Dissection of a continuous-discontinuous strategy: a review of its elementary components

S. Feld-Payet*

ONERA, Université Paris-Saclay, Materials and Structures Department - BP 72 - 29 av. de la Division Leclerc, 92322, Châtillon Cedex, France, sylvia.feld-payet@onera.fr

Numerous strategies have been proposed in the litterature to obtain a discrete crack representation from a continuous model [1]. These strategies may seem rather complex and completely different if considered in their entierty. However, they can actually be decomposed into elementary components which correspond to the methods chosen to answer the three following questions:

- When to insert the discontinuity?
- Where to insert the discontinuity?
- How to resume the computation?

Such decomposition of continuous-discontinuous strategy enables to compare more easily the different procedures. Besides, these elementary components can be selected independently according to the user's requirements and then assembled together to constitue a complete continuous-discontinuous strategy.

The aim of this contribution is to provide guidelines to analyze and compare different strategies of the literature to obtain, in a post-processing step, a discrete crack representation from a diffuse damage model. The choice of the different components depends on:

- whether the variable that represents material degradation is coupled to the constitutive equations or simply a result of a post-processing calculation;
- whether the continuous model is regularized or not;
- how the discontinuity is represented;
- the necessity to capture crack branching and crack initiation away from any boundary.

In all cases, ease of implementation and computational cost are important factors in the decision process and must thus be taken into account.

In this contribution, different orientation criteria used for a local approach of fracture are considered. They lead to either a scalar field or a vector field related to the discontinuity surface. These fields serve as input data for crack path tracking algorithms that are used to obtain a continuous and regular discrete crack path. The output data then serve to define implicitely or explicitely the crack surface, with several technics enabling to switch from one definition to another. An original classification of these crack path tracking algorithms based on the input and output data nature [2] will be presented. With this approach, it is easier to see how some interesting ideas of one strategy can be applied to others. For example, the principle used for the extension from 2D to 3D crack path tracking proposed in [3] can be easily used for other 2D approaches that rely on a scalar field with a ridge. Finally, as the insertion of a discontinuity in a continuous models implies a change of discretization, different technics to transfer fields and to help retrieve equilibrium are discussed.

References

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