1. Record Nr. UNINA9910488710803321

Autore	Carpinteri Alberto <1952->
Titolo	Fracture and complexity : one century since Griffith's milestone / / Alberto Carpinteri
Pubbl/distr/stampa	Dordrecht, Netherland : , : Springer Science Business Media, B.V., , [2021] ©2021
ISBN	94-024-2026-6
Descrizione fisica	1 online resource (968 pages)
Collana	Solid Mechanics and Its Applications ; ; Volume 237
Disciplina	620.1126
Soggetti	Fracture mechanics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Preface -- Contents -- Author and Contributors -- About the Author -- Previous Authored or Edited Books -- Contributors -- Part IFrom Stress Singularity to Strain Energy Release Rate: Local Versus Global Approach to Fracture Mechanics -- 1 Stress Concentration at the Notch Root -- 1.1 Preliminary Remarks -- 1.2 Plane Stress Condition -- 1.3 Plane Strain Condition -- 1.4 Thick-Walled Cylinder -- 1.5 Circular Hole in a Plate Subjected to Tension -- 1.6 Analytical Functions -- 1.7 Kolosoff-Muskhelishvili Method -- 1.8 Elliptical Hole in a Plate Subjected to Tension -- 1.9 Griffith's Fracture Energy Criterion -- 1.10 Experimental Confirmations -- References -- 2 Stress Intensification at the Crack Tip -- 2.1 Preliminary Remarks -- 2.2 Westergaard's Method -- 2.3 Mode II and Mixed Modes -- 2.4 Stability of Crack Propagation -- 2.5 Elasto-Plastic Material -- 2.6 Isoparametric Finite Elements -- 2.7 Quarter Point Element -- 2.8 Degenerate Triangular Element -- 2.9 Estimation of Error in the Numerical Evaluation of Stress-Intensity Factors -- 2.10 Experimental Determination of the Critical Stress-Intensity Factor KIC for Metallic Materials (ASTM E399 Standard) -- 2.10.1 Characteristics and size of Test Specimens -- 2.10.2 Test procedure -- 2.10.3 Testing Apparatus -- 2.10.4 Analysis of the Load-Displacement Diagrams -- 2.11 Determination of the Fracture Toughness of Rocks -- 2.11.1 Calculation of the Fracture Toughness KCB -- 2.11.2 Correction

of Fracture Toughness for Nonlinearity -- References -- 3 Stress Intensification at the Vertex of a Re-entrant Corner -- 3.1 Preliminary Remarks -- 3.2 Singular Stress Field in the Case of Linear Elastic Material -- 3.3 Singular Stress Field in the Case of Strain-Hardening Material -- 3.4 Extension of the Plastic Zone Around a Re-entrant Corner -- 3.5 Generalized Fracture Toughness.
3.6 Critical Amplitude of a Re-entrant Corner -- 3.7 Size-scale Effects in Structural Elements with Re-entrant Corners -- 3.8 The Notch Blunting Effect -- References -- 4 Energy Approach to Fracture Mechanics -- 4.1 Preliminary Remarks -- 4.2 Relation Between Energy and Stress-Singularity Treatments: Irwin's Theorem -- 4.3 Local Compliance of a Cracked Structural Element -- 4.4 J-Integral -- 4.4.1 Independence of the J-Integral from the Integration Curve -- 4.4.2 Variations of Energy -- 4.4.3 Identity of the J-Integral with the Strain Energy Release Rate mathcalG I -- 4.5 Experimental Investigations -- 4.5.1 Experimental Determination of Fracture Toughness Parameters -- 4.5.2 Comparison Between the Fracture Parameters Obtained -- 4.6 Experimental Determination of Fracture Energy for Mortar and Concrete (Rilem Recommendation) -- 4.6.1 The Proposed Testing Method -- 4.6.2 Testing Procedure and Characteristics of the Test Specimens -- References -- 5 Mixed-Mode Crack Propagation -- 5.1 Preliminary Remarks -- 5.2 Criterion of Maximum Hoop Stress -- 5.3 Criterion of Minimum Strain Energy Density -- 5.4 Criterion of Maximum Released Energy -- 5.5 J-Vector Criterion -- 5.6 Experimental Tests and Empirical Criteria -- 5.7 Scale Effects in Relation to Crack Size -- 5.8 Effect of Stress Parallel to the Crack -- 5.9 Plastic Effects at the Crack Tip -- 5.10 Directional Stability in Crack Propagation -- 5.11 Loci of Resistance in the Principal Stress Plane -- 5.11.1 Mohr-Coulomb Criterion -- 5.11.2 Griffith's Macroscopic Criterion -- 5.11.3 Friction on Griffith Cracks -- 5.11.4 Microcrack Population Model -- References -- Part IIFrom Simple Nonlinear Constitutive Laws to Complex Mechanical Behaviour: Catastrophe and Chaos -- 6 Nonlinear Crack Models -- 6.1 Preliminary Remarks -- 6.2 Plastic Zone at the Crack Tip.
