Fatigue Under Biaxial and Multiaxial Loading

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Fatigue Under Biaxial and Multiaxial Loading (ESIS Publication 10) - K. F. Kussmaul - 1991
A collection of papers from a conference which focuses on problems in biaxial and multiaxial fatigue research and the application of adequate design criteria to engineering solutions.

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**Biaxial/Multiaxial Fatigue and Fracture** - Andrea Carpinteri - 2003-03-19

The European Structural Integrity Society (ESIS) Technical Commitee on Fatigue of Engineering Materials and Structures (TC3) decided to compile a Special Technical Publication (ESIS STP) based on the 115 papers presented at the 6th International Conference on Biaxial/Multiaxial Fatigue and Fracture. The 25 papers included in the STP have been extended and revised by the authors. The conference was held in Lisbon, Portugal, on 25-28 June 2001, and was chaired by Manual De Freitas, Instituto Superior Tecnico, Lisbon. The meeting, organised by the Instituto Superior Tecnico and sponsored by the Portuguese Minesterio da Cienca e da Tecnologia and by the European Structural Integrity Society, was attended by 151 delegates from 20 countries. The papers in the and experimental aspects of the Multiaxial fatigue and fracture of engineering materials and structures. They are divided in to the following six sections; Multiaxial Fatigue of Welded Structures; High cycle Multiaxial fatigue; Non proportional and Variable-Amplitude loading; Defects, Notches, Crack Growth; Low Cycle Multiaxial Fatigue; Applications and Testing Methods. As is well-known, most engineering components and structures in the mechanical, aerospace, power generation, and other industries are subjected to multiaxial loading during their service life. One of the most difficult tasks in design against fatigue and fracture is to translate the information gathered from uniaxial fatigue and fracture tests on engineering materials into applications involving complex states of cyclic stress-strain conditions. This book is the result of co-operation between many researchers from different laboratories, universities and industries in a number of
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**Advances in Multiaxial Fatigue** - David L. McDowell - 1993
Papers presented at the ASTM Symposium on Multiaxial Fatigue, held in San Diego, November 1991, to communicate the most recent international advances in multiaxial cyclic deformation and fatigue research as well as applications to component analysis and design. The 24 papers are grouped into five ca

**Multiaxial Fatigue and Fracture** - E. Macha - 1999-09-06
This volume contains 18 papers selected from 90 presented at the Fifth International Conference on Biaxial/Multiaxial Fatigue and Fracture held in Cracow, Poland 8-12 September 1997. The papers in this book deal with theoretical, computational and experimental aspects of the multiaxial fatigue and fracture of engineering materials and structures. The papers are divided into the following four categories: 1. Proportional
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Most papers in this publication talk about the behaviour of constructional materials and elements of machines under non-proportional loading and under variable amplitude and random loading, which are more realistic load histories met in industrial practice. Variable amplitude loading under cyclic load with basic frequency and random loading under load with a continuous band of frequency is classified here. This book gives a review of the latest world success and directions of investigations on multiaxial fatigue and fracture. More and more often publications are results of the co-operation of researchers from different laboratories and countries. Seven out of eighteen papers included here were worked out by international authors teams. This is a symptom of the times, when science and investigations know no borders.

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**Fatigue Damage, Crack Growth and Life Prediction** - F. Ellyin - 2012-12-06

Fatigue failure is a multi-stage process. It begins with the initiation of cracks, and with continued cyclic loading the cracks propagate, finally leading to the rupture of a component or specimen. The demarcation between the above stages is not well-defined. Depending upon the scale of interest, the variation may span three orders of magnitude. For example, to a material scientist an initiated crack may be of the order of a micron, whereas for an engineer it can be of the order of a millimetre. It is not surprising therefore to see that investigation of the fatigue process has followed different paths depending investigation. Interest in the study of fatigue failure increased with the advent of industrialization. Because of the urgent need to design against fatigue failure, early investigators focused on prototype testing and proposed failure criteria similar to design formulae. Thus, a methodology developed whereby the fatigue theories were proposed based on experimental observations, albeit at times with limited scope. This type of phenomenological approach progressed rapidly during the past four decades as closed-loop testing machines became available.

