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Numerical Simulations of Frost Heave Using COMSOL Multiphysics Software in Unsaturated Freezing Soils

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Abstract : Frost heave is arguably the most problematic adverse phenomenon in cold region areas. Frost heave is a complex process that depends on heat and water transfer. These coupled physical fields generate considerable heave stresses as well as deformations. In the present study, a coupled thermal-hydraulic-mechanical (THM) model using COMSOL Multiphysics in frozen unsaturated soils, such as fine sand, is investigated. Particular attention to the frost heave and temperature distribution, as well as the water migrating during soil freezing, is assessed. The results obtained from the numerical simulations are consistent with the results measured in the full-scale tests conducted by Cold Regions Research and Engineering Laboratory (CRREL).

Keywords : frost heave, numerical simulations, COMSOL software, unsaturated freezing soil
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