6.3 Strain Energy Density Criterion-Strain-Hardening Materials -- 6.3.1 Material Behaviour -- 6.3.2 Isotropic Versus Kinematic Hardening -- 6.3.3 Effect of Loading Step -- 6.4 Strain Energy Density Criterion-Strain-Softening Materials -- 6.4.1 Material Behaviour -- 6.4.2 Variation in the - Softening Slope -- 6.4.3 Effect of Loading Step -- 6.4.4 Size Effects on Strength and Ductility -- 6.4.5 Centre-Cracked Slab in Tension -- 6.4.6 Three-Point Bending of a Reinforced Beam with Edge Crack -- 6.4.7 Eccentric Compression of Wall with Edge Crack -- 6.5 Cohesive Crack Model-Mode I -- 6.5.1 Localized Strain -- 6.5.2 Three-Point Bending Test -- 6.5.3 Numerical Procedure -- 6.6 Ductile-Brittle Transition and Snap-Back Instability -- 6.6.1 Influence of Initial Crack Depth and Beam Slenderness -- 6.7 Cohesive Crack Model-Mixed Mode -- 6.7.1 Experimental Program -- 6.7.2 Directional Stability of the Crack Trajectory -- 6.8 Loss of Symmetry and Bifurcations -- 6.8.1 Crack Length Control Scheme -- 6.8.2 Solution of the Single Crack Growth Step -- 6.9 Nonlinear Crack Concepts Applied to Compression: The Overlapping Crack Model -- 6.10 Overlapping Crack Model for Eccentric Compression -- 6.10.1 Numerical Algorithm -- 6.10.2 Comparison Between Model Predictions and Experimental Results -- 6.10.3 Size-Scale and Slenderness Effects in Eccentric Compression Tests -- References -- 7 Size-Scale Transition from Ductile to Brittle Failure -- 7.1 Preliminary Remarks -- 7.2 Dimensional Analysis -- 7.2.1 Buckingham's Theorem -- 7.3 Different Structural Geometries -- 7.4 Size-Scale Effects on Apparent

Fracture Toughness -- 7.4.1 Metals -- 7.4.2 Concrete and Rocks -- 7.4.3 Cohesive Crack Model -- 7.4.4 Influence of the Shape of the Cohesive Diagram -w -- 7.4.5 Damage Model Versus Cohesive Model -- 7.5 Dugdale Plastic Zone Correction -- 7.6 BCS Crack Model. 7.7 Virtual Crack Propagation Model -- 7.8 Cohesive Limit Analysis -- 7.8.1 Uniaxial Tensile Loading of Slabs -- 7.8.2 Three-Point Bending of Beams [34, 35] -- 7.8.3 Three-Point Bending of Deep Beams -- 7.9 Size-Scale Effects on Apparent Bending Strength -- 7.10 Brittleness Limit for Infinite Size-Scale -- 7.11 Structural Response Versus Crack Growth Resistance Curve -- 7.11.1 Scale Effect on the Structural Response -- 7.11.2 Strain-Hardening Material -- 7.11.3 Linear-Elastic Material -- 7.11.4 Three-Point Bending Geometry -- 7.11.5 Scale Effect on the J-Resistance Curve -- References -- 8 Mechanical Behaviour of Reinforced Structural Elements -- 8.1 Preliminary Remarks -- 8.2 Crack Growth Stability in Steel-Bar Reinforced Concrete Elements: Rotation Compatibility Condition -- 8.2.1 Statically Indeterminate Reaction of Reinforcement -- 8.2.2 Bending Moment of Reinforcement Plastic Flow -- 8.2.3 Rigid-Hardening Behaviour of the Cracked