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**Multiaxial Fatigue and Deformation** - Sreeramesh Kalluri - 2000

Contains papers from a May 1999 symposium, describing state-of-the-art multiaxial testing techniques and analytical methods for characterizing fatigue and deformation behaviors of engineering materials. Papers are classified into sections on multiaxial strength of materials, multiaxial deformation.

**Biaxial Fatigue of Metals** - Jaap Schijve - 2015-08-25

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Problems of fatigue under multiaxial fatigue loads have been addressed in a very large number of research publications. The present publication is primarily a survey of biaxial fatigue under constant amplitude loading on metal specimens. It starts with the physical understanding of the fatigue phenomenon under biaxial fatigue loads. Various types of proportional and non-proportional biaxial fatigue loads and biaxial stress distributions in a material are specified. Attention is paid to the fatigue limit, crack nucleation, initial micro crack growth and subsequent macro-crack in different modes of crack growth. The interference between the upper and lower surfaces of a fatigue crack is discussed. Possibilities for predictions of biaxial fatigue properties are analysed with reference to the similarity concept. The significance of the present understanding for structural design problems is considered. The book is completed with a summary of major observations.

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**Low Cycle Fatigue** - Harvey D. Solomon - 1988

**Multiaxial Fatigue** - Keith John Miller - 1985

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**Mechanics Of Solids And Structures** - Proceedings Of The International Conference - Travis F W - 1991-09-05

**Fatigue Testing and Analysis Under Variable Amplitude Loading Conditions** - Peter C. McKeighan - 2005

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**Advances in Fatigue Science and Technology** - C. Moura Branco - 2012-12-06
This volume contains the edited version of lectures and selected research contributions presented at the NATO ADVANCED STUDY INSTITUTE on ADVANCES IN FATIGUE SCIENCE AND TECHNOLOGY, held in Alvor, Portugal, 4th to 15th of April 1988, and organized by CEMUL - Center of Mechanics and Materials of The Technical University of Lisbon. The Institute was attended by 101 participants, including 15 lecturers, from 14 countries. The participants were leading scientists and engineers from universities, research institutions and industry, and also Ph.D~ students. Some participants presented papers during the Institute reporting the state-of-art of their research projects. All the sessions were very active and quite extensive discussions on scientific aspects took place during the Institute. The Advanced Study Institute provided a forum for interaction among eminent scientists and engineers, from different schools of thought and young researchers. The Institute addressed the essential aspects related to fatigue science and technology, namely: Short Cracks, Metallurgical Aspects, Environmental Fatigue, Threshold Behaviour, Notch Behaviour, Creep and Fatigue Interactions at High Temperature, Multiaxial Fatigue, Low Cycle Fatigue, Methodology of Fatigue Testing, Variable Amplitude Fatigue, Fatigue of Advanced Materials, Elastic-Plastic Fatigue, and several engineering applications such as welded joints, energy systems, offshore structures, automotive industry, machine and engine components. This book is organized in three parts: Part I: Fundamentals of Fatigue Part II: Engineering Applications Part III: Research Contributions The research contributions covered most of the areas referred above.

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Aspects, Environmental Fatigue, Threshold SCIENCE AND TECHNOLOGY. held in Alvor. Portugal, 4th to 15th of April 1988. and organized by CEMUL - Center of Mechanics and Materials of The Technical University of Lisbon. The Institute was attended by 101 participants, including 15 lecturers. from 14 countries. The participants were leading scientists and engineers from universities, research institutions and industry. and also Ph.D~ students. Some participants presented papers during the Institute reporting the state-of-art of their research projects. All the sessions were very active and quite extensive discussions on scientific aspects took place during the Institute. The Advanced Study Institute provided a forum for interaction among eminent scientists and engineers. from different schools of thought and young researchers. The Institute addressed the foundations and current state of the art of essential aspects related to fatigue science and technology, namely: Short Cracks, Metallurgical Behaviour, Notch Behaviour. Creep and Fatigue Interactions at High Temperature, Multiaxial Fatigue, Low Cycle Fatigue, Methodology of Fatigue Testing, Variable Amplitude Fatigue, Fatigue of Advanced Materials. Elastic-Plastic Fatigue, and several engineering applications such as welded joints, energy systems, offshore structures, automotive industry, machine and engine components. This book is organized in three parts: Part I: Fundamentals of Fatigue Part II: Engineering Applications Part III: Research Contributions The research contributions covered most of the areas referred above.

