Fatigue, Durability, and Fracture Mechanics

The Merging of Fatigue and Fracture Mechanics Concepts

The basic tenet of LEFM is that the stress intensity factor, K, is the key controlling parameter for fatigue crack growth and fast brittle fracture under monotonic loading. This research program examined whether or not this fundamental assumption formed an effective basis for an engineering technology. And, as needed, suggested directions for an improved technology. Keywords: Fatigue, Fracture, Mechanics. (JES).

Fatigue and Fracture Mechanics XXV

Fatigue and Fracture Mechanics Proceedings of the first International Conference, on Computer-Aided Assessment and Control of Localized Damage, held in Portsmouth, UK, 26-28 June 1990

Fatigue and Fracture Mechanics

Fatigue and Fracture Mechanics Etube (mechanical engineering, University College London) presents novel research and the results of wave-induced stress on the operational life of offshore structures. Using the results of an investigation undertaken to assess the fatigue and fracture performance of steels used in the industry, the five chapters discuss details of the methodology to develop a typical jack-up offshore standard load history (JOSH); factors that influence fatigue resistance of structural steels used in the construction of jack-up structures; methods used to model the relevant factors for inclusion in JOSH, with emphasis on loading and structural response interaction; results and details of experimental variable amplitude corrosion fatigue tests conducted using JOSH; and a novel generalized methodology for fast assessment of offshore structural welded joints. Distributed by ASME. c. Book News Inc.

Fatigue and Fracture Mechanics

Fatigue and Fracture Mechanics

Fracture Mechanics

Fatigue Failure and Fracture Mechanics

Fundamentals of Fatigue and Fracture Mechanics

Basic Fracture Mechanics The application of methods of fracture mechanics to the prediction of fatigue life presupposes the existence of a single flaw of ‘critical’ size the slow propagation of which, under repeated cyclic loading, represents the relevant damage mechanism that governs ‘fatigue’ until the flaw has grown to unstable size. The conditions under which this approach to fatigue provides a reasonable model of real behavior are, however, exactly the conditions that should be avoided by adequate fatigue design. Thus the merit of fracture mechanics with respect to fatigue is not in the realistic modeling of the fatigue process in its various aspects, but in the delimitation of the conditions under which this process approaches the model too closely for purposes of design. The paper discusses the different aspects of the fatigue process in relation to the basic concepts of fracture mechanics. (Author).
Probabilistic Fracture Mechanics and Fatigue Methods

The seventh Jerry L. Swedlow Memorial Lecture presents a review of some of the technical developments, that have occurred during the past 40 years, which have led to the merger of fatigue and fracture mechanics concepts. This review is made from the viewpoint of ‘crack propagation.’ As methods to observe the ‘fatigue’ process have improved, the formation of fatigue micro-cracks has been observed earlier in life and the measured crack sizes have become smaller. These observations suggest that fatigue damage can now be characterized by ‘crack size.’ In parallel, the crack-growth analysis methods, using stress-intensity factors, have also improved. But the effects of material inhomogeneities, crack-fracture mechanisms, and nonlinear behavior must now be included in these analyses. The discovery of crack-closure mechanisms, such as plasticity, roughness, and oxide/corrosion/fretting product debris, and the use of the effective stress-intensity factor range, has provided an engineering tool to predict small- and large-crack-growth rate behavior under service loading, conditions. These mechanisms have also provided a rationale for developing, new, damage-tolerant materials. This review suggests that small-crack growth behavior should be viewed as typical behavior, whereas large-crack threshold behavior should be viewed as the anomaly. Small-crack theory has unified ‘fatigue’ and ‘fracture mechanics’ concepts; and has bridged the gap between safe-life and durability/damage-tolerance design concepts. Newman, James C., Jr. Langley Research Center

Fatigue and Fracture Mechanics

This book introduces the field of fracture mechanics from an applications viewpoint. Then it focuses on fitness for service, or life extension, of existing structures. Finally, it provides case studies to allow the practicing professional engineer or student to see the applications of fracture mechanics directly to various types of structures.

Fatigue and Fracture Mechanic

The fatigue phenomenon process in structural elements and connections. The tubular welded joints used in the construction of offshore structures can experience millions of variable amplitude load cycles during their service life. Such fatigue loading represents a main cause of degradation in these structures. As a result, fatigue is an important consideration in their design. Fatigue and Fracture Mechanisms of Offshore Structures present novel research and the results of wave-induced stress on the operational life of offshore structures. Increasing oil consumption in the world and scarcity of land-oil resources due to political and economical reasons has caused offshore oil exploration and production to become a growing investigation field in the past six decades. The analysis of structures to use energy deposits and other recourses, or for other purposes, in ocean environments requires a special consideration since environmental and loading conditions offshore are very complicated and contain large uncertainties. Offshore structures are continuously subjected to random ocean waves producing stochastic loads that cause mainly fatigue failure in structural components.

Fatigue and Fracture Mechanic

Collection of selected, peer reviewed papers from the 25th Polish National Conference on Fatigue and Fracture Mechanics, May 20-23, 2014, Fojutowo, Poland. The 45 papers are grouped as follows: Chapter 1: Fatigue of Materials, Chapter 2: Fracture Behaviour of Materials, Chapter 3: Other Aspects of Material Strength.