Beam Section -- 8.2.4 Bending Moment of Matrix Fracture -- 8.2.5 Stability of the Process of Matrix Fracture and Steel Plastic Flow -- 8.2.6 Summary -- 8.3 Crack Growth Stability in Steel-Bar Reinforced Concrete Elements: Crack Opening Displacement Compatibility Condition -- 8.3.1 Displacement Compatibility Condition and Statically Indeterminate Reaction of Reinforcement -- 8.3.2 Combined Stress-Intensity Factor -- 8.3.3 Crack Propagation -- 8.3.4 Moment Versus Rotation Response -- 8.3.5 Comparison with Experimental Results -- 8.3.6 Experimental Confirmation of Snap-Back Behaviour -- 8.3.7 Concluding Remarks -- 8.4 Crack Growth Stability in Fibrous Composites: Discrete Model -- 8.4.1 Theoretical Model -- 8.4.2 Displacement Compatibility Conditions -- 8.4.3 Crack Propagation -- 8.4.4 Structural Response of the Cracked Element -- 8.4.5 Two Fibres -- 8.4.6 Large Number of Fibres -- 8.4.7 Concluding Remarks. 8.5 Crack Growth Stability in Fibrous Composites: Continuous Model -- 8.5.1 Continuous Model -- 8.5.2 Discrete Model Versus Continuous Model -- 8.5.3 Continuous Model Versus Experimental Results -- 8.5.4 Bridging Option Versus Cohesive Option -- 8.5.5 Concluding Remarks -- 8.6 Hysteretic Behaviour of Steel-Bar Reinforced Concrete Elements: Rotation Compatibility Condition -- 8.6.1 Elastic-Plastic Shake-Down Under Repeated Loadings -- 8.6.2 Critical Crack Depth and Bending Moment -- 8.6.3 Fatigue Crack Growth and Energy Dissipation -- 8.7 Hysteretic Behaviour of Steel-Bar Reinforced Concrete Elements: Crack Opening Displacement Compatibility Condition -- 8.7.1 Moment Versus Rotation Diagrams -- 8.7.2 Beam A -- 8.7.3 Beam B -- 8.7.4 Beam C -- 8.7.5 Experimental Comparisons -- 8.7.6 Concluding Remarks -- 8.8 Hysteretic Behaviour of Fibrous Composites -- 8.8.1 Concluding Remarks -- 8.9 Transitions of Reinforced Concrete Beams in Flexure: Tensile, Shearing, Crushing Failures -- 8.9.1 Modelling Flexural and Shear Cracks -- 8.9.2 Modelling Concrete Crushing -- 8.9.3 Transition Between Different Failure Modes -- 8.9.4 Experimental Evidences -- 8.10 Cohesive/Overlapping Crack Model for Nonlinear Analysis of Reinforced Concrete Beams -- 8.10.1 Mathematical Formulation -- 8.10.2 Numerical Algorithm -- 8.10.3 Computation of the Elastic Coefficients -- 8.10.4 Parametric Analysis and Experimental Comparisons -- 8.10.5 Size-Scale Effects -- 8.10.6 Effect of the Tensile Steel Reinforcement Percentage -- 8.10.7 Effect of the Steel Reinforcement in Compression -- 8.10.8 Effect of the Concrete Compressive Strength -- 8.10.9 Effect of the Stirrups Confinement -- 8.11 Lower and Upper Reinforcement Limits

to the Ductile Behaviour of Concrete Members: Minimum Reinforcement and Rotational Capacity -- 8.11.1 Minimum Reinforcement. 8.11.2 Models for Computing Minimum Reinforcement.