**Metal Fatigue in Engineering** - Ralph I. Stephens - 2000-11-03
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Metal Fatigue in Engineering - Ralph I. Stephens - 2000-11-03
Classic, comprehensive, and up-to-date Metal Fatigue in Engineering Second Edition For twenty years, Metal Fatigue in Engineering has served as an important textbook and reference for students and practicing engineers concerned with the design, development, and failure analysis of components, structures, and vehicles subjected to repeated loading. Now this generously revised and expanded edition retains the best features of the original while bringing it up to date with the latest developments in the field. As with the First Edition, this book focuses on applied engineering design, with a view to producing products that are safe, reliable, and economical. It offers in-depth coverage of today's most common analytical methods of fatigue design and fatigue life predictions/estimations for metals. Contents are arranged logically, moving from simple to more complex fatigue loading and conditions. Throughout the book, there is a full range of helpful learning aids, including worked examples and hundreds of problems, references, and figures as well as chapter summaries and "design do's and don'ts" sections to help speed and reinforce understanding of the material. The Second Edition contains a vast amount of new information, including: * Enhanced coverage of micro/macro fatigue mechanisms, notch strain residual stresses, digital prototyping, and fatigue design of weldments * Nonproportional loading and critical plane approaches for multiaxial fatigue * A new chapter on statistical aspects of fatigue
Duplex Stainless Steels (DSSs) are chromium-nickel-molybdenum-iron alloys that are usually in proportions optimized for equalizing the volume fractions of austenite and ferrite. Due to their ferritic-austenitic microstructure, they possess a higher mechanical strength and a better corrosion resistance than standard austenitic steels. This type of steel is now increasing its application and market field due to its very good properties and relatively low cost. This book is a review of the most recent progress achieved in the last 10 years on microstructure, corrosion resistance and mechanical strength properties, as well as applications, due to the development of new grades. Special attention will be given to fatigue and fracture behavior and to proposed models to account for mechanical behavior. Each subject will be developed in chapters written by experts recognized around the international industrial and scientific communities. The use of duplex stainless steels has grown rapidly in the last 10 years, particularly in the oil and gas sector.

**Duplex Stainless Steels** - Iris Alvarez-Armas - 2013-01-16
review of the most recent progress achieved in well as the chemical industry. In all these examples, topics like welding, corrosion resistance and mechanical strength properties (mainly in the fatigue domain) are crucial. Therefore, the update of welding and corrosion properties and the introduction of topics like texture effects, fatigue and fracture strength properties, and mechanical behavior modeling give this book specific focus and character.