Localized Damage. Computer Aided Assessment and Control

In the preliminary stage of designing new structural hardware that must perform a given mission in a fluctuating load environment, there are several factors the designers 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 be able to 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. During the past few decades, fracture mechanics has become a necessary discipline for the solution of many structural problems. These problems include the prevention of failures resulting from preexisting cracks in the parent material, welds or that develop under cyclic loading environment during the life of the structure. The importance of fatigue and fracture in nuclear, pressure vessel, aircraft, and aerospace structural hardware cannot be overemphasized where safety is of utmost concern. This book is written for the designer and strength analyst, as well as for the material and process engineer who is concerned with the integrity of the structural hardware under load-bearing or other environments in which fatigue and fracture must be given special attention. The book is a result of years of both academic and industrial experiences that the principal author and co-authors have accumulated through their work with aircraft and aerospace structures.

Fatigue and Fracture Mechanic

This book presents selected papers presented during Fatigue Durability India 2019. The contents of this volume discuss advances in the field of fatigue, durability, and fracture, and cover mechanical failure and its applications. The chapters cover a wide spectrum of topics, including design, engineering, testing and computational evaluation of the components or systems for fatigue, durability, and fracture mechanics. The contents of this book will appeal not only to academic researchers, but also to design engineers, failure analysts, maintenance engineers, certification personnel, and R&D professionals involved in a wide variety of industries.

The Mechanics of Fracture and Fatigue

This book contains 15 fully peer-reviewed Invited Papers which were presented at the 13th Biennial European Conference on Fracture and is a companion to the CD-ROM http://www.elsevier.com/locate/isbn/008043701xProceedings. The organisers of the ECF 13 opted from the very beginning for an
application-oriented conference, and consequently, this book contributes to the understanding of fracture phenomena, and disseminates fracture concepts and their application to the solution of engineering problems to practitioners in a wide range of fields. The fields covered in this book can be broadly classified into: elastic-plastic fracture mechanics, fracture dynamics, fatigue and interactive processes, failure, structural integrity, coatings and materials, with applications to the following industrial sectors: transport, aerospace engineering, civil engineering, pipelines and automotive engineering.

Localized Damage II: Fatigue and fracture mechanics

Fatigue and Fracture Mechanics of High Risk Parts The purpose of this Handbook is to provide a review of the knowledge and experiences in the field of fatigue fracture mechanics. It is well-known that engineering structures can fail due to cyclic loading. For instance, a cyclically time-varying loading reduces the structure strength and can provoke a fatigue failure consisting of three stages: (a) crack initiation (b) crack propagation and (c) catastrophic failure. Since last century many scientists have tried to understand the reasons for the above-mentioned failures and how to prevent them. This Handbook contains valuable contributions from leading experts within the international scientific community and covers many of the important problems associated with the fatigue phenomena in civil, mechanical and nuclear engineering.

Fatigue and Fracture Mechanics

Fatigue and Fracture Mechanics This book presents the proceedings of one of the major conferences in fatigue, fracture and structural integrity (NT2F). The papers are organized and divided in five different themes: fatigue and fracture mechanics of structures and advanced materials; fatigue and fracture in pressure vessels and pipelines: mechanical behavior and structural integrity of welded, bonded and bolted joints; residual stress and environmental effects on the fatigue behavior; and simulation methods, analytical and computation models in fatigue and fracture.

Fatigue and Fracture Mechanics

National Symposium on Fatigue and Fracture Mechanics

Fatigue and Fracture Mechanics On Fatigue Mechanics A major objective of engineering design is the determination of the geometry and dimensions of machine or structural elements and the selection of material in such a way that the elements perform their operating function in an efficient, safe and economic manner. For this reason the results of stress analysis are coupled with an appropriate failure criterion. Traditional failure criteria based on maximum stress, strain or energy density cannot adequately explain many structural failures that occurred at stress levels considerably lower than the ultimate strength of the material. On the other hand, experiments performed by Griffith in 1921 on glass fibers led to the conclusion that the strength of real materials is much smaller, typically by two orders of magnitude, than the theoretical strength. The discipline of fracture mechanics has been created in an effort to explain these phenomena. It is based on the realistic assumption that all materials contain crack-like defects from which failure initiates. Defects can exist in a material due to its composition, as second-phase particles, debonds in composites, etc., they can be introduced into a structure during fabrication, as welds, or can be created during the service life of a component like fatigue, environment-assisted or creep cracks. Fracture mechanics studies the loading-bearing capacity of structures in the presence of initial defects. A dominant crack is usually assumed to exist.

