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Direct Estimation of Stress Intensity Factors by a 3D multi-grid DEK-FEM

A. Gravouil[1,2], C. Roux[1], M.C. Baietto[1], and J. Réthoré[1]

[1] University of Lyon / INSA de Lyon / LAMCOS CNRS, Lyon, France
[2] University Institute of France

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ABSTRACT

A 3D localized multi-grid strategy combined with X-FEM and a direct estimation of the Stress Intensity Factors (SIFs) is proposed here. It is mainly based on 3D Linear Elastic Fracture Mechanics and William's series expansion [1]. The proposed method aims at automatically coupling the different scales of the problem (component, crack, crack front) and to automatically calculate the SIFs without any path-independent integral [2].

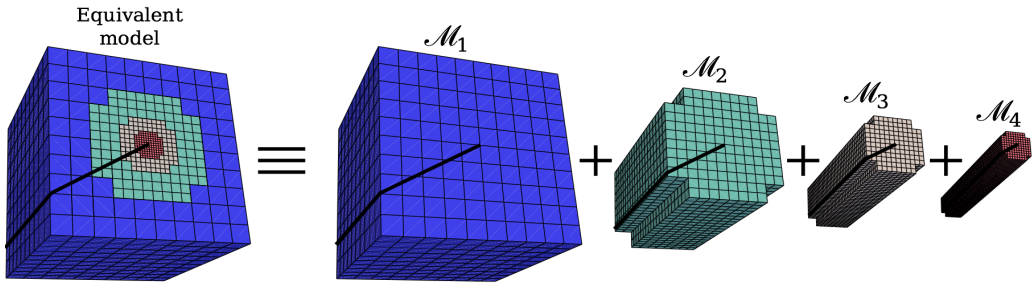

Figure 1: 3D X-FEM localized multi-grid with Direct Estimation of the SIFs (DEK-FEM).

The proposed method directly provides the Williams' [1] asymptotic coefficients as degrees of freedom, among which the SIFs or the T -stress. A domain decomposition strategy is used to introduce an area where this series expansion is used as mechanical basis. The DEK-FEM presented in [2] is extended to three-dimension linear elastic simulations. The SIF evolution along the crack front is automatically provided, but also the T-stress evolution and the other asymptotic parameters. Local refinement is needed in order to improve the accuracy of the identification while limiting the computation cost, thus this strategy is embedded in a localized multi-grid strategy as proposed by [3,4].

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