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The design of mechanical structures with predictable and improved durability cannot be achieved without a thorough understanding of the mechanisms of fatigue damage and more specifically the relationships between the microstructure of materials and their fatigue properties. Written by leading researchers in the field, this book, along with the complementary books Fatigue of Materials and Structures: Fundamentals and Application to Damage and Design (both also edited by Claude Bathias and André Pineau), provides an authoritative, comprehensive and unified treatment of the mechanics and micromechanisms of fatigue in metals, polymers and composites. Each chapter is devoted to one of the major classes of materials or to different types of fatigue damage, thereby providing overall coverage of the field. This book deals with multiaxial fatigue, thermomechanical fatigue, fretting-fatigue, damage and damage tolerance, and will be an important and much used reference for students, practicing engineers and researchers studying fracture and fatigue in numerous areas of materials science and engineering, mechanical, nuclear and aerospace engineering.
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Les aciers inoxydables duplex (Traité MIM,
série matériaux et métallurgie) - ALVAREZ-
ARMAS Iris - 2012-04-16
Les aciers inoxydables duplex sont des alliages
Fe-Cr-Ni-Mo dont l'utilisation s'est fortement
accrue depuis 10 ans. Leur structure biphasée
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Fatigue and Durability of Structural Materials explains how mechanical material behavior relates to the design of structural machine components. The major emphasis is on fatigue and failure behavior using engineering models that have been developed to predict, in advance of service, acceptable fatigue and other durability-related lifetimes. The book covers broad classes of materials used for high-performance structural applications such as aerospace components, automobiles, and power generation systems. Coverage focuses on metallic materials but also addresses unique capabilities of important nonmetals. The concepts are applied to behavior at room or ambient temperatures; a planned second volume will address behavior at higher-temperatures. The volume is a repository of the most significant contributions by the authors to the art and science of material and structural durability over the past half century. During their careers, including 40 years of direct collaboration, they have developed a host of durability models that are based on sound physical and engineering principles. Yet, the models and interpretation of behavior have a unique simplicity that is appreciated by the practicing engineer as well as the beginning student. In addition to their own pioneering work, the authors also present the work of numerous others who have provided useful results that have moved progress in these fields. This book will be of immense value to practicing mechanical and materials engineers and designers charged with producing structural components with adequate durability. The coverage is appropriate for a range of technical levels from undergraduate engineering students through material behavior researchers and model developers. It will be of interest to personnel in the automotive and off-highway...
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Low Cycle Fatigue and Elasto-Plastic Behaviour of Materials—3 - K.T. Rie - 2012-12-06
Proceeds of the Third International Conference on Low Cycle Fatigue and Elasto-plastic Behaviour of Materials, Berlin Congress Center, Berlin, Germany, 7-11 September 1992

The Rainflow Method in Fatigue - Y. Murakami - 2013-10-22
The Rainflow Method in Fatigue: The Tatsuo Endo Memorial Volume documents the proceedings of The International Symposium on Fatigue Damage Measurement and Evaluation Under Complex Loadings held in Fukuoka, Japan, on 25-26 July 1991. The Symposium was held in memory of Professor Tatsuo Endo, inventor of the rainflow method of counting fatigue cycles. His contributions were key to the development of an overall method for evaluating the service life of engineering components subjected to fatigue loading. This volume contains 23 papers organized into four parts. Part I on the cycle counting method includes papers on the historical development of the rainflow cycle.
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**International Conference on Biaxial, Multiaxial Fatigue and Fracture : ICBMF ; 3 - 1 - 1989**

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**Third International Conference on Biaxial/multiaxial Fatigue - - 1989**

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**Handbook of Fatigue Crack Propagation in Metallic Structures - A. Carpinteri - 2012-12-02**

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.
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Grain Boundaries and Crystalline Plasticity - Louisette Priester - 2013-02-07
This book explores the fundamental role of grain boundaries in the plasticity of crystalline materials, providing a multi-scale approach to plasticity to facilitate understanding. It starts with the atomic description of a grain boundary, moves on to the elemental interaction processes between dislocations and grain boundaries, and finally shows how the microscopic phenomena influence the macroscopic behaviors and constitutive laws. Drawing on topics from physical, chemical, and mechanical disciplines, this work also explains properties of deformation at low and high temperature, creep, fatigue, and rupture.
**Effects of Heavy-vehicle Characteristics on Pavement Response and Performance**

This book contains the fully peer-reviewed papers presented at the Third Engineering Foundation Conference on Small Fatigue Cracks, held under the chairmanship of K.S. Ravichandran and Y. Murakami during December 6-11, 1998, at the Turtle Bay Hilton, Oahu, Hawaii. This book presents a state-of-the-art description of the mechanics, mechanisms and applications of small fatigue cracks by most of the world's leading experts in this field. Topics ranging from the mechanisms of crack initiation, small crack behavior in metallic, intermetallic, ceramic and composite materials, experimental measurement, mechanistic and theoretical models, to the role of small cracks in fretting fatigue and the application of small crack results to the aging aircraft and high-cycle fatigue problems, are covered.

