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Fatigue Life Prediction of Composites and Composite Structures Fatigue in Composites Fatigue of Composite Materials Fatigue and Fracture of Adhesively-Bonded Composite Joints Damage and Failure of Composite Materials Fatigue of Composite Materials Fatigue of Textile Composites Fatigue in Composites Fatigue of Composite Materials Fatigue Behaviour of Fiber Reinforced Polymers Creep and Fatigue in Polymer Matrix Composites Composite Materials Introduction to Fatigue in Metals and Composites Fatigue of Fibrous Composite Materials Fatigue of Composite Materials--Damage Model and Life Prediction Fatigue Design of Steel and Composite Structures Fatigue of Composite Materials Fatigue in Composite Materials Composite Materials Fatigue of Filamentary Composite Materials Mechanics of Composite, Hybrid and Multifunctional Materials, Fracture, Fatigue, Failure and Damage Evolution, Volume 3 Fatigue Fundamentals for Composite Materials Development of a Fatigue-life Methodology for Composite Structures Subjected to Out-of-plane Load Components Considerations Concerning Fatigue Life of Metal Matrix Composites Fatigue Damage Fracture and Fatigue Fatigue of Fiber-reinforced Composites A Fatigue Model for Composite Materials Advances in Fatigue Science and Technology Fatigue of Textile and Short Fiber Reinforced Composites Development of a Fatigue-Life Methodology for Composite Structures Subjected to

Out-Of-Plane Load Components Composite Materials Fatigue Prediction for Composite Materials and Structures Composite Materials Composite Materials Modeling Damage, Fatigue and Failure of Composite Materials Durability Analysis of Composite Systems 2001 Composite Materials Modern Trends in Composite Laminates Mechanics Fatigue Life Methodology for Bonded Composite Skin/stringer Configurations

Annotation Papers presented at the Fourth Symposium on [title], held in Indianapolis, Indiana, May 1991, address topics in the areas of strength and failure modes; damage--measurement, analysis, and modeling; intralaminar and interlaminar fracture; micromechanics and interfaces; fatigue of polymer matrix composites; and fatigue of ceramic matrix, metal matrix, and specialty composites. Annotation copyright by Book News, Inc., Portland, OR. The aim of the book is to give a clear picture of some new modern trends in composite mechanics and to give a presentation of the current state-of-the-art of the theory and application of composite laminates. The book addresses the basics as well as recent developments in the theory of laminates and their effective properties, the problem of testing and identification of properties, strength, damage, and failure of composite laminates, lightweight construction principles, optimization techniques, the generation of smart structures, and a number of special technical aspects (e.g. stress localization), their modelling and analysis. The intention of the book is to provide deeper understanding, to give mathematical and algorithmic techniques for analysis, simulation and optimization and to link various aspects of composite mechanics as necessary to exploit the full potential that is possible for composite structures. A methodology is presented for determining the fatigue life of composite structures based on fatigue characterization data and geometric nonlinear finite element analyses. To demonstrate the approach, predicted results were compared to fatigue tests

performed on specimens which consisted of a tapered composite flange, representing a stringer or frame, bonded onto a composite skin. In a first step, quasi-static tension and fatigue tests were performed to evaluate the debonding mechanisms between the skin and the bonded stringer. Specimen edges were examined under the microscope to document the damage occurrence. In a second step, a two-dimensional finite element model was developed to analyze the tests. To predict matrix cracking onset, the relationship between the externally applied tension load and the maximum principal stresses transverse to the fiber direction was determined through geometrically nonlinear analysis. Transverse tension fatigue life data were used to generate an onset fatigue life P-N curve for matrix cracking. The resulting prediction was in good agreement with measured data from the fatigue tests. In a third step, a fracture mechanics approach based on geometrically nonlinear analysis was used to determine the relationship between the externally applied tension load and the critical energy release rate. Mixed mode energy release rate fatigue life data from DCB, 4ENF, and MMB tests were used to create a fatigue life onset G-N curve for delamination. The resulting prediction was in good agreement with data from the fatigue tests. Additionally, the prediction curve for cumulative life to failure was generated from the matrix onset and delamination onset fatigue life curves. The results were in good agreement with data from the fatigue tests, which demonstrated that the methodology offers a significant potential to predict cumulative fatigue life of composite structures. Creep and Fatigue in Polymer Matrix Composites, Second Edition, updates the latest research in modeling and predicting creep and fatigue in polymer matrix composites. The first part of the book reviews the modeling of viscoelastic and viscoplastic behavior as a way of predicting performance and service life. Final sections discuss techniques for modeling creep rupture and failure and how to test and predict long-term creep and fatigue in polymer matrix composites. Reviews the