Proceedings of the 17th International Conference on New Trends in Fatigue and Fracture Emphasizes applications of fracture mechanics to prevent fracture and fatigue failures in structures, rather than the theoretical aspects of fracture mechanics. The concepts of driving force and resistance force are used to differentiate between the mathematical side and the materials side. Case studies of actual failures are new to the third edition. Annotation copyrighted by Book News, Inc., Portland, OR

Fatigue and Fracture Mechanics

Fracture and Fatigue Control in Structures

Fatigue and Fracture Mechanics of Offshore Structures This book presents the proceedings of Fatigue Durability India 2016, which was held on September 28–30 at J N Tata Auditorium, Indian Institute of Science, Bangalore. This 2nd International Conference & Exhibition brought international industrial experts and academics together on a single platform to facilitate the exchange of ideas and advances in the field of fatigue, durability and fracture mechanics and its applications. This book comprises articles on a broad spectrum of topics from design, engineering, testing and computational evaluation of components and systems for fatigue, durability, and fracture mechanics. The topics covered include interdisciplinary discussions on working aspects related to materials testing, evaluation of damage, nondestructive testing (NDT), failure analysis, finite element modeling (FEM) analysis, fatigue and fracture, processing, performance, and reliability. The contents of this book will appeal not only to academic researchers, but also to design engineers, failure analysts, maintenance engineers, certification personnel, and R&D professionals involved in a wide variety of industries.
Fracture Mechanics: Applications and Challenges

Handbook of Fatigue Crack Propagation in Metallic Structures Annotation The tubular welded joints used in the construction of offshore structures can experience millions of variable amplitude load cycles during their service life. Such fatigue loading represents a main cause of degradation in these structures. As a result, fatigue is an important consideration in their design. Fatigue and Fracture Mechanisms of Offshore Structures present novel research and the results of wave-induced stress on the operational life of offshore structures. Containing results of an investigation undertaken to assess the fatigue and fracture performance of steels used in the offshore industry, Fatigue and Fracture Mechanics of Offshore Structures includes Stress analysis of tubular joints Fatigue design Fatigue loading in Jackup structures Jack-up dynamic response Modelling of wave loading Test specimen considerations The stress intensity factor concept Variable amplitude crack growth models Consideration of sequence effects Sea state probability model The important research in this book will be of interest to those dealing with a wide range of engineering structures - from bridges and buildings to masts and pipelines, as well as fatigue and fracture specialists, and those concerned with materials technology.

Fatigue and Fracture Mechanics of Offshore Structures The materials used in manufacturing the aerospace, aircraft, automobile, and nuclear parts have inherent flaws that may grow under fluctuating load environments during the operational phase of the structural hardware. The design philosophy, material selection, analysis approach, testing, quality control, inspection, and manufacturing are key elements that can contribute to failure prevention and assure a trouble-free structure. To have a robust structure, it must be designed to withstand the environmental load throughout its service life, even when the structure has pre-existing flaws or when a part of the structure has already failed. If the design philosophy of the structure is based on the fail-safe requirements, or multiple load path design, partial failure of a structural component due to crack propagation is localized and safely contained or arrested. For that reason, proper inspection technique must be scheduled for reusable parts to detect the amount and rate of crack growth, and the possible need for repairing or replacement of the part. An example of a fail-sa- designed structure with crack-arrest feature, common to all aircraft structural parts, is the skin-stiffened design configuration. However, in other cases, the design p- losophy has safe-life or single load path feature, where analysts must demonstrate that parts have adequate life during their service operation and the possibility of catastrophic failure is remote. For example, all pressurized vessels that have single load path feature are classified as high-risk parts. During their service operation, these tanks may develop cracks, which will grow gradually in a stable manner.

Virtual Testing and Predictive Modeling Selected, peer reviewed papers from the Conference on XXIV Symposium on Fatigue Failure and Fracture Mechanics, May 22-25, 2012, Bydgoszcz-Pieczyska, Poland

Fatigue and Fracture Mechanics With its combination of practicality, readability, and rigor that is characteristic of any truly authoritative reference and text, Fracture Mechanics: Fundamentals and Applications quickly established itself as the most comprehensive guide to fracture mechanics available. It has been adopted by more than 100 universities and embraced by thousands of professional engineers worldwide. Now in its third edition, the book continues to raise the bar in both scope and coverage. It encompasses theory and applications, linear and nonlinear fracture mechanics, solid mechanics, and materials science with a unified, balanced, and in-depth approach. Reflecting the many advances made in the decade since the previous edition came about, this indispensable Third Edition now includes: A new chapter on environmental cracking Expanded coverage of weight functions New material on toughness test methods New problems at the end of the book New material on the failure assessment diagram (FAD) method Expanded and updated coverage of crack closure and variable-amplitude fatigue Updated solutions manual In addition to these enhancements, Fracture Mechanics: Fundamentals and Applications, Third Edition also includes detailed mathematical derivations in appendices at the end of applicable chapters; recent developments in laboratory testing, application to structures, and computational methods; coverage of micromechanisms of fracture; and more than 400 illustrations. This reference continues to be a necessity on the desk of anyone involved with fracture mechanics.

Problems of Fracture Mechanics and Fatigue

Fracture and Fatigue Control in Structures 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. The book also tackles the crack tip plasticity and covers crack growth. The last chapter in the text discusses some applications in fracture mechanics. The book will be of great use to engineers who want to get acquainted with fracture mechanics.