Multiphase analysis of strain localization with regularized models

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ABSTRACT

As it is well known, in the context of the finite element simulation of strain localization using Cauchy continuum and elasto-plasticity with softening, the shear band width strongly depends on the adopted mesh and in particular equals to the size of the element for each mesh refinement. This fact causes loss of objectivity of the computational results and due to the importance of strain localization e.g. regarding slope stability, there is an urgent need of regularizing the numerical solution to make predictions of practical value.

The main purpose of this work is to avoid mesh sensitivity problems in strain localization simulation of multiphase geomaterials using viscoplasticity and nonlocal theories as regularization techniques in the post bifurcation regime. These formulations are implemented in an existing finite element code for multiphase porous media [1;2;3;4;5;6;7]. Both methods introduce (implicitly and explicitly) a characteristic length which prevents strains from localizing into infinitely narrow bands when the mesh is refined.

The efficiency of the models in terms of regularized performance is illustrated using benchmark numerical examples from the geomechanics field like a biaxial strain localization test and a slope failure problem. The particular features and limitations of both models are referred along with an extensive discussion about the parameters important for strain localization under the scope of the coupling between the soil deformation and the hydraulic behaviour during failure process.

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