Some Numerical and Mechanical Issues When Using Intrinsic Cohesive Approaches

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ABSTRACT

Since the pioneering works of [1, 2], cohesive zone models are extensively used in failure and damage mechanics. Nevertheless, their numerical implementation as well as the development of micro-mechanical damage model using cohesive approaches are still important issues of concern. This work aims at determining a micromechanical model for elastoplastic materials using intrinsic cohesive approaches in numerical simulations, e.g. the Cohesive-Volumetric Finite Element Method. The idea, first proposed by [3] and recently used by [4], consists in replacing the cohesive-volumetric discretization by an equivalent 'matrix-inclusions' composite: the continuous matrix has the same behavior as bulk elements whereas inclusions correspond to the edges of the underlying mesh (see Figure 1).

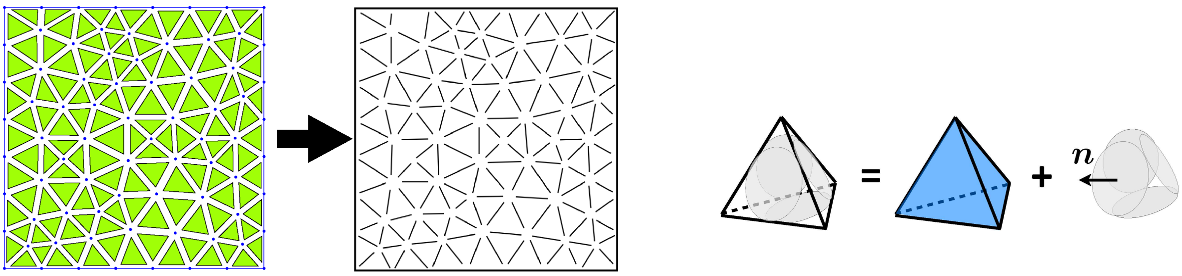

Figure 1: From cohesive-volumetric discretization to the equivalent 'matrix-inclusions" composite.

The overall behavior of such composite is asymptotically obtained using variational homogenization estimate [5, 6, 7]. The case of isotropic elastic media with bilinear cohesive law is firstly proposed. An elliptic micromechanical damage model is thus derived for brittle materials. Then the extension of the model to plastic media is considered. The main interests of this work are:

1. The overall elastic loss due to intrinsic models is *a priori* estimated and a criteria on cohesive stiffness is proposed.

2. The local damageable parameters are linked to (i) the overall properties of the relevant material and to (ii) the mesh parameters. Such calibration allow to derive an overall *mesh-independent* behavior.

3. The proposed model is available whatever the mesh type and the triaxiality loading rate contrary to previous results available in the literature.

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