latest research in modeling and predicting creep and fatigue in polymer matrix composites Puts a specific focus on viscoelastic and viscoplastic modeling Features the time-temperature-age superposition principle for predicting long-term response Examines the creep rupture and damage interaction, with a particular focus on time-dependent failure criteria for the lifetime prediction of polymer matrix composite structures that are illustrated using experimental cases An Introduction to Fatigue in Metals and Composites provides a balanced treatment of the phenomenon of fatigue in metals, nonmetals and composites with polymeric, metallic and ceramic matrices. The applicability of the safe life philosophy of design is examined for each of the materials. Attention is also focused on the stable crack growth phase of fatigue and differences in the operative mechanisms for the various classes of materials are considered. The impacts of these differences on the development of damage tolerance strategies are examined. Among topics discussed are; variable amplitude loading with tensile and compressive overload; closure obstruction; bridging mechanisms; mixed mode states; small cracks; delamination mechanisms and environmental conditions. The arrangement and presentation of the topics are such that An Introduction to Fatigue in Metals and Composites can serve as a course text for mechanical, civil, aeronautical and astronautical engineering and material science courses as well as a reference for engineers who are concerned with fatigue testing and aircraft, automobile and engine design. This book covers several aspects of the fatigue behavior of textile and short fiber reinforced composites. The first part is dedicated to 2D and 3D reinforced textile composites and includes a systematic description of the damage evolution for quasi-static and tensile-tensile fatigue loadings. Acoustic emissions and digital image correlation are considered in order to detect the damage modes' initiation and development. The acoustic emission thresholds of the quasi-static loading are connected to the "fatigue limit" of the materials with distinctions for

glass and carbon reinforcements. The second part is devoted to the fatigue behavior of injection molded short fiber reinforced composites. Experimental evidence highlights the dependence of their fatigue response on various factors: fiber and matrix materials, fiber distribution, environmental and loading conditions are described. A hybrid (experimental/simulations) multi-scale method is presented, which drastically reduces the amount of experimental data necessary for reliable fatigue life predictions. This book provides the first comprehensive review of its kind on the long-term behaviour of composite materials and structures subjected to time variable mechanical, thermal, and chemical influences, a subject of critical importance to the design, development, and certification of high performance engineering structures. Specific topics examined include damage, damage characterization, and damage mechanics; fatigue testing and evaluation; fatigue behaviour of short and long fibre reinforced polymer and metal matrix materials; viscoelastic and moisture effects; delamination; statistical considerations; the modeling of cumulative damage development; and life prediction. The volume provides an extensive presentation of data, discussions, and comparisons on the behaviour of the major types of material systems in current use, as well as extensive analysis and modeling (including the first presentation of work not found elsewhere). The book will be of special interest to engineers concerned with reliability, maintainability, safety, certification, and damage tolerance; to materials developers concerned with making materials for long-term service, especially under severe loads and environments, and to lecturers, students, and researchers involved in material system design, performance, solid mechanics, fatigue, durability, and composite materials. The scope of the work extends from entry level material to the frontiers of the subject. This bound edition presents multiple investigations into various aspects of fatigue in composite materials and structures. This work is divided into three sections. The first section presents research into various

