

Steel Structures Design Using Fem

This book is the Proceedings of a State-of-the-Art Workshop on Connections and the Behaviour, Strength and Design of Steel Structures held at Laboratoire de Mecanique et Technologie, Ecole Normale, Cachan France from 25th to 27th May 1987. It contains the papers presented at the above proceedings and is split into eight main sections covering: Local Analysis of Joints, Mathematical Models, Classification, Frame Analysis, Frame Stability and Simplified Methods, Design Requirements, Data Base Organisation, Research and Development Needs. With papers from 50 international contributors this text will provide essential reading for all those involved with steel structures.

The book explains the finite element method with various engineering applications to help students, teachers, engineers and researchers. It explains mathematical modeling of engineering problems and approximate methods of analysis and different approaches

Temporary structures are a vital but often overlooked component in the success of any construction project. With the assistance of modern technology, design and operation procedures in this area have undergone significant enhancements in recent years. Design Solutions and Innovations in Temporary Structures is a comprehensive source of academic research on the latest methods, practices, and analyses for effective and safe temporary structures. Including perspectives on numerous relevant topics, such as safety considerations, quality management, and structural analysis, this book is ideally designed for engineers, professionals, academics, researchers, and practitioners actively involved in the construction industry.

This is a review of developments in the behaviour and design of steel structures in seismic areas. The proceedings look at the analytical and experimental research on the seismic response of steel structures, and cover topics such as global behaviour and codification, design and application.

Various structures, such as buildings, bridges, and paved roads play an important role in our lives. However, these construction projects require large expenditures. Designing infrastructure cost-efficiently while satisfying all necessary design constraints is one of the most important and difficult tasks for a structural engineer. Traditionally, mathematical gradient-based optimization techniques have been applied to these designs. However, these gradient-based methods are not suitable for discrete design variables such as factory-made cross sectional area of structural members. Recently, researchers have turned their interest to phenomenon-mimicking optimization techniques because these techniques have proved able to efficiently handle discrete design variables. One of these techniques is harmony search, an algorithm developed from musical improvisation that has been applied to various structural design problems and has demonstrated cost-savings. This book gathers all the latest developments relating to the application of the harmony search algorithm in the structural design field in order for readers to efficiently understand the full spectrum of the algorithm's potential and to easily apply the algorithm to their own structural problems. This book contains six chapters with the following subjects: standard harmony search algorithm and its applications by Lee; standard harmony search algorithm for steel frame design by Degertekin; adaptive harmony search algorithm and its applications by Saka and Hasançebi; harmony particle swarm algorithm and its applications by Li and Liu; hybrid algorithm of harmony search, particle swarm & ant colony for structural design by Kaveh and Talatahari; and parameter calibration of viscoelastic and damage functions by Mun and Geem. This book details the theory and applications of finite element (FE) modeling of post-tensioned (PT) concrete structures, and provides the

updated MATLAB code (as of 2019). The challenge of modeling PT prestressed concrete structures lies in the treatment of the interface between the concrete and prestressing tendons. Using MATLAB, this study develops an innovative nonlinear FE formulation which incorporates contact techniques and engineering elements to considerably reduce the need of computational power. This FE formulation has the ability to simulate different PT frame systems with fully bonded, fully unbonded or partially bonded tendons, as well as actual sliding behavior and frictional effects in the tendons. It also allows for the accurate simulation of anchor seating loss.

Behaviour of Steel Structures in Seismic Areas is a comprehensive overview of recent developments in the field of seismic resistant steel structures. It comprises a collection of papers presented at the seventh International Specialty Conference STESSA 2012 (Santiago, Chile, 9-11 January 2012), and includes the state-of-the-art in both theore

These are the proceedings of the International Conference on Design, Fabrication and Economy of Metal Structures held on 24-26 April 2013 in Miskolc, Hungary which contain 99 papers covering: Structural optimization Thin-walled structures Stability Fatigue Frames Fire Fabrication Welding technology Applications Steel-concrete composite Special problems The authors are from 23 different countries, ensuring that the themes covered are of worldwide interest and importance. The International Institute of Welding (IIW), the International Society of Structural and Multidisciplinary Optimization (ISSMO), the TÁMOP 4.2.1.B-10/2/KONV-2010-0001 project entitled "Increasing the quality of higher education through the development of research - development and innovation program at the University of Miskolc supported by the European Union, co-financed by the European Social Fund" and many other sponsors helped organizers to collect these valuable studies, the results of which will provoke discussion, and provide an important reference for civil and mechanical engineers, architects, researchers and structural designers and fabricators, as well as managers in a range of industries including building, transport, shipbuilding, aircraft, chemical and offshore engineering.

