Advanced Fracture Mechanics and Structural Integrity

Acoustic Emission and Related Non-destructive Evaluation Techniques in the Fracture Mechanics of Concrete: Fundamentals and Applications, Second Edition presents innovative Acoustic Emission (AE) systems applied to testing and design of concrete and concrete-like materials. The second edition is expanded by a large number of advanced applications included in the new chapter. The book is divided into two parts: Part One covers the fundamentals of AE and Part Two presents many practical applications of AE.

Problems of elastic rods, plates, and shells through formulating a strain compatibility function as well as applying energy methods Elastic and elastic-plastic fracture mechanics Plastic and creep materials - including fracture mechanics, creep, superplasticity, fiber reinforced composites, powder compacts, and porous solids. Text includes: stress and strain, equilibrium, and compatibility understanding of the fundamentals of elasticity and plasticity, applies these fundamentals to solve analytically a spectrum of engineering problems, and introduces advanced topics of mechanics of materials. The book provides a basic understanding of the subject to engineers who want to get acquainted with fracture mechanics.

Fundamentals of Fracture Mechanics

Fracture Mechanics is an essential tool to evaluate whether a component is likely to fail or not. This book has been written in a simple and step-by-step manner to help readers familiarize with the basic and advanced topics. Additionally, it has over 185 illustrations to further reinforce and simplify the learning process. With this coverage, the book will be useful to professionals and students of engineering.

Acoustic Emission and Related Non-destructive Evaluation Techniques in the Fracture Mechanics of Concrete

BASIC Fracture Mechanics: Including an Introduction to Fatigue discusses the fundamentals of fracture and fatigue. The book presents a series of Beginner's All-purpose Symbolic Instruction Code (BASIC) programs that implement fracture and fatigue methods. The first chapter reviews the BASIC, while the second chapter covers elastic fracture. Chapter 3 deals with the stress intensity factors that calculate the crack tip plasticity and covers crack growth. The last chapter in this text discusses some applications in fracture mechanics. The book will be of great use to engineers who want to get acquainted with fracture mechanics.

Ultimate Limit State Analysis and Design of Plated Structures

Almost all books available on fracture mechanics cover the majority of topics presented in this book, and often much, much more. While great as references, this makes teaching from them more difficult because the materials are not typically presented in the order that most professors cover them in their lectures and more than half the information presented in the book is not covered at all.

Concrete Fracture Models and Applications

Concrete Fracture Models and Applications 2015 is a book that provides an in-depth understanding of the fundamentals of fracture and fatigue. The book presents a series of Beginner's All-purpose Symbolic Instruction Code (BASIC) programs that implement fracture and fatigue methods. The first chapter reviews the BASIC, while the second chapter covers elastic fracture. Chapter 3 deals with the stress intensity factors that calculate the crack tip plasticity and covers crack growth. The last chapter in this text discusses some applications in fracture mechanics. The book will be of great use to engineers who want to get acquainted with fracture mechanics.

Fracture Mechanics

In the preliminary stage of designing new structural hardware to perform a given mission in a fluctuating load environment, there are several factors that the designer should consider. Trade studies for different design configurations should be performed and, based on strength and weight considerations, among others, an optimum configuration selected. The selected design must withstand the environment in question without failure. Therefore, a comprehensive structural analysis that consists of static, dynamic, fatigue, and fracture is necessary to ensure the integrity of the structure. Engineers and designers responsible for the feasibility of fabricating the structural hardware in the optimal selection process. During the past few decades, fracture mechanics has become a necessary discipline for the solution of many structural problems in which the survivability of structure containing pre-existing flaws is of great interest. These problems include structural failures resulting from cracks that are induced in the material, or defects that are introduced in the part during the manufacturing process. Unsoundness of the part, improper handling or rough machining, that must be assessed through fracture mechanics concepts.

Fracture Mechanics of Metals, Composites, Welds, and Bolted Joints

This book covers both theoretical and practical aspects of fracture mechanics and integrates materials science with solid mechanics.

