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خلاصه مقاله:

Pressurized circular holes are modeled through the use of a semiinfinite displacement discontinuity method based on the Linear Elastic Fracture Mechanics (LEFM) principles. In order to increase the accuracy of the re sults along the circular boundary and cracks a linear variation of displacement discontinuities is assumed along each boundary element. This method uses two collocation points for each element (i.e. the element in question is divided into two sub-elements) and is modified so that it is able to model elastostatic and crack problems in half planes. Therefore each element has a first order (linear) distribution of displacement discontinuity but only two degrees of freedom. A hybrid element approach is used for the analysis of crack problems by incorporating a special treatment for crack tips. A crack with any arbitrary geometry can be modeled by this technique. To verify this method and show its accuracy and effectiveness, some example problems in semi-infinite planes are solved numerically. Then the numerical results (i.e. Mode I and Mode II stress intensity factors) computed by the proposed method are compared with those cited in the literature. The solved examples demonstrate that this method is comparable, but more efficient than, the conventional displacement discontinuity method. Although using a special element for the treatment of each crack tip is somewhat complicated but it will highly increase the accuracy of the displacement discontinuity variations near these singular ends. The Mode I and Mode II stress intensity factors; KI and KII, near the crack tips of the cracks emanating from a pressurized circular hole are precisely approximated. Because of the dominancy of the Mode I stress intensity factor KI, the well known maximum tangential stress fracture criterion is used to estimate the crack propagation path and its direction.

کلمات کلیدی:

Circular holes, Displacement discontinuity, linear element, LEFM, Special crack tip element, Crack analysis, Semi-infinite plane problems