Offshore Structure Fatigue Analysis Design Sacs Manual

This book helps designers and manufacturers to select and develop the most suitable and competitive steel structures, which are safe, fit for production and economic. An optimum design system is used to find the best characteristics of structural models, which guarantee the fulfilment of design and fabrication requirements and minimize the cost function. Realistic numerical models are used as main components of industrial steel structures. Chapter 1 containts some experiences with the optimum design of steel structures Chapter 2 treats some newer mathematical optimization methods. Chapter 3 gives formulae for fabrication times and costs. Chapters 4 deals with beams and columns. Summarizes the Eurocode rules for design. Chapter 5 deals with the design of tubular trusses. Chapter 6 gives the design of frame structures and fire-resistant design rules for a frame. In Chapters 7 some minimum cost design problems of stiffened and cellular plates and shells are worked out for cases of different stiffenings and loads. Chapter 8 gives a cost comparison of cylindrical and conical shells. The book contains a large collection of literatures and a subject list and a name index.

About the Series: This important new series of five volumes has been written with both the professional engineers and the academic in mind. Christian Lalanne explores every aspect of vibration and shock, two fundamental and crucially important areas of mechanical engineering, from both the theoretical and practical standpoints. As all products need to be designed to withstand the environmental conditions to which they are likely to be subjected, prototypes must be verified by calculation and laboratory tests, the latter according to specifications from national or international standards. The concept of tailoring the product to its environment has gradually developed whereby, from the very start of a design project, through the to the standards specifications and testing procedures on th e prototype, the real environment in which the product being tested will be functioning is taken into account. The five volumes of Mechanical Shock and Vibration cover all the issues that need to be addressed in this area of mechanical engineering. The theoretical analyses are placed in the context of the real world and of laboratory tests - essential for the development of specifications. Volume IV: Fatigue Damage Fatigue damage in a system with one degree of freedom is one of the two criteria applied when comparing the severity of vibratory environments. The same criterion is also employed for a specifciation representing the effects produced by the set of vibrations imposed in a real environment. In this volume, which is devoted to the calculation of fatigue damage, the author explores the hypotheses adopted to describe the behavior of material suffering fatigue and the laws of fatigue accumulation. He also considers the methods of counting the response peaks, which are used to establish the histogram when it is impossible to use the probability density of the peaks obtained with a Gaussian signal. The expressions for mean damage and its standard deviation are established and other hypotheses are tested.

'Analysis and Design of Marine Structures' explores recent developments in methods and modelling procedures for structural assessment of marine structures: - Methods and tools for establishing loads and load effects; - Methods and tools for strength assessment; - Materials and fabrication of structures; - Methods and tools for structural

design and optimisation; - Structural reliability, safety and environment protection. The book is a valuable reference source for academics, engineers and professionals involved in marine structures and design of ship and offshore 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.

This book presents up-to-date knowledge of dynamic analysis in engineering world. To facilitate the understanding of the topics by readers with various backgrounds, general principles are linked to their applications from different angles. Special interesting topics such as statistics of motions and loading, damping modeling and measurement, nonlinear dynamics, fatigue assessment, vibration and buckling under axial loading, structural health monitoring, human body vibrations, and vehicle-structure interactions etc., are also presented. The target readers include industry professionals in civil, marine and mechanical engineering, as well as researchers and students in this area.

A guide to the analysis and design of compliant offshore structures that highlights a new generation of platforms Offshore Compliant Platforms provides an authoritative guideto the analysis and design of compliant offshore structures and puts the focus on a new generation of platforms such as: triceratops, Buoyant Leg Storage and Regasification platforms. Whilst the authors – noted experts on the topic – include basic information on the conceptual development of conventional platforms, the book presents detailed descriptions of the design and development of new deep-water platforms. The book describes the preliminary design of triceratops in ultra-deep waters and presents a detailed analysis of environmental loads that are inherent in offshore locations such as wave, wind and current. The new methodology for the dynamic analysis of triceratops under ice loads, predominantly in ice-covered regions, is also examined with detailed parametric studies. In addition, the book covers the structural geometry and the various methods of analysis for assessing the performance of any other similar offshore platform under the special loads. A discussion of the fatigue analysis and service life prediction is also included. This important book: • Includes the analysis and design of compliant offshore structures with a focus on a new generation of platforms • Examines the preliminary design of triceratops in ultra-deep waters • Covers an analysis of environmental loads that are inherent in offshore locations such as wave, wind and current • Reviews the structural geometry and various methods of analysis for assessing the performance of any other similar offshore platform under

special loads • Discusses fatigue analysis and service life prediction Written for engineers and researchers across engineering including civil, mechanical, structural, offshore, ocean and naval architecture, Offshore Compliant Platforms fills the need for a guide to new offshore platforms that provides an understanding of the behaviour of these structures under different loading conditions.