Extended Finite Element Method

Applied Optimal Design and Mathematical Structures Edward J. Haug & Jørn S. Arora This computer-aided design text presents and illustrates techniques for optimizing the design of a wide variety of mechanical and structural systems through the use of finite element (NDE) and optimization methods that include: The selection and evaluation of design parameters, objective functions, and constraints for optimal design; The selection of optimization methods; the selection of optimization software; and the selection of optimization software. The book is divided into two parts: Part One covers the fundamentals of optimal design and Part Two presents many practical applications of optimal design.

Fracture Mechanics

Introduction to geologic fracture mechanics covering geologic structural discontinuities from theoretical and field-based perspectives.

Fracture Mechanics, Second Edition

Concise statements, rocks, and flow-reinforced composites commonly termed as quasistatic, need a different fracture mechanics approach to model the crack propagation study because of the presence of significant size of fracture process zone ahead of the crack-tip. Recent studies show that concrete structures manifest three important stages in fracture process: crack initiation, stable crack propagation and unstable fracture or failure. Fracture Mechanics concept can better explain the above various stages including the concepts of ductility, size-effect, strain softening and post-crack behavior of concrete and concrete structures. The book presents a basic introduction on the various nonlinear concrete fracture models considering the respective fracture parameters. To this end, the book presents a detailed review on various different concrete fracture models. The book covers the development of cohesive crack models for standard test geometries using commonly used softening functions is shown and extensive studies on the behavior of cohesive crack fracture parameters are also carried out. The subsequent chapters contain important topics in the double-K model framework for the double-K model framework formulation of size-effect behavior of the double-K fracture parameters. The application of weight function approach for determining the K value associated with cohesive stress distribution in the fracture process zone is also presented. Available test data are used to validate the new approach. Further, effect of specimen geometry, loading condition, size-effect and softening function on various fracture parameters is investigated. Towards the end, a comparative study between different fracture parameters obtained from various models is presented.

Fracture Mechanics of Electromagnetic Materials

This edition comprehensively updates the field of fracture mechanics by including details of the latest research programmes. It contains new material on non-metals, design issues and statistical aspects. The application of fracture mechanics to different types of materials is stressed.
Engineering Solid Mechanics

Deformation and Fracture Mechanics of Engineering Materials

This book is about the use of fracture mechanics for the solution of practical problems; academic rigor is not at issue and dealt with only in so far as it improves insight and understanding: it often concerns secondary errors in engineering. Knowledge of (ignorance of) such basic input as loads and stresses in practical cases may cause errors for overshadowing those introduced by shortcomings of fracture mechanics and necessary approximations; this is amply demonstrated in the text. I have presented more than three dozen 40-hour courses on fracture mechanics and damage tolerance analysis, so that I have probably more experience in teaching the subject than anyone else. I learned more than the students, and became cognizant of difficulties and of the real concerns in applications. In particular I found, how a subject should be explained to appeal to the practicing engineer to demonstrate that his practical problem can indeed be solved with engineering methods. This experience is reflected in the present volume in this book. Sufficient background is provided for an understanding of the issues, but preparation prevails. Mathematics cannot be avoided, but they are presented in a way that appeals to insight and intuition, in lieu of formal derivations which would show but the mathematical skill of the writer.

Fracture Mechanics

Advances in Fracture Mechanics and Structural Integrity is organized to cover quantitative descriptions of crack growth and fracture phenomena. The mechanics of fracture are explained, emphasizing elastic-plastic and time-dependent material behavior. Applications are presented, using examples from power generation, aerospace, marine, and chemical industries, with focus on predicting the remaining life of structures and advanced model testing methods for structural materials. Numerous examples and end-of-chapter problems are provided, along with references to encourage further study. The book is written for use in an advanced graduate course on fracture mechanics or structural integrity.

Basic Fracture Mechanics

Fracture mechanics studies the development and spreading of cracks in materials. The study uses two techniques including analytical and experimental solid mechanics. The former is used to determine the driving force on a crack and the latter is used to measure material's resistance to fracture. The text begins with a detailed discussion of fundamental concepts including linear elastic fracture mechanics (LEFM), nonlinear fracture mechanics, and fracture mechanics of brittle material. This critical, authoritative guide supplies easy-to-use and understandable tools based on hands-on experience in design, emphasizing practical applications. The book covers MATLAB programs for calculating fatigue life under variable amplitude cyclic loading. The experimental measurements of fracture toughness parameters KIC, JIC, and crack opening displacement (COD) are provided in the last chapter.