Modern Trends in Research on Steel, Aluminium and Composite Structures includes papers presented at the 14th International Conference on Metal Structures 2021 (ICMS 2021, Poznań, Poland, 16-18 June 2021). The 14th ICMS summarised a few years' theoretical, numerical and experimental research on steel, aluminium and composite structures, and presented new concepts. This book contains six plenary lectures and all the individual papers presented during the Conference. Seven plenary lectures were presented at the Conference, including "Research developments on glass structures under extreme loads", Parhp3D – The parallel MPI/openMPI implementation of the 3D hp-adaptive FE code", "Design of beam-to-column steel-concrete composite joints: from Eurocodes and beyond", "Stainless steel structures – research, codification and practice", "Testing, modelling and design of bolted joints – effect of size, structural properties, integrity and robustness", "Design of hybrid beam-to-column joints between RHS tubular columns and I-section beams" and "Selected aspects of designing the cold-formed steel structures". The individual contributions delivered by authors covered a wide variety of topics: – Advanced analysis and direct methods of design, – Cold-formed elements and structures, – Composite structures, – Engineering structures, – Joints and connections, – Structural stability and integrity, – Structural steel, metallurgy, durability and behaviour in fire. Modern Trends in Research on Steel,

Aluminium and Composite Structures is a useful reference source for academic researchers, graduate students as well as designers and fabricators.

This book introduces the design concept of Eurocode 3 for steel structures in building construction, and their practical application. It especially comments on the regulations of the British National Annexes. Following a discussion of the basis of design, including the limit state approach, the material standards and their use are detailed. The fundamentals of structural analysis and modeling are presented, followed by the design criteria and approaches for various types of structural members. The following chapters expand on the principles and applications of elastic and plastic design, each exemplified by the step-by-step design calculation of a braced steel-framed building and an industrial building, respectively. Besides providing the necessary theoretical concepts for a good understanding, this manual intends to be a supporting tool for the use of practicing engineers. In order of this purpose, throughout the book, numerous worked examples are provided, concerning the analysis of steel structures and the design of elements under several types of actions. These examples will provide for a smooth transition from earlier national codes to the Eurocode.

Recent Trends in Cold-Formed Steel Construction discusses advancements in an area that has become an important construction material for buildings. The book addresses cutting-edge new technologies and design methods using cold-formed steel as a main structural material, and provides technical guidance on how to design and build sustainable and energy-efficient cold-formed steel buildings. Part One of the book introduces the codes, specifications, and design methods for cold-formed steel structures, while Part Two provides computational analysis of cold-formed steel structures. Part Three examines the structural performance of cold-formed steel buildings and reviews the thermal performance, acoustic performance, fire protection, floor vibrations, and blast resistance of these buildings, with a final section reviewing innovation and sustainability in cold-formed steel construction. Addresses building sciences issues and provides performance solutions for cold-formed buildings Provides guidance for using the next generation design method, computational tools, and technologies Edited by an experienced researcher and educator with significant knowledge on new developments in cold-formed steel construction

Steel plated structures are important in a variety of marine and land-based applications, including ships, offshore platforms, power and chemical plants, box girder bridges and box girder cranes. The basic strength members in steel plated structures include support members (such as stiffeners and plate girders), plates, stiffened panels/grillages and box girders. During their lifetime, the structures constructed using these members are subjected to various types of loading which is for the most part operational, but may in some cases be extreme or even accidental. Ultimate Limit State Design of Steel Plated Structures reviews and describes both fundamentals and practical design procedures in this field.