This topical book contains the latest scientific and engineering developments in the field of tubular steel structures, as presented at the "11th International Symposium and IIW International Conference on Tubular Structures". The International Symposium on Tubular Structures (ISTS) has a long-standing reputation for being the principal showcase for manufactured tubing and the prime international forum for discussion of research, developments and applications in this field. Various key and emerging subjects in the field of hollow structural sections are covered, such as: novel applications and case studies, static and fatigue behaviour of connections/joints, concrete-filled and composite tubular members, earthquake resistance, specification and code developments, material properties and structural reliability, impact resistance and brittle fracture, fire resistance, casting and fabrication innovations. Research and development issues presented in this book are applicable to buildings, bridges, offshore structures, entertainment rides, cranes, towers and various mechanical and agricultural equipment. This book is thus a pertinent reference source for architects, civil and mechanical engineers, designers, steel fabricators and contractors, manufacturers of hollow sections or related construction products, trade associations involved with tubing, owners or developers of tubular structures, steel specification committees, academics and research students. The conference presentations herein include two keynote lectures (the International Institute of Welding Houdremont Lecture and the ISTS Kurobane Lecture), plus finalists in the CIDECT Student Papers Competition. The 11th International Symposium and IIW International Conference on Tubular Structures – ISTS11 – took place in Québec City, Canada from August 31 to September 2, 2006.

This new reference describes the applications of modern structural engineering to marine structures. It will provide an invaluable resource to practicing marine and offshore engineers working in oil and gas as well as those studying marine structural design. The coverage of fatigue and fracture criteria forms a basis for limit-state design and re-assessment of existing structures and assists with determining material and inspection requirements. Describing applications of risk assessment to marine and offshore industries, this is a practical and useful book to help engineers conduct structural design. *Presents modern structural design principles helping the engineer understand how to conduct structural design by analysis *Offers practical and usable theory for industrial applications of structural reliability theory

Avoiding or controlling fatigue damage is a major issue in thedesign and inspection of welded structures subjected to dynamicloading. Life predictions are usually used for safe life analysis,i.e. for verifying that it is very unlikely that

fatigue damagewill occur during the target service life of a structure. Damagetolerance analysis is used for predicting the behavior of a fatiguecrack and for planning of in-service scheduled inspections. Itshould be a high probability that any cracks appearing are detectedand repaired before they become critical. In both safe lifeanalysis and the damage tolerance analysis there may be largeuncertainties involved that have to be treated in a logical andconsistent manner by stochastic modeling. This book focuses on fatigue life predictions and damage toleranceanalysis of welded joints and is divided into three parts. Thefirst part outlines the common practice used for safe life anddamage tolerance analysis with reference to rules and regulations.The second part emphasises stochastic modeling and decision-makingunder uncertainty, while the final part is devoted to recentadvances within fatigue research on welded joints. Industrialexamples that are included are mainly dealing with offshore steelstructures. Spreadsheets which accompany the book give the readerthe possibility for hands-on experience of fatigue lifepredictions, crack growth analysis and inspection planning. Assuch, these different areas will be of use to engineers andresearchers.

The Symposium, held in Torino (ISI, Villa Gualino) July 1-5, 1991 is the sixth of a series of IUTAM-Symposia on the application of stochastic analysis to continuum and discrete mechanics. The previous one, held in Innsbruck (1987), was mainly concentrated on qual itative and quantitative analysis of stochastic dynamical systems as well as on bifurcation and transition to chaos of deterministic systems. This Symposium concentrated on fundamental aspects (stochastic analysis and mathe matical methods), on specific applications in various branches of mechanics, engineering and applied sciences as well as on related fields as analysis of large systems, system identifica tion, earthquake prediction. Numerical methods suitable to provide quantitative results, say stochastic finite elements, approximation of probability distribution and direct integration of differential equations have also been the object of interesting presentations. Specific topics of the sessions have been: Engineering Applications, Equivalent Lineariza tion of Discrete Stochastic Systems, Fatigue and Life Estimation, Fluid Dynamics, Numerical Methods, Random Vibration, Reliability Analysis, Stochastic Differential Equations, System Identification, Stochastic Control. We are indebted to the IUTAM Bureau for having promoted and sponsored this Sympo sium and the Scientific Committee for having collaborated to the selection of participants and lecturers as well as to a prompt reviewing of the papers submitted for publication into these proceedings. A special thank is due to Frank Kozin: the organization of this meeting was for him ';ery important; he missed the meeting but his organizer ability was present.