Principles of Fracture Mechanics

Reviews and describes both the fundamental and practical design procedures for the ultimate limit state design of steel plate structures. This text presents a new reference guiding engineers on practical design procedures for steel plate structures. The derivation of the basic mathematical expressions is presented together with a thorough discussion of the assumptions and the validity of the underlying expressions and solution methods. Furthermore, the book also includes an easy-to-use design tool that facilitates learning by applying the concepts of the limit states for practice using an easy-to-use computer program, which can be downloaded. Ultimate Limit State Design of Steel Plate Structures provides expert guidance on mechanical model test results as well as nonlinear finite element solutions, sophisticated design methodologies useful for practitioners in industries or research institutions, and selected methods for other fracture mechanics approaches. Its comprehensive guide on fracture toughness is a valuable resource for design engineers and researchers.

Fatigue of Materials

This textbook consists of notes by Iain Finnie who taught a popular course on fracture mechanics at the University of California at Berkeley. It presents a comprehensive and detailed exposition of fracture mechanics of fatigue and methods for the safe design of engineering components made from metal alloys, brittle materials like glasses and ceramics, and composite and polymer materials. The book presents a unified perspective of fracture with a strong fundamental foundation and practical applications. In addition to its role as a text, this reference would be invaluable for the practicing engineer who is interested in the design and evaluation of components that are fracture critical. The book also presents details of derivations of the basic equations of fracture mechanics and the classical fracture mechanics methodology beginning with a review of the basic equations of solid mechanics followed by solutions useful in fracture prediction. The textbook introduces the reader to a wide range of application of fracture mechanics in materials science, engineering, rock mechanics, dentistry, and medicine. The book is aimed at researchers and students who are interested in fracture mechanics and its applications, including experimental and computational methods. The book includes a comprehensive set of exercises, classroom problems, and additional resources available for those teaching courses or training sessions.

Fracture and Fatigue Control in Structures

Fracture Mechanics: Fundamentals and Applications, Fourth Edition is the most useful and comprehensive guide to fracture mechanics available. It has been adopted by more than 130 universities worldwide by professors, researchers, and graduate students. In its new edition, applications, and computational analysis and modeling. It encompasses theory and applications, linear and nonlinear fracture mechanics, solid mechanics, and materials science with a unified, balanced, and in-depth approach. Numerous chapter problems have been added or revised, and additional resources are available for free. This book covers MATLAB programs for calculating fatigue life under variable amplitude cyclic loading. The experimental measurements of fracture toughness parameters KIC, JIC, and crack opening displacement (COD) are provided in the last chapter.

Wear Fracture Characterization

This book is a collection of 13 chapters divided into seven sections: Section I: General Foundations of the Stress Field and Toughness with one chapter, Section II: Fractography and Impact Analysis with one chapter, Section III: "Toughness Fracture Mechanics" with two chapters, Section IV: "Fatigue" with one chapter and Section VII: "Fatigue Biomaterials and compatible" with two chapters. This book covers a wide range of application of fracture mechanics in materials science, engineering, rock mechanics, dentistry, and medicine. The book is aimed towards materials scientists, metallurgists, mechanical and civil engineers, doctors and dentists and can be used well in education, research and industry.

Fracture Mechanics

This important, self-contained reference deals with structural life assessment (SLA) and structural health monitoring (SHM) in a combined form. SLA periodically evaluates the state and condition of a system and uses probabilistic and stochastic modeling for the design of structures. The book covers the fundamentals of fracture mechanics and provides a comprehensive overview of fracture mechanics and fracture toughness, including the effects of corrosion, cracking, and fatigue. The book is suitable for researchers, engineers, and students in the fields of materials science, engineering, and fracture mechanics.

Practical Fracture Mechanics in Design

Theoretical treatments of fracture mechanics abound in the literature. Among the first books to address this vital topic from an applied standpoint was the first edition of Fracture Mechanics in Design. Completeness and breadth of coverage and depth of treatment to practical problems in fracture mechanics and fracture mechanics in design, fracture evaluation and prediction of fracture. The book is intended for advanced students in engineering and in applied sciences, as well as for practicing engineers and research workers in the field of fracture mechanics. The book presents a comprehensive overview of fracture mechanics and fracture toughness, including the effects of corrosion, cracking, and fatigue. The book is suitable for researchers, engineers, and students in the fields of materials science, engineering, and fracture mechanics.

