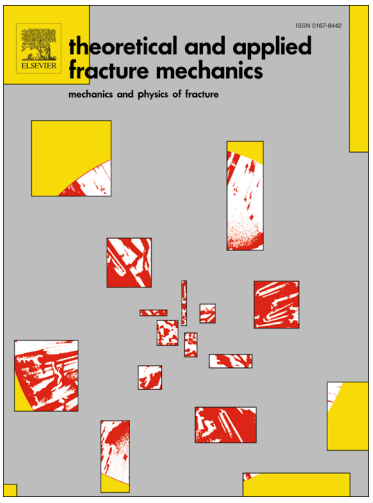

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Evaluation of stress intensity factors and T-stress by finite block method: Static and Dynamic

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Abstract

In this paper, the Finite Block Method (FBM) for computing the Stress Intensity Factors (SIFs) and the T-stress under static load and transient dynamic load is presented. Based on the one-dimensional first order partial differential matrices derived from the Lagrange series interpolation, the higher order partial differential matrices can be determined directly. By using the mapping technique, a block with arbitrary shape of the boundary is transformed in the polar coordinate (r,θ) into the normalised coordinate (ξ,η) $|\xi|\le 1, |\eta|\le 1$. In order to capture the stress intensity factor and the T-stress, the Williams' series of stress function is introduced in the circular core, centred at the crack tip, with the consideration of traction and displacement continuities along the circumference of the circular core. Time dependent problems are analysed by using the Laplace transformation method and the Durbin's inversion method is used to determine all the physical time dependent variables. However, in the Laplace domain, the Deng's series of stress and displacement has to be used. The accuracy and the convergence of the FBM are demonstrated by four examples. Comparisons have been made with the solutions obtained by the Boundary Collocation Method (BCM) and the Finite Element Method (FEM).

Key words: Williams' series of stress function, finite block method, stress intensity factor, T-stress, Laplace transform.

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