This proceedings volume contains 38 papers presented at the 4th Working Conference on "Rel iability· and Optimization of Structural Systems", held at the Technical University of Munich, Germany, September 11- 13, 1991. The Working Conference was organised by the IFIP (Interna tional Federation for Information

Processing) Working Group 7.5 of Technical Committee 7 and was the fourth in a series, following similar conferences held at the University of Aalborg, Den mark, May 1987, at the Imperial College, London, UK, September 1988 and at the University of California, Berkeley, California, USA, March 1990. The Working Conference was attended by 54 participants from 16 countries. The objectives of Working Group 7.5 are: • to promote modern structural systems optimization and reliability theory, • to advance international cooperation in the field of structural system optimization and reliability theory, • to stimulate research, development and application of structural system optimization and reli ability theory, • to further the dissemination and exchange of information on reliability and optimization of structural systems • to encourage education in structural system optimization and reliability theory. At present the members of the Working Group are: A. H.-S. Ang, U.S.A. M. Grimmelt, FRG G. A ugwti, Italy N. C. Lind, Canada M. J. Baker, UK H. O. Mad&en, Denmark P. Bjerager, Norway R. E. Melcher~, Australia C. A. Cornell, U.S.A. F. Mo~e~, U.S.A.

The failure of any welded joint is at best inconvenient and at worst can lead to catastrophic accidents. Fracture and fatigue of welded joints and structures analyses the processes and causes of fracture and fatigue, focusing on how the failure of welded joints and structures can be predicted and minimised in the design process. Part one concentrates on analysing fracture of welded joints and structures, with chapters on constraint-based fracture mechanics for predicting joint failure, fracture assessment methods and the use of fracture mechanics in the fatigue analysis of welded joints. In part two, the emphasis shifts to fatigue, and chapters focus on a variety of aspects of fatigue analysis including assessment of local stresses in welded joints, fatigue design rules for welded structures, k-nodes for offshore structures and modelling residual stresses in predicting the service life of structures. With its distinguished editor and international team of contributors, Fracture and fatigue of welded joints and structures is an essential reference for mechanical, structural and welding engineers, as well as those in the academic sector with a research interest in the field. Analyses the processes and causes of fracture and fatigue, focusing predicting and minimising the failure of welded joints in the design process Assesses the fracture of welded joints and structure featuring constraint-based fracture mechanics for predicting joint failure Explores specific considerations in fatigue analysis including the assessment of local stresses in welded joints and fatigue design rules for welded structures

A comprehensive overview of managing and assessing safety and functionality of ageing offshore structures and pipelines A significant proportion, estimated at over 50%, of the worldwide infrastructure of offshore structures and pipelines is in a life extension phase and is vulnerable to ageing processes. This book captures the central elements of the management of ageing offshore structures and pipelines in the life extension phase. The book gives an overview of: the relevant ageing processes and hazards; how ageing processes are managed through the life cycle, including an

overview of structural integrity management; how an engineer should go about assessing a structure that is to be operated beyond its original design life, and how ageing can be mitigated for safe and effective continued operation. Key Features: Provides an understanding of ageing processes and how these can be mitigated. Applies engineering methods to ensure that existing structures can be operated longer rather than decommissioned unduly prematurely. Helps engineers performing these tasks in both evaluating the existing structures and maintaining ageing structures in a safe manner. The book gives an updated summary of current practice and research on the topic of the management of ageing structures and pipelines in the life extension phase but also meets the needs of structural engineering students and practicing offshore and structural engineers in oil & gas and engineering companies. In addition, it should be of value to regulators of the offshore industry.