Geologic Fracture Mechanics

This bestselling text/reference provides a comprehensive treatment of the fundamentals of fracture mechanics. It presents theoretical background as well as practical applications, and it integrates materials science with solid mechanics. In the Second Edition, about 30% of the material has been updated and expanded; new technology is discussed, and feedback from users of the first edition has been incorporated.

Fracture Mechanics

Wood Fracture Characterization provides a guide to the application of modern fracture mechanics concepts to wood materials used in structural engineering, which commonly involve discontinuities and irregularities. The authors cover the tests, data reduction schemes and numerical methods used for wood structural applications, based on cohesive zone analysis, and used to validate the prediction of fracture.
Fracture Mechanics

Intended for engineers of a variety of disciplines dealing with structural materials, this text describes the current state of knowledge. It begins by describing the fracture process at the two extremes of scale: first in the context of atomic structures, then in terms of a continuous elastic medium. Treating the fracture process in increasingly sophisticated ways, the book then considers plastic corrections and the procedures for measuring the toughness of materials. Practical considerations are then discussed, including crack propagation, geometry dependence, flaw density, mechanisms of failure by cleavage, the ductile-brittle transition, and continuum damage mechanics. The whole is rounded off with discussions of generalised plasticity and the link between the microscopic and macroscopic aspects, and problems are provided at the end of each chapter.

Fracture Mechanics Criteria and Applications

It is difficult to do justice to fracture mechanics in a textbook, for the subject encompasses so many disciplines. A general survey of the field would serve no purpose other than to give a collection of references. The present book by Professor E. E. Gobutos is refreshing, because it does not fall into the esoteric tradition of outlining equations and results. Basic ideas and underlying principles are clearly explained so as to how they are used in application. The presentations are concise and each topic can be understood by advanced undergraduates in material science and continuum mechanics. The book is highly recommended not only as a text in fracture mechanics but also as a reference to those interested in the general aspects of failure analysis. In addition to providing an in-depth view of the analytical methods for evaluating the fundamental quantities used in linear elastic fracture mechanics, various criteria are discussed re: acting their limitations and applications. Particular emphasis is given to predicting crack initiation, subcritical growth and the onset of rapid fracture from a single criterion. Those models in which it is assumed that the crack extends from tip to tip rely on the specific surface energy concept. The differences in the global and energy states before and after crack extension were associated with the energy required to create a unit area of crack surface. Applications were limited by the requirement of self-similar crack growth.

Handbook of Structural Life Assessment

Extended Finite Element Method provides an introduction to the extended finite element method (XFEM), a novel computational method which has been proposed to solve complex crack propagation problems. The book helps readers understand the method and make effective use of the XFEM code and software plugins now available to model and simulate these complex problems. The book explores the governing equation behind XFEM, including level set method and enrichment shape function. The authors outline a new XFEM algorithm based on the continuum-based shell and consider numerous practical problems, including plate-simulations, arbitrary crack propagation in shells and dynamic response in 3D composite materials. Authored by an expert team from one of China's leading academic and research institutions, this book offers complete coverage of XFEM, from fundamentals to applications, with numerous examples. This book provides the understanding needed to effectively use the latest XFEM code and software tools to model and simulate dynamic crack problems.

Rock Fracture Mechanics

Fracture and 'slow' crack growth reflect the response of a material (i.e. its microstructure) to the conjoint actions of mechanical and chemical driving forces and are affected by temperature. There is therefore a need to understand and predict the influence of the chemical and temperature environments and of microstructure, in the terms of the key internal and external variables, and for their incorporation into design and probabilistic implications. This text, the third edition, which has been used in a fracture mechanics course for advanced undergraduate and graduate students, is based on the work of the University of California at Berkeley—University of New Mexico team whose interactive approach to teaching fracture mechanics, surface and electrochemistry, materials science, and probability and statistics to address a range of fracture safety and durability issues on aluminum, ferrous, nickel, and titanium alloys and ceramics. Examples are included to highlight the approach and applicability of the findings in practical durability and reliability problems.