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Effects of Heavy-vehicle Characteristics on Pavement Response and Performance - Thomas D. Gillespie - 1993

Fatigue Design of Components - G. Marquis - 1997-12-10
This volume contains a selection of papers presented at Fatigue Design 95 held in Helsinki, Finland from 5-8 September 1995. The papers have been peer reviewed and present practical aspects for the design of components and structures to avoid fatigue failure. Topics covered include: fatigue design experiences, ground vehicle components, component reliability, multiaxial fatigue, notch analysis, service loading, welded structures, probabilistics aspects in fatigue, fatigue design optimization.

Factors that Affect the Precision of Mechanical Tests - Ralph Papirno - 1989
The 17 peer-reviewed papers describe investigations where the precision of test procedures were either examined (to study the precision) or enhanced (to increase the precision). Topics include hardness testing, fatigue and fracture testing, and specimen alignment and gripping problems.
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**Polymer Composites in the Aerospace Industry** - Phil E - 2014-09-17
Polymer composites are increasingly used in aerospace applications due to properties such as strength and durability compared to weight. Edited by two leading authorities in the field, this book summarises key recent research on design, manufacture and performance of composite components for aerospace structures. Part one reviews the design and manufacture of different types of composite component. Part two discusses aspects of performance such as stiffness, strength, fatigue, impact and blast behaviour, response to temperature and humidity as well as non-destructive testing and monitoring techniques.

**Temperature-Fatigue Interaction** - L. Remy - 2002-03-11
This volume contains a selection of peer-reviewed papers presented at the International
and materials forming, stainless steels for power held in Paris, May 29-31, 2001, organised by the Fatigue Committee of the Société Française de Métallurgie et de Matériaux (SF2M), under the auspices of the European Structural Integrity Society. The conference disseminated recent research results and promoting the interaction and collaboration amongst materials scientists, mechanical engineers and design engineers. Many engineering components and structures used in the automotive, aerospace, power generation and many other industries experience cyclic mechanical loads at high temperature or temperature transients causing thermally induced stresses. The increase of operating temperature and thermal mechanical loading trigger the interaction with time-dependent phenomena such as creep and environmental effects (oxidation, corrosion). A large number of metallic materials were investigated including aluminium alloys for the automotive industry, steels and cast iron for the automotive industry plants, titanium, composites, intermetallic alloys and nickel base superalloys for aircraft industry, polymers. Important progress was observed in testing practice for high temperature behaviour, including environment and thermo-mechanical loading as well as in observation techniques. A large problem which was emphasized is to know precisely service loading cycles under non-isothermal conditions. This was considered critical for numerous thermal fatigue problems discussed in this conference.

Temperature-Fatigue Interaction - L. Remy - 2002-03-11
This volume contains a selection of peer-reviewed papers presented at the International Conference on Temperature-Fatigue Interaction, held in Paris, May 29-31, 2001, organised by the Fatigue Committee of the Société Française de Métallurgie et de Matériaux (SF2M), under the auspices of the European Structural Integrity Society. The conference disseminated recent
Fatigue '96 - G. Lütjering - 1996-05-20

The aim of the 6th International Fatigue Congress, besides covering the entire field of fatigue, was to promote the intimate connection between basic science and engineering application by the selection of appropriate session topics. Fatigue is the main cause of failure of engineering structures and components. Making reliable fatigue predictions is highly difficult because knowledge about fatigue mechanisms in all stages of the fatigue process must be developed much further. In addition, the decreasing availability of raw materials and energy resources forces engineers to continually reduce the weight of constructions. This congress presents research results also...
session topics. Fatigue is the main cause of composites. Researchers, on the other hand, are confronted with the engineering demands. Furthermore, the overwhelming development which is presently taking place in the field of computer software and hardware dealing with fatigue problems is outlined along with the directions of future developments in all areas of fatigue. Close to 300 fully peer-reviewed papers are published in the proceedings, including nearly 30 overview and keynote papers covering the various session topics. The proceedings should therefore serve as a comprehensive review of the fatigue field at the present state-of-the-art, suitable for scientists, engineers and students.