Essentials of Offshore Structures: Framed and Gravity Platforms examines the engineering ideas and offshore drilling platforms for exploration and production. This book offers a clear and acceptable demonstration of both the theory and application of the relevant procedures of structural, fluid, and geotechnical mechanics to offshore structures. It makes available a multitude of "solved problems" and "sample problems to solve" which give readers a strong understanding of the analysis and design of steel-framed and base-supported concrete gravity offshore structures. The book highlights sensible engineering applications for offshore structural design, research, and development; it can also be useful to those working in the design industry. The user will have a detailed overview of the various structures used in the offshore environment and the preliminary costing factors that will influence their choice for the site. Analytical principles emphasized in the book will help the user to clearly comprehend the various issues that need to be taken into account in the analysis and design of an offshore structure, using the API code. The book includes extensive worked-out problems and sample problems for use by the students and instructors, with a Solution Manual. The seabed pile/gravity foundation analyses and design are clearly outlined with their embedment characteristics and problems worked out. A global description of environmental forces has been given that includes those due to wave, wind, current, tides, earthquakes, ice floe/sheet action, and limit ice-load on Arctic structures. The book outlines the various factors that influence the material choice for offshore structures including fatigue and corrosion of the platforms in the ocean environment. Separate chapters detail the factors that influence the pile embedment and concrete gravity foundation characteristics, material choice including fatigue and corrosion, estimation of ocean environmental forces that will be exerted on the offshore structures, and the analysis fundamentals that the reader needs to possess. The last two chapters give detailed insights into the analysis and design of framed and concrete gravity platform offshore structures using API code procedures. Overall, this book is a comprehensive presentation of the analysis and design of steel and concrete offshore structures.

This book introduces readers to various types of offshore platform geometries. It addresses the various environmental loads encountered by these structures, and provides detailed descriptions of the fundamentals of structural dynamics in a classroom style, helping readers estimate damping in offshore structures and grasp these aspects' applications in preliminary analysis and design. Basic concepts of

structural dynamics are emphasized through simple illustrative examples and exercises. Design methodologies and guidelines, which are FORM based concepts, are explained through a selection of applied sample structures. Each chapter also features tutorials and exercises for self-learning. A dedicated chapter on stochastic dynamics helps students to extend the basic concepts of structural dynamics to this advanced domain of research. Hydrodynamic response of offshore structures with perforated members is one of the most recent research applications, and has proven to be one of the most effective means of retrofitting offshore structures. In addition, the book integrates the concepts of structural dynamics with the FORM-evolved design of offshore structures, offering a unique approach. This new edition is divided into seven chapters, each of which has been updated. Each chapter also includes a section on frequently asked Questions and Answers (Q&A), which enhances understanding of this complex subject through easy and self-explanatory text. Furthermore, the book presents valuable content with respect to new and recent research carried out by the author in structural dynamics. All numeric examples have been re-checked with more additional explanations. New exercises have been added to improve understanding of the subject matter. Computer coding is also included (wherever possible) to aid computer-based learning of the contents of the book. The book can serve as a textbook for senior undergraduate and graduate courses in civil, structural, applied mechanics, mechanical, aerospace, naval architecture and ocean engineering programs. The book can also serve as a text for professional learning and development programs or as a guide for practicing and consulting offshore structural engineers. The contents of this book will be useful to graduate students, researchers, and professionals alike.

This book provides background and guidance on the use of the structural hot-spot stress approach to fatigue analysis. The book also offers Design S-N curves for use with the structural hot-spot stress for a range of weld details, and presents parametric formulas for calculating stress increases due to misalignment and structural discontinuities. Highlighting the extension to structures fabricated from plates and non-tubular sections. The structural hot-spot stress approach focuses on cases of potential fatigue cracking from the weld toe and it has been in use for many years in tubular joints. Following an explanation of the structural hot-spot stress, its definition and its relevance to fatigue, the book describes methods for its determination. It considers stress determination from both finite element analysis and strain gauge measurements, and emphasizes the use of finite element stress analysis, providing guidance on the choice of element type and size for use with either solid or shell elements. Lastly, it illustrates the use of the recommendations in four case studies involving the fatigue assessment of welded structures using the structural hot-spot stress

Fatigue Design of Marine StructuresCambridge University Press

Materials in Marine Technology covers the important aspects of metallurgy and materials engineering which must be taken into account when designing for marine environments. The purpose is to aid materials selection and the incorporation of materials data into the design, manufacture and inspection strategy. Recent advances in materials technology, including the use of new materials for marine applications Alloys, Polymers and Composites are examined in detail. The integrated approach is design oriented and is supported by recent case studies.

