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Combining the Fictitious Stress Method and Displacement Discontinuity Method in Solving Crack Problems in Anisotropic Material

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Abstract : In this study, the purpose of obtaining the influence functions of the displacement discontinuity in an anisotropic elastic medium is to produce the boundary element equations. A Displacement Discontinuous Method formulation (DDM) is presented with the aim of modeling two-dimensional elastic fracture problems. This formulation is found by analytical integration of the fundamental solution along a straight-line crack. With this purpose, Kelvin's fundamental solutions for anisotropic media on an infinite plane are used to form dipoles from singular loads, and the various combinations of the said dipoles are used to obtain the influence functions of displacement discontinuity. This study introduces a technique for coupling Fictitious Stress Method (FSM) and DDM; the reason for applying this technique to some examples is to demonstrate the effectiveness of the proposed coupling method. In this study, displacement discontinuity equations are obtained by using dipole solutions calculated with known singular force solutions in an anisotropic medium. The displacement discontinuities method obtained from the solutions of these equations and the fictitious stress methods is combined and compared with various examples. In this study, one or more crack problems with various geometries in rectangular plates in finite and infinite regions, under the effect of tensile stress with coupled FSM and DDM in the anisotropic environment, were examined, and the effectiveness of the coupled method was demonstrated. Since crack problems can be modeled more easily with DDM, it has been observed that the use of DDM has increased recently. In obtaining the displacement discontinuity equations, Papkovitch functions were used in Crouch, and harmonic functions were chosen to satisfy various boundary conditions. A comparison is made between two indirect boundary element formulations, DDM, and an extension of FSM, for solving problems involving cracks. Several numerical examples are presented, and the outcomes are contrasted to existing analytical or reference outs.

Keywords : displacement discontinuity method, fictitious stress method, crack problems, anisotropic material
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