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Divergence Theorem for Discontinuous Problems; 2.6.2 The Weak form of Governing Equation; 2.7 The X-FEM Discretization of Governing Equation; 2.7.1 Numerical Implementation of X-FEM Formulation; 2.7.2 Numerical Integration Algorithm; 2.8 Application of X-FEM in Weak and Strong Discontinuities; 2.8.1 Modeling an Elastic Bar with a Strong Discontinuity; 2.8.2 Modeling an Elastic Bar with a Weak Discontinuity; 2.8.3 Modeling an Elastic Plate with a Crack Interface at its Center 2.8.4 Modeling an Elastic Plate with a Material Interface at its Center 2.9 Higher Order X-FEM; 2.10 Implementation of X-FEM with Higher Order Elements; 2.10.1 Higher Order X-FEM Modeling of a Plate with a Material Interface; 2.10.2 Higher Order X-FEM Modeling of a Plate with a Curved Crack Interface; Chapter 3 Enrichment Elements; 3.1 Introduction; 3.2 Tracking Moving Boundaries; 3.3 Level Set Method; 3.3.1 Numerical Implementation of LSM; 3.3.2 Coupling the LSM with X-FEM; 3.4 Fast Marching Method; 3.4.1 Coupling the FMM with X-FEM; 3.5 X-FEM Enrichment Functions 3.5.1 Bimaterials, Voids, and Inclusions 3.5.2 Strong Discontinuities and Crack Interfaces; 3.5.3 Brittle Cracks; 3.5.4 Cohesive Cracks; 3.5.5 Plastic Fracture Mechanics; 3.5.6 Multiple Cracks; 3.5.7 Fracture in Bimaterial Problems; 3.5.8 Polycrystalline Microstructure; 3.5.9 Dislocations; 3.5.10 Shear Band Localization; Chapter 4 Blending Elements; 4.1 Introduction; 4.2 Convergence Analysis in the X-FEM; 4.3 Ill-Conditioning in the X-FEM Method; 4.3.1 One-Dimensional Problem with Material Interface; 4.4 Blending Strategies in X-FEM; 4.5 Enhanced Strain Method 4.5.1 An Enhanced Strain Blending Element for the Ramp Enrichment Function

Sommario/riassunto

Introduces the theory and applications of the extended finite element method (XFEM) in the linear and nonlinear problems of continua, structures and geomechanics. Explores the concept of partition of unity, various enrichment functions, and fundamentals of XFEM formulation. Covers numerous applications of XFEM including fracture mechanics, large deformation, plasticity, multiphase flow, hydraulic fracturing and contact problems. Accompanied by a website hosting source code and examples.
