

RESUMO N° 171

MIXED FE FOR STRAIN LOCALIZATION IN PLASTICITY

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Tackling incompressibility and localization in plasticity with standard finite elements is known to be an unfeasible task as stress locking and mesh dependency spoil the numerical solution. As it has been shown in previous works by Cervera et al. [1,2], a mixed formulation in terms of displacements and strain not only provides a propitious solution to the problem of incompressibility, but also it was found to possess the needed robustness in case of strain concentration.

When complex physics is present, higher accuracy is required to solve the field of interest.

First the formulation is presented to address the construction of the finite element approximation. Due to mixed nature of the problem, the selected interpolation spaces must respect the Inf-Sup Condition. In this work, all variables fields are interpolated with functions of the same order: it is well known that such choice does not satisfy the Inf-Sup Condition. Consequently, a Variational Multi Scale (VMS) approach is used to stabilize the mixed problem.

Incompressibility and quasi-incompressibility conditions are addressed as a natural extension of the method [3]. Moreover, global and local error norms are discussed to support the advantages of the proposed method.

[1] M. Cervera, M. Chiumenti and R. Codina. Mixed stabilized finite element methods in nonlinear solid mechanics. Part I: Formulation. Computer Methods in Applied Mechanics and Engineering, Vol. 199, 2571-2589, 2010.

[2] M. Cervera, M. Chiumenti and R. Codina. Mixed stabilized finite element methods in nonlinear solid mechanics. Part II: Strain Localization. Computer Methods in Applied Mechanics and Engineering, Vol. 199, 2559-2570, 2010.

[3] M. Cervera, M. Chiumenti, L. Benedetti and R. Codina. Mixed stabilized finite element methods in nonlinear solid mechanics. Part III: Compressible and incompressible plasticity. Computer Methods in Applied Mechanics and Engineering, accepted, 2014.