taibi, Jean-Marie Fleureau, Nabil Abou-Bekr, Abdelghani Saouab

Abstract :

A simple thermo-hydro-mechanical (THM) constitutive model for unsaturated soils is described. The effective stress concept is extended to unsaturated soils with the introduction of a capillary stress. This capillary stress is based on a microstructural model and calculated from attraction forces due to water menisci. The effect of desaturation and the thermal softening phenomenon are modelled with a minimal number of material parameters and based on existing models. THM process is qualitatively and quantitatively modelled by using experimental data and previous work to show the application of the model, including a drying path under mechanical stress with transition between saturated and unsaturated states, a heating path under constant suction and a deviatoric path with imposed suction and temperature. The results show that the present model can simulate the THM behaviour in unsaturated soils in a satisfactory way.

Keywords : unsaturated soils; effective stress concept; THM behaviour; elasto-plastic constitutive law.

Journal title / Revue : INTERNATIONAL JOURNAL FOR NUMERICAL AND ANALYTICAL METHODS IN GEOMECHANICS, ISSN : 0363-9061, DOI: 10.1002/nag.952, Issue : 12, Volume : 35, pp. 1299–1317, 25 AOUT 2011.