Elements of Fracture Mechanics

New developments in the applications of fracture mechanics to engineering problems have taken place in the last years. Composite materials have extensively been used in engineering problems. Quasi-brittle materials including concrete, cement paste, rock, soil, etc. all benefit from these developments. Layered materials and especially thin film/multilayer systems are becoming important in micro and nanoelectromechanical systems (MEMS and NEMS). Nanomaterials and microstructured systems are being introduced in our everyday life. In all these problems fracture mechanics is the key to the prediction of the response of materials and structures. These new challenges motivated the author to proceed with the second edition of the book. The second edition of the book contains four new chapters in addition to the ten chapters of the first edition. The fourteen chapters of the book cover the basic principles and traditional applications, as well as the latest developments of fracture mechanics as applied to problems of composite materials, thin films, nanomaterials and composites, materials. Thus the book provides an introductory course to the contemporary paradigm of fracture mechanics. In this book four main topics are covered: (a) the mathematical formulation of the four basic principles of fracture mechanics, (b) the comprehensive treatment of fracture mechanics. It includes the basic principles and traditional applications as well as the new frontiers of research of fracture mechanics during the last three decades in topics of contemporary importance, like composites, thin films, nanomaterials and composites, materials. The book contains fifty example problems and more than two hundred unsolved problems. A "Solutions Manual" is available upon request for course instructors from the author.

Mechanics of Sheet Metal Forming

Most design engineers are tasked to design against failure, and one of the biggest causes of product failure is failure of the material due to fatigue/fracture. From leading experts in fracture mechanics, this new text provides new approaches and new applications to advance the understanding of crack initiation and propagation. With applications in composite materials, layered structures, and microelectronic packaging, among others, this timely coverage is an important resource for anyone studying or applying concepts of fracture mechanics. Concise and easily understandable with an expansive treatment of crack tip fields (chapter 3) provides the basis for applying fracture mechanics in solving practical problems. Unique coverage of bimaterial interfacial cracks (chapter 8), with applications to commercially important areas of composite materials, layered structures, and microelectronic packaging. A full chapter (chapter 9) on the cohesive zone model approach, which has been extensively used in recent years to simulate crack propagation. A unified discussion of fracture criteria involving non-linear/plastic deformations.

Fracture Mechanics

Porous Rock Fracture Mechanics: Hydraulic Fracturing, Drilling and Structural Engineering focuses on the fracture mechanics of porous rocks and modern simulation techniques for progressive quasi-static and dynamic fractures. The topics covered in this volume include a wide range of academic and industrial applications, including petroleum, mining, and civil engineering. Chapters focus on advanced topics in the field of rock's fracture mechanics and address theoretical concepts, experimental characterization, numerical simulation techniques, and their applications as appropriate. Each chapter reflects the current state-of-the-art in the modern use of fracture simulation in industrial and academic sectors. Some of the major contributions in this volume include, but are not limited to: anisotropic elastic-plastic deformation mechanisms in fluid saturated porous rocks, dynamics of fluids transport in fractured rocks and simulation techniques, fracture mechanics and rock fractures, fluid saturated porous rocks, fluid-saturated porous rocks, and multiphase flow. A comprehensive understanding of fracture processes is needed in various fields of engineering, such as petroleum, mining, and civil engineering. This book provides a unified and systematic approach to the understanding of fracture processes in porous rocks and porous media. This book will serve as an important resource for petroleum geoscientists, hydraulic fracturing engineers, rock mechanics engineers, and researchers working in the field of fracture mechanics. The book includes numerous case studies and examples to illustrate the concepts discussed in each chapter. The book presents a comprehensive understanding of the principles and applications of fracture mechanics in porous rocks and porous media. The book is intended for advanced students and researchers in the field of fracture mechanics, as well as for professionals working in related industries. The book is designed to provide a comprehensive understanding of the principles and applications of fracture mechanics in porous rocks and porous media. The book is intended for advanced students and researchers in the field of fracture mechanics, as well as for professionals working in related industries. The book is designed to provide a comprehensive understanding of the principles and applications of fracture mechanics in porous rocks and porous media.