DYNAMIC STRESS INTENSITY FACTORS AT THE CRACK TIP UNDER DYNAMIC LOADS BY USING XFEM

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ABSTRACT

In the framework of the extended finite element method (XFEM), we mainly focus on the extraction of dynamic stress intensity factors (DSIFs) for stationary cracks being subjected to dynamic loads. Having constructed the approximation of dynamic XFEM, the derivation of governing equation for dynamic XFEM is presented. The Newmark implicit algorithm is used for time integration. Meanwhile, a mass lumping strategy for XFEM implicit dynamics is proposed. In addition, the interaction integral method is given for evaluating DSIFs. Compared with the interaction integral method for evaluating stress intensity factors (SIFs) of cracks under static conditions, the contribution of inertial effects is added to the interaction integral method for evaluating DSIFs. The numerical illustrations show that the XFEM can evaluate accurately DSIFs and the proposed mass lumping strategy is also quite effective. To obtain correct DSIFs, the inertial effects on interaction integral cannot be ignored.

A Rectangle plate with an inclined crack shown in Figure 1. Figure 2 shows Comparisons of the present numerical results K_I and the reference solution by Song and Parlino (2006).

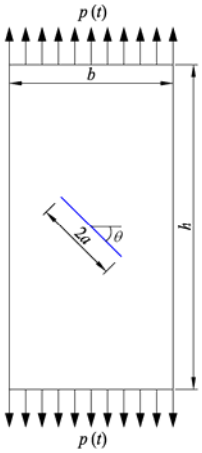

Fig. 1 Rectangle plate with an inclined crack

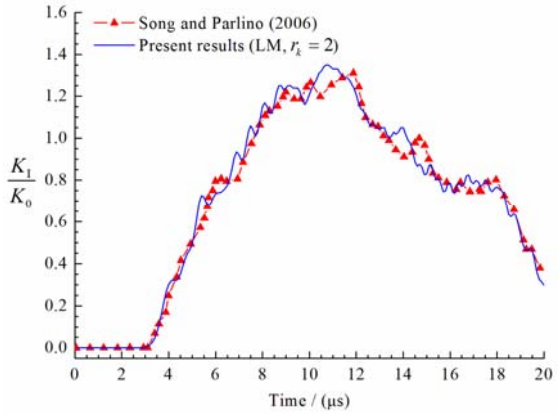

Fig.2 Comparisons of the present numerical results K_I and the reference solution by Song and Parlino (2006)