A new interpretation of the global tracking algorithm in the context of the strong discontinuity approach

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ABSTRACT

The numerical simulation of two-dimensional fracture processes of quasi-brittle materials by means of the Embedded Finite Element Method is dealt with. The attention is paid to the coupling with the global crack-tracking strategy often used to ensure the crack path continuity. It has been proposed in the literature in the form of a heat conduction-like problem. It turns out that the stiffness-like matrix associated with this formulation is singular and a numerical perturbation has to be introduced in order to overcome the ill-posedness of the problem. The sensitivity of the solution on this parameter may represent a limitation for the global tracking approach. In addition, it is found that if the root of each discontinuity is not updated during an incremental analysis, a loss of continuity of the crack path may appear when principal stress directions rotate. This contribution aims to provide a solution to the aforementioned issues. A new interpretation of the mathematical problem based upon Navier-Stokes equations is proposed in order to link the diffusive contribution to a characteristic mesh length. Furthermore, a modified crack-tracking algorithm, considering the evolution of the root for the identification of the crack path, is proposed. The numerical assessment of the proposed tracking strategy is reported by means of benchmark tests at the structural level.

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