The derivation of the basic mathematical expressions is presented together with a thorough discussion of the assumptions and the validity of the underlying expressions and solution methods. Particularly valuable coverage in the book includes: * Serviceability and the ultimate limit state design of steel structural systems and their components * The progressive collapse and the design of damage tolerant structures in the context of marine accidents * Age related structural degradation such as corrosion and fatigue cracks Furthermore, this book is also an easily accessed design tool which facilitates learning by applying the concepts of the limit states for practice using a set of computer programs which can be downloaded. In addition, expert guidance on mechanical model test results as well as nonlinear finite element solutions, sophisticated design methodologies useful for practitioners in industries or research institutions, selected methods for accurate and efficient analyses of nonlinear behavior of steel plated structures both up to and after the ultimate strength is reached, is provided. Designed as both a textbook and a handy reference, the book is well suited to teachers and university students who are approaching the limit state design technology of steel plated structures for the first time. The book also meets the needs of structural designers or researchers who are involved in civil, marine and mechanical engineering as well as offshore engineering and naval architecture.

For more than forty years the series of International Colloquia on Stability and Ductility of Steel Structures has been supported by the Structural Stability Research Council (SSRC). Its objective is to present the latest results in theoretical, numerical and experimental research in the area of stability and ductility of steel and steel-concrete composite structures. In Stability and Ductility of Steel Structures 2019, the focus is on new concepts and procedures concerning the analysis and design of steel structures and on the background, development and application of rules and recommendations either appearing in recently published Codes or Specifications and in emerging versions, all in anticipation of the new edition of Eurocodes. The series of International Colloquia on Stability and Ductility of Steel Structures started in Paris in 1972, the last five being held in: Timisoara, Romania (1999), Budapest, Hungary (2002), Lisbon, Portugal (2006), Rio de Janeiro, Brazil (2010) and Timisoara, Romania (2016). The 2019 edition of SDSS is organized by the Czech Technical University in Prague.

In recent years, bridge engineers and researchers are increasingly turning to the finite element method for the design of Steel and Steel-Concrete Composite Bridges. However, the complexity of the method has made the transition slow. Based on twenty years of experience, Finite Element Analysis and Design of Steel and Steel-Concrete Composite Bridges provides structural engineers and researchers with detailed modeling techniques for creating robust design models. The book's seven chapters begin with an overview of the various forms of modern steel and steel-concrete composite bridges as well as current design codes. This is followed by self-contained chapters concerning: nonlinear

material behavior of the bridge components, applied loads and stability of steel and steel–concrete composite bridges, and design of steel and steel–concrete composite bridge components. Constitutive models for construction materials including material non-linearity and geometric non-linearity (The mechanical approach including problem setup, strain energy, external energy and potential energy), mathematics behind the method Commonly available finite elements codes for the design of steel bridges Explains how the design information from Finite Element Analysis is incorporated into Building information models to obtain quantity information, cost analysis

These two volumes of proceedings contain 11 invited keynote papers and 172 contributed papers presented at the International Conference on Advances in Steel Structures held on 11-14 December 1996 in Hong Kong. The papers cover a wide spectrum of topics and have been contributed from over 20 countries around the world. The conference, the first ever of its kind in Hong Kong, provided a forum for discussion and dissemination by researchers and designers of recent advances in the analysis, behaviour, design and construction of steel structures. The papers in the proceedings report the current state-of-the-art and point to the future directions of structural steel research. Volume I contains 93 papers on the analysis, behaviour, design and construction of framed structures and bridges, with 90 papers in Volume II dealing with plates, shells, analysis, optimization and computer applications, dynamics and seismic design, fatigue, and soil-structure interaction.

This book gathers the latest advances, innovations, and applications in the field of building design and construction, by focusing on new design solutions for buildings and new technologies creation for construction, as presented by researchers and engineers at the 2nd International Conference Building Innovations (ICBI), held in Poltava – Baku, Ukraine – Azerbaijan, on May 23-24, 2019. It covers highly diverse topics, including structures operation, repairