

The Plane Crack Problem in a Functionally Graded Orthotropic Strip

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In this paper, the plane crack problem in a functionally graded orthotropic strip with an edge crack or an internal crack perpendicular to the boundaries is investigated. The strip with the principal axes x (1-direction) and y (2-direction) is infinite along the y -axis and has the thickness h along the x -axis. Since the present model can be used as an approximation to a number of structural components and laboratory specimens, it is very significant to investigate this kind of crack problems. The elastic property of materials is assumed to vary continuously along the thickness. Four independent material parameters, namely, (stiffness parameter), (Poisson's ratio), (stiffness ratio) and (shear parameter) are used to denote the elastic properties. According to the integral transform technique, the elastic displacement field can be expressed in the integral form. By introducing auxiliary functions, the present problem can be turned into solving a group of singular integral equations. The corresponding asymptotic expressions of the singular kernels for the internal crack and the edge crack are obtained, respectively. In numerical examples, the effects of the gradient index of materials, the geometric parameter of structure and loading conditions (crack surface pressure, fixed-grip loading and bending) on stress intensity factors are analyzed in details. According to author's knowledge, the results on the edge crack problem of an orthotropic functionally graded strip are not reported up to now.

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