Abstract:

Strain localization phenomena in saturated or non-saturated soils initiate the well-known base failure problem of geotechnical engineering. The mechanical description of this type of phenomena basically falls into the category of liquid-saturated granular elasto-plastic cohesive-frictional materials, which can be described within a macroscopic approach by use of the Theory of Porous Media (TPM). In the present contribution, the TPM formulation of the porous solid skeleton material is extended by micropolar degrees of freedom in the sense of the Cosserat brothers. This procedure, in contrast to the usual continuum mechanical approach to the TPM, allows on the one hand for the determination of the local average grain rotations. On the other hand, when shear banding occurs, micropolarity furthermore yields a regularization effect on the solution of the governing set of differential equations both in the case of saturated and non-saturated soils. In the saturated case, the inclusion of the viscosity effect of the pore-fluid alone is also appropriate to regularize the localization problem.