aspects of fatigue modeling, including prediction of fatigue life, fatigue strength and fatigue crack growth rate. The second section deals primarily with experimental characterization of fatigue in composites, and the third section discusses fatigue behavior of full-scale composite structures. This volume is the third in the American Society for Composites Series on Advances in Composite Materials under the general editorship of Michael Hyer of Virginia Tech. Contributions on fatigue selected for this volume and others in the series are versions of recent ASC presentations which until now were available only on CD-ROM. Keywords include: fatigue, fatigue behavior, fatigue life prediction, multidirectional composite laminates, fatigue modeling, multi-factor interaction model, probabilistic model, composite materials, fatigue life analysis, fatigue limit predictors, fatigue delamination and fatigue damage. This proceedings covers the general problem related to the damage initiation and development, the failure criteria and the specific aspects related to fatigue, creep behaviour, moisture diffusion and the problem of the joining systems. Composite Materials, Volume 5: Fracture and Fatigue covers the concepts, theories, and experiments on fracture and fatigue behavior of composite materials. The book discusses the fracture of particulate composites, including metal, polymer, and ceramic matrices; relates micromechanics effects to composite strength; and summarizes the various theories relating constituent properties and microstructure to fracture. The text also describes differing theories regarding the strength and fracture of composites; and the theory and experiment relating to time-dependent fracture covering both long-term as well as dynamic fracture. The fatigue of both polymer- and metal-matrix composites and the factors influencing the toughness of both brittle and ductile matrix composites are also considered. Design engineers, materials scientist, materials engineers, and metallurgists will find the book useful. This volume addresses the specific subject of fatigue, a subject not familiar to many engineers, but still relevant for proper

and good design of numerous steel structures. It explains all issues related to the subject: Basis of fatigue design, reliability and various verification formats, determination of stresses and stress ranges, fatigue strength, application range and limitations. It contains detailed examples of applications of the concepts, computation methods and verifications. Fatigue in Composites provides extensive contemporary research on fatigue from internationally recognized researchers. Part I introduces the concept, delivering a historical review of the fatigue behavior of fibre-reinforced plastics and illustrating fatigue test methods and fatigue under multiaxial stress systems. Part II reviews current research on micromechanical aspects, emphasizing long-term behavior, interface performance, delamination and damage accumulation. Part III covers the analysis and testing of fatigue behavior. Part IV details physical , micromechanical, computational, statistical, and life-prediction models for constant and variable stress. The final sections offer an overview of the wide range of composite fatigue-related problems experienced by engineers. 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 wel'e 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 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. A survey of work on the fatigue behavior of composites dealing with the problems met with by materials scientists and designers in aerospace, automotive, marine, and structural engineering. Including a historical review, standards, micromechanical aspects, life-prediction methods for constant stress and variable stress, and fatigue in practical situations. Fatigue Life Prediction of Composites and Composite Structures, Second Edition, is a comprehensive review of fatigue damage and fatigue life modeling and prediction methodologies for composites and their use in practice. In this new edition, existing chapters are fully updated, while new chapters are introduced to cover the most recent developments in the field. The use of composites is growing in structural applications in many industries, including aerospace, marine, wind turbine and civil engineering. However, there are uncertainties about their long-term performance, including performance issues relating to cyclic fatigue loading that hinder the adoption of a commonly accepted credible fatigue design methodology for the life prediction of composite engineering structures. With its distinguished editor and international team of contributors, this book is a standard reference for industry professionals and researchers alike. Examines past, present and future trends associated with the fatigue life prediction

of composite materials and structures Assesses novel computational methods for fatigue life modeling and prediction of composite materials under constant amplitude loading Covers a wide range of techniques for predicting fatigue, including their theoretical background and practical applications Addresses new topics and covers contemporary research developments in the field The efforts to identify and implement a fatigue life methodology applicable to demonstrate delamination failures for use in certifying composite rotor blades are presented. The RSRA/X-Wing vehicle was a proof-of-concept stopped rotor aircraft configuration which used rotor blades primarily constructed of laminated carbon fiber. Delamination of the main spar during ground testing demonstrated that significant interlaminar stresses were produced. Analysis confirmed the presence of out-of-plane load components. The wear out (residual strength) methodology and the requirements for its implementation are discussed. Sumich, Mark and Kedward, Keith T. Ames Research Center RTOP 532-09-91... As composites are a combination of many organic and inorganic materials already studied, we draw on this information to guide us in strength evaluations, interpretation of results, and design aspects of the new materials. Basically, many micro- and macrostructural differences exist between the materials made of metals and those of reinforced plastics, sandwich constructions, and composites. The microstructure of the metals allows engineers to assume metals are isotropic and hence use simple formulas relating stress and strain. In contrast, composites are a mixture of dissimilar materials ranging from ductile, rubbery, weak, low-modulus materials to brittle, strong, high-modulus reinforcements. The result is a non-homogeneous or anisotropic material involving complicated relations of stress and strain. If the dissimilar materials are arranged in layers and oriented in specific patterns, such as many reinforced plastics and sandwich constructions, the composite may be considered an orthotropic material and treated as such

