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Localization and Stability of Unsaturated Soil

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Unsaturated soil plays a dominant role in geotechnical engineering, since the state of saturation significantly influences the effects of draining, deformation and localization of the subsurface. From the mechanical point of view, unsaturated soil is characterized by a triphasic material consisting of a porous solid matrix (the soil) together with the pore-water and the pore-gas. Based on a continuum mechanical approach, unsaturated soil can be described within the well-founded framework of the Theory of Porous Media (TPM), thus including saturated soil (solid matrix and pore-water) and empty soil (solid matrix and pore-gas) as special cases. Based on quasi-static situations, the numerical computations make use of weak formulations of the momentum balance of the overall triphasic medium together with the mass balance equations of the pore-fluids and Darcy-like relations for the seepage velocities. Proceeding from a materially incompressible elasto-viscoplastic soil skeleton, the numerical examples exhibit the draining, the deformation and the localization behaviour of unsaturated soil with a particular focus on embankment stability problems.

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