Summary: The Laplace transform of stress field in a cylindrically anisotropic elastic wedge, fixed at an edge and traction-free at the other, containing a screw dislocation with time-dependent Burgers vector is obtained by means of integral transform method. Energy dissipation in the wedge is modeled by viscous damping. Furthermore, solution to an intact wedge subjected to the dynamic anti-plane point load is obtained. These solutions are utilized to construct integral equations for a wedge weakened by several radial cracks subject to anti-plane impact loads. The integral equations are of Cauchy singular type. The stress analysis around a crack tip in cylindrically anisotropic material reveals that power of stress singularity depends upon the ratio of material stiffness coefficients. Therefore, a general definition for crack Stress Intensity Factor (SIF) is rendered for any power of stress singularity at a crack tip. Moreover, the numerical procedure for the solution to Cauchy integral equations is extended to solve integral equations with general power of singularity of solution. The procedure is utilized to obtain Laplace transform of the cracks SIFs. In the case of a cracked wedge under impact loads the inverse Laplace transforms of SIFs are determined numerically. To verify the formulation the quasi-static case of all the examples is solved by means of a different procedure. The results of latter case are compared with the dynamic solutions as time tends to infinity. Interaction between cracks, effects of structural energy dissipation, and wedge geometry on cracks SIFs are studied.

MSC: 74-XX Mechanics of deformable solids

Keywords: elastic wedge; energy dissipation; screw dislocation; impact load; radial crack; stress singularity

References:


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