This report introduces definitions of the terminology relevant to stress determination for

fatigue analysis of welded components. The various stress concentrations, stress categories and fatigue analysis methods are defined. Fatigue analysis methods considered are nominal stress, hot spot stress, notch stress, notch strain and fracture mechanics approaches. The report also contains comprehensive recommendations concerning the application of finite element methods and experimental methods for stress determination. It is intended for fatigue design of common welded structures, such as cranes, excavators, vehicle frames, bridges, ship hulls, offshore structures etc. fabricated from materials at least 3mm thick. In general, attention is focused on weld details which give rise to fatigue cracking from the surface, notably from the weld toe.
Treatise on Materials Science and Technology, Volume 28: Materials for Marine Systems and Structures provides an integrated approach, utilizing the environmental information of the ocean scientists, materials science, and structural integrity principles as they apply to offshore structures and ships. The book discusses the materials and their performance in marine systems and structures; the marine environment; and marine befouling. The text also describes marine corrosion; corrosion control; metallic materials for marine structures; and concrete marine structures. Materials for mooring systems and fracture control for marine structures are also considered. Professional scientists and engineers, as well as graduate students in the fields of ocean and marine engineering and naval architecture and associated fields will find the book useful.
This is the second part of the translation of the original German text Meerestechnische Konstruktionen which was published by Springer-Verlag in 1988. The translated material is a reviewed and updated version of the German text. Wheras the first volume concentrates on general and external factors, this one focuses on factors affecting the design and analysis of offshore structures themselves. In an effort to address a wide audience the topic is presented in a general context. Therefore it introduces students and practising engineers to the field of marine technology and, at the same time, serves as a reference book for experts. Finally it gives specialists in related fields an idea of where their work on individual problems of offshore structures stands in relation to the field as a whole. Offshore Structures, Vol. 2 is based on the authors' lectures and design practice in offshore structures and their components. It assists the reader in developing practical solutions by introducing a large number of examples and reference is made to further specialised literature.
'Analysis and Design of Marine Structures' explores recent developments in methods and modelling procedures for structural assessment of marine structures:- Methods and tools for establishing loads and load effects;- Methods and tools for strength assessment;- Materials and fabrication of structures;- Methods and tools for structural design and opt
This book contains contributions from various authors on different important topics related with probabilistic methods used for the design of structures. Initially several of the papers were prepared for advanced courses on structural reliability or on probabilistic methods for structural design. These courses have been held in different countries and have been given by different groups of lecturers. They were aimed at engineers and researchers who already had some exposure to structural reliability methods and thus they presented overviews of the work in the various topics. The book includes a selection of those contributions, which can be of support for future courses or for engineers and researchers that want to have an update on specific topics. It is

considered a complement to the existing textbooks on structural reliability, which normally ensure the coverage of the basic topics but then are not extensive enough to cover some more specialised aspects. In addition to the contributions drawn from those lectures there are several papers that have been prepared specifically for this book, aiming at complementing the others in providing an overall account of the recent advances in the field. It is with sadness that in the meanwhile we have seen the disappearance of two of the contributors to the book and, in fact two of the early contributors to this field.

This is a theoretical and practical guide for fatigue design of marine structures including sailing ships and offshore oil structures.

Analysis and Design of Marine Structures includes the papers from MARSTRUCT 2013, the 4th International Conference on Marine Structures (Espoo, Finland, 25-27 March 2013). The MARSTRUCT series of conferences started in Glasgow, UK in 2007, followed by the second conference in Lisbon, Portugal (March 2009), while the third conference was held in Ham

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.

Stochastic Analysis of Offshore Steel Structures provides a clear and detailed guide to advanced analysis methods of fixed offshore steel structures using 3D beam finite elements under random wave and earthquake loadings. Advanced and up-to-date research results are coupled with modern analysis methods and essential theoretical information to consider optimal solutions to structural issues. As these methods require and use knowledge of different subject matters, a general introduction to the key areas is provided. This is followed by in-depth explanations supported by design examples, relevant calculations and supplementary material containing related computer programmers. By combining this theoretical and practical approach Stochastic Analysis of Offshore Steel Structures cover a range of key concepts in detail including: The basic principles of standard 3D beam finite elements and special connections, Wave loading - from hydrodynamics to the calculation of wave loading on structural members, Stochastic response calculations with corresponding solution algorithms including earthquakes, and Fatigue damage, reliability calculation and reliability based design optimization. The broad and detailed coverage makes this a solid

reference for research oriented studies and practical sophisticated design methods. Students, researchers, insuring bodies and practical designer offices can turn to Stochastic Analysis of Offshore Steel Structures to broaden their theoretical understanding and develop their practical designs and applications of 3D finite analysis in fixed offshore steel structures.

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.