mathematically. In addition to the various strength properties of the component materials, the composite also is affected by environmental factors, fabrication factors, and service factors. For example, temperature, moisture, various liquids, various gases, notches, imperfections, surface conditions, size, damping characteristics, adhesion, fastenings, cold working, orientation of crystals and fibers, and the rate of loading are all factors that affect the time and repetition of load, which is called fatigue. The effect of such factors generally cannot be predetermined mathematically, so that experimental evaluation must be made of each new composite. In evaluating strength and related properties of the composites, experience with well-known materials provided the concepts for testing coupons, models, prototypes, and full-scale structures. Experimental evaluations include the effects of various environmental exposures, repeated and dead loads, various stress ranges, and as many mechanical tests as possible. Current trends are to use accelerated methods of test (such as the Prot, staircase, Probit, and rate process) to assay quickly the material's strength and life and to provide design criteria. Standard strength determinations provide stress-strain relations in tension, compression, and shear. Fatigue determinations provide curves of stress and strain magnitude versus usable life or time to failure. Superimposed on such graphs are the effects of environments in service. Just as there are many facets and ramifications in construction of composites, there are likewise many variables in the testing for establishing design criteria. If established procedures are not feasible, modifications are necessary to evaluate a new product and provide the assurance of safe design loads. It is commonly accepted that the majority of engineering failures happen due to fatigue or fracture phenomena. Adhesive bonding is a prevailing joining technique, widely used for critical connections in composite structures. However, the lack of knowledge regarding fatigue and fracture behaviour, and the shortage of tools for credible fatigue design, hinders the potential benefits of adhesively bonded

joints. The demand for reliable and safe structures necessitates deep knowledge in this area in order to avoid catastrophic structural failures. This book reviews recent research in the field of fatigue and fracture of adhesively-bonded composite joints. The first part of the book discusses the experimental investigation of the reliability of adhesively-bonded composite joints, current research on understanding damage mechanisms, fatigue and fracture, durability and ageing as well as implications for design. The second part of the book covers the modelling of bond performance and failure mechanisms in different loading conditions. A detailed reference work for researchers in aerospace and engineering Expert coverage of different adhesively bonded composite joint structures An overview of joint failure Fatigue of Textile Composites provides a current, state-of-art review on recent investigations on the fatigue behavior of composite materials, mainly those reinforced with textiles. As this particular group of composite materials is extremely important for a wide variety of industrial applications, including automotive, aeronautical, and marine, etc., mainly due to their peculiarities and advantages with respect to unidirectional laminated composites, the text presents comprehensive information on the huge variety of interlacement geometric architectures that are suitable for a broad range of different applications, their excellent drapability and versatility, which is highly important for complex double-curvature shape components and three-dimensional woven fabrics without plane reinforcement, and their main mechanical characteristics which are currently in high demand from industry. Presents the current state-of-the-art investigations on fatigue behavior of composite materials, mainly those reinforced with textiles Contains invaluable information pertaining to a wide variety of industries, including automotive, aeronautical, and marine, amongst others Provides comprehensive information on the huge variety of interlacement geometric architectures that are suitable for a broad range of different applications Under many common

circumstances, it would appear that composite materials are superior to metals in their fatigue resistance. However, the usual concept of fatigue or fatigue damage must be broadened for composites. A single fatigue crack which propagates through a component to cause failure rarely occurs in the singular manner identified with homogeneous materials. Instead, fatigue damage in composites may consist of various combinations of matrix cracking, debonding, delamination, void growth, and fiber breakage. As a result, fatigue cannot be defined in terms of a single failure mode, and indeed, a single criterion for fatigue failure is difficult to choose. The present discussion presents a general descriptive overview of fatigue of composite materials from the standpoint of basic characteristics and concepts, especially in the context of fatigue behavior of more familiar materials. While the exact nature of fatigue damage processes in composite materials is, as yet, undetermined, the principal objective of this document is to present the current understandings and practices which have the greatest possible generality. Readers are advised to seek more specific information for specific situations and to develop as much first hand data as possible for a given applied situation. Boron/epoxy laminates in a [0-deg/ + 45-deg/ - 45-deg/ 0-deg/0-deg/ + 45 -deg/ - 45-deg/0-deg] layup were tested statically for initial strength and fracture strain and were tested in strain-controlled fatigue loading at 30 Hz, with a strain-amplitude ratio of one tenth for five different testing sequences. Bringing together materials mechanics and modelling, this book provides a complete guide to damage mechanics of composite materials for engineers. Modelling Damage, Fatigue and Failure of Composite Materials provides the latest research on the field of composite materials, an area that has attracted a wealth of research, with significant interest in the areas of damage, fatigue, and failure. The book is a comprehensive source of physics-based models for the analysis of progressive and critical failure phenomena in composite materials, and focuses on materials

