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Circular hole; 2.3.3 Elliptical hole; 2.3.4 Westergaard analysis of a sharp crack; 2.4 STRESS INTENSITY FACTOR, K ; 2.4.1 Definition of the stress intensity factor; 2.4.2 Examples of stress intensity factors for LEFM; 2.4.3 Griffith theories of strength and energy; 2.4.4 Brittle material; 2.4.5 Quasi-brittle material; 2.4.6 Crack stability; 2.4.7 Fixed grip versus fixed load; 2.4.8 Mixed mode crack propagation; 2.5.1 Displacement extrapolation/correlation method; 2.5.2 Mode I energy release rate; 2.5.3 Mode I stiffness derivative/virtual crack model; 2.5.4 Two virtual crack extensions for mixed mode cases; 2.5.5 Single virtual crack extension based on displacement decomposition; 2.5.6 Quarter point singular elements; 2.6 ELASTOPLASTIC FRACTURE MECHANICS (EPFM); 2.6.1 Plastic zone; 2.6.2 Crack tip opening displacements (CTOD); 2.6.3 J integral; 2.6.4 Plastic crack tip fields; 2.6.5 Generalisation of J; 2.7 NUMERICAL METHODS BASED ON THE J INTEGRAL; 2.7.1 Nodal solution; 2.7.2 General finite element solution; 2.7.3 Equivalent domain integral (EDI) method; 2.7.4 Interaction integral method; Chapter 3 Extended Finite Element Method for Isotropic Problems; 3.1 INTRODUCTION; 3.2 A REVIEW OF XFEM DEVELOPMENT; 3.3 BASICS OF FEM; 3.3.1 Isoparametric finite elements, a short review; 3.3.2 Finite element solutions for fracture mechanics; 3.4 PARTITION OF UNITY; 3.5 ENRICHMENT; 3.5.1 Intrinsic enrichment; 3.5.2 Extrinsic enrichment; 3.5.3 Partition of unity finite element method; 3.5.4 Generalised finite element method; 3.5.5 Extended finite element method; 3.5.6 Hp-clouds enrichment; 3.5.7 Generalisation of the PU enrichment; 3.5.8 Transition from standard to enriched approximation; 3.6 ISOTROPIC XFEM; 3.6.1 Basic XFEM approximation; 3.6.2 Signed distance function; 3.6.3 Modelling strong discontinuous fields; 3.6.4 Modelling weak discontinuous fields; 3.6.5 Plastic enrichment; 3.6.6 Selection of nodes for discontinuity enrichment; 3.6.7 Modelling the crack; 3.7 DISCRETIZATION AND INTEGRATION; 3.7.1 Governing equation; 3.7.2 XFEM discretization

Sommario/riassunto

This important textbook provides an introduction to the concepts of the newly developed extended finite element method (XFEM) for fracture analysis of structures, as well as for other related engineering applications. One of the main advantages of the method is that it avoids any need for remeshing or geometric crack modelling in numerical simulation, while generating discontinuous fields along a crack and around its tip. The second major advantage of the method is that by a small increase in number of degrees of freedom, far more accurate solutions can be obtained. The method has recen