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Three-dimensional stress-strain fields are routinely determined for complex components using elastic and elastic-plastic finite element models. Although the local stress-strain response can be easily determined, the proper approach to strain based multiaxial fatigue analysis is not clear. Several multiaxial fatigue theories have been suggested, but there exists a lack of consensus on which model is most appropriate. To clarify the situation, experiments have been performed on two different multiaxial specimen geometries. Results are compared with theoretical predictions.

Fatigue Life Estimates for a Simple Notched Component Under Biaxial Loading - JW. Fash - 1985

Fatigue and Fracture Mechanices - S. R. Daniewicz - 2005-09-01

Fatigue Design and Reliability - G. Marquis -
required degree of reliability for the structure or component during its service life. Approaches to ensuring reliability may vary greatly depending on the structure being designed. Papers in this volume intentionally provide a multidisciplinary perspective on the issue. Authors represent the ground vehicle, heavy equipment, power generation, ship building and other industries. Identical solutions cannot be used in all cases because design methods must always provide a balance between accuracy and simplicity. The point of balance will shift depending on the type of input data available and the component being considered.

**Fatigue Design and Reliability** - G. Marquis - 1999-02-19

This volume represents a selection of papers presented at the Third International Symposium on Fatigue Design, Fatigue Design 1998, held in Espoo, Finland, 26-29 May, 1998. One objective of this symposium series was to help bridge the gap that sometimes exists between researchers and engineers responsible for designing components against fatigue failure. The 21 selected papers provide an up-to-date survey of engineering practice and a preview of design methods that are advancing toward application. Reliability was selected as a key theme for FD'98. During the design of components and structures, it is not sufficient to combine mean material properties, average usage parameters, and pre-selected safety factors. The engineer must also consider potential scatter in material properties, different end users, manufacturing tolerances and uncertainties in fatigue damage models. Judgement must also be made about the consequences of potential failure and the
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Low Cycle Fatigue and Elasto-Plastic Behaviour of Materials - K.T. Rie - 2012-12-06
In 1979 the first International Symposium on Low Cycle Fatigue and Elasto-Plastic Behaviour of Materials was held in Stuttgart, FRG. Since then research in low cycle fatigue has proceeded rapidly. The vital interest of engineers and researchers in communicating the rapid advances in the ongoing research in low cycle fatigue has encouraged me to initiate again the Second International Conference which was held in Munich, FRG, 7-11 September 1987. Failure in low cycle fatigue represents a serious problem in the design and operation of highly stressed structures. Under complex loading and
Second International Conference which was held in Munich, FRG, 7-11 September 1987. Failure in low cycle fatigue represents a serious problem in the design and operation of highly stressed structures. Under complex loading and environmental circumstances, especially for high temperature services, reliable life prediction cannot be expected without detailed consideration of the failure mechanism and without extensive use of mechanistic approaches. The purpose of this conference was to provide a forum to discuss the advances in recent research in the field of low cycle fatigue. The conference was intended to help to further bridge the gap between those who are involved in basic research, and the engineers who have to perform the design of highly stressed structural components.

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**Application of Fracture Mechanics to Polymers, Adhesives and Composites** - D R Moore - 2003-12-04

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Fracture of Polymers, Composites and Adhesives II - J G Williams - 2003-11-26
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Minimum Reinforcement in Concrete Members - A. Carpinteri - 1999-04-22
The ESIS-Technical Committee 9 on Concrete was established in 1990 and has met seven times. A proposal was put to European and extra-European laboratories entitled "Scale effects and transitional failure phenomena of reinforced concrete beams in flexure" which lead to several positive responses. The central topic discussed by the committee was that of the minimum reinforcement in concrete members. The minimum amount of reinforcement is defined as that for which "peak load at first concrete cracking" and "ultimate load after steel yielding" are equal. In this way, any brittle behaviour is avoided as well as any localized failure, if the member is not over-reinforced. In other words, there is a reinforcement percentage range, depending on the size-scale, within which the plastic limit analysis may be applied with its static and kinematic theorems. Carpinteri, Ferro, Bosco and El-Katieb propose a LEFM model, according to which reinforcement reactions are applied directly on the crack surfaces and a compatibility condition is locally imposed on the crack opening displacement in correspondence with the reinforcement. The theoretical model is found to provide a satisfactory estimate of the
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