modeling, while also reviewing treatments to give the reader thorough direction for analyzing failure in composite structures. Part one of the book reviews the damage development in composite materials such as generic damage and damage accumulation in textile composites and under multiaxial loading, while part two focuses on the modeling of failure mechanisms in composite materials with attention given to fibre/matrix cracking and debonding, compression failure, and delamination fracture. Final sections examine the modeling of damage and materials response in composite materials, including micro-level and multi-scale approaches, the failure analysis of composite materials and joints, and the applications of predictive failure models. Examines current research in modeling damage, fatigue, and failure of composite materials Provides a comprehensive source of physics-based models for the analysis of progressive and critical failure phenomena in composite materials Assesses the failure and life prediction in composite materials Discusses the applications of predictive failure models such as computational approaches to failure analysis Fatigue life prediction on composite materials is studied analytically using degradation and damage models, resultant strains, and fatigue modulus. Definition of fatigue modulus, new damage models using fatigue modulus and resultant strain, and prediction of fatigue life of composite materials using degradation and damage models are discussed. This approach can predict accurately the multi-stress level fatigue life as well as single-stress level fatigue life of composite materials. Fatigue life is predicted by the following procedures: (1) establish the fatigue modulus degradation model, (2) find fatigue life equation as a function of fatigue modulus, (3) calculate the fatigue life using strain failure criterion. Degradation models for composite damage are generalized; the three-parameter degradation model is found most suitable to predicting fatigue life of composites. Also the predicted two-stress level fatigue life using the proposed cumulative damage models is reasonably close to the

experimental data. This major handbook is the first authoritative survey of current knowledge of fatigue behaviour of composites. It deals in detail with a wide range of problems met by designers in the automotive, marine and structural engineering industries. Compiled from the contributions of some of the best-known researchers in the field, it provides an invaluable, practical and encyclopaedic handbook covering recent developments. Comprehensively discusses the problems of fatigue in composites met by designers in the aerospace, marine and structural engineering industries Provides a general introduction on fatigue in composites before reviewing current research on micromechanical aspects Analyses various types of composites with respect to fatigue behaviour and testing and provides in-depth coverage of life-prediction models for constant variable stresses Mechanics of Composite, Hybrid, and Multifunctional Materials, Fracture, Fatigue, Failure and Damage Evolution, Volume 3 of the Proceedings of the 2021 SEM Annual Conference & Exposition on Experimental and Applied Mechanics, the third volume of four from the Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on a wide range of areas, including: Recycled Constituent Composites Damage Detection Advanced Imaging of Composites Multifunctional Materials Composite Interfaces Tunable Composites Novel Experimental Methods Extreme Environments Interfacial Fracture Integration of Models & Experiments Mechanics of Energy & Energetic Materials Integration of Models & Experiments In Situ Techniques for Fatigue & Fracture Microscale & Microstructural Effects on Mechanical Behavior Book is organized around new experiments in and modeling of fatigue and its effects over a range of composite materials subjected to multiple mechanical and thermal stresses. An objective of the investigations discussed is to explain failure mechanisms and improve long-term loading prediction and performance. Chapters in the book are edited and refereed

