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A Computational Model for Freezing and Thawing in Soil

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A thermo-hydro-mechanical (THM) finite element model is developed to simulate freezing and thawing in soil. The governing equations are based on averaging theory and include conservation of mass, momentum and energy. The constitutive models constitute the equation of state (EOS) for water, Clausius-Clapeyron relationship for cryogenic suction, and empirical relationship for the melting point depression and unfrozen water content. The model is capable of simulating all important phenomena occurring during soil freezing, including: freezing induced heaving, convective-conductive heat transfer, water flow to the freezing region, and porosity change due to cryogenic suction and solid deformation.

References

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