presentations made at the most recent ICFC5 conference, held in Nanjing, China.TABLE OF CONTENTS Preface •Fatigue Life Assessment via Ply-By-Ply Stress Analysis Under Biaxial Loading F. Schmidt, T. J. Adam and P. Horst •A Residual Stiffness—Residual Strength Coupled Model for Composite Laminate Under Fatigue Loading W. Lian •Damage in Thermoplastic Composite Structures: Application to High Pressure Hydrogen Storage Vessels C. Thomas, F. Nony, S. Villalonga and J. Renard •Cyclic Interlaminar Crack Growth in Unidirectional and Braided Composites S. Stelzer, G. Pinter, M. Wolfahrt, A. J. Brunner and J. Noisternig •Experimental Analysis and Modelling of Fatigue Behaviour of Thick Woven Laminated Composites P. Nimdum and J. Renard •Fatigue Behaviour of Woven Composite p Joint J. Zhang, Y. Fu, L. Zhao, X. Liang, H. Huang and B. Fei •Monotonic and Cyclic Deformation Behavior of Ultrasonically Welded Hybrid Joints Between Light Metals and Carbon Fiber Reinforced Polymers (CFRP) F. Balle and D. Eifler •Fatigue-Driven Residual Life Models Based on Controlling Fatigue Stress and Strain in Carbon Fibre/Epoxy Composites J. J. Xiong, J. B. Bai and C. Y. Luo •An Energy-Based Fatigue Approach for Composites Combining Failure Mechanisms, Strength and Stiffness Degradation H. Krüger, R. Rolfes and E. Jansen •Fatigue Life Prediction Of Off-Axis Unidirectional Laminate F. WU and W.-X. YAO •Thermal Fatigue of AX41 Magnesium Alloy Based Composite Studied Using Thermal Expansivity Measurements Z. Drozd, Z. Trojanová and P. Luká? •Fabrication of TI/APC-2 Nanocomposite Laminates and Their Fatigue Response at Elevated Temperature M.-H. R. Jen, C.-K. Chang, Y.-C. Sung and F.-C. Hsu •Fatigue and Fracture of Elastomeric Matrix Nanocomposites C. Bathias and S. Dong •Fatigue Delamination of Carbon Fiber Fabrics Reinforced PPS Laminates J. Bassery and J. Renard •Damage Mechanism and Fatigue Behaviour of Uniaxially and Sequentially Loaded Wound Tube Specimens F. Schmidt and P. Horst •Influence of Thermal and

Mechanical Cycles on the Damping Behaviour of Mg Based-Nanocomposite Z. Trojanová, A. Makowska-Mielczarek, W. Riehemann and P. Luká? •Delamination Detection in CFRP Laminates Using A0 and S0 Lamb Wave Modes N. Hu, Y.-L. Liu, H. Fukunaga and Y. Li •Calorimetric Analysis of Dissipative Effects Associated with the Fatigue of GFRP Composites H. Sawadogo, S. Panier and S. Hariri •Correlation Between Crack Propagation Rate and Cure Process of Epoxy Resins V. Trappe, S. Günzel and M. Jaunich Author Index Annotation Proceedings of a symposium on [title] held April 1987, Cincinnati, OH. The majority of papers deal with composite systems of thermosetting epoxies. Some attention is given to more recent thermoplastic systems. Annotation copyrighted by Book News, Inc., Portland, OR. Fatigue has long been recognized as a mechanism that can provoke catastrophic material failure in structural applications and researchers are now turning to the development of prediction tools in order to reduce the cost of determining design criteria for any new material. Fatigue of Fiber-reinforced Composites explains these highly scientific subjects in a simple yet thorough way. Fatigue behavior of fiber-reinforced composite materials and structural components is described through the presentation of numerous experimental results. Many examples help the reader to visualize the failure modes of laminated composite materials and structural adhesively bonded joints. Theoretical models, based on these experimental data, are demonstrated and their capacity for fatigue life modeling and prediction is thoroughly assessed. Fatigue of Fiber-reinforced Composites gives the reader the opportunity to learn about methods for modeling the fatigue behavior of fiber-reinforced composites, about statistical analysis of experimental data, and about theories for life prediction under loading patterns that produce multiaxial fatigue stress states. The authors combine these theories to establish a complete design process that is able to predict fatigue life of fiber-reinforced composites under multiaxial, variable amplitude stress

states. A classic design methodology is presented for demonstration and theoretical predictions are compared to experimental data from typical material systems used in the wind turbine rotor blade industry. Fatigue of Fiber-reinforced Composites also presents novel computational methods for modeling fatigue behavior of composite materials, such as artificial neural networks and genetic programming, as a promising alternative to the conventional methods. It is an ideal source of information for researchers and graduate students in mechanical engineering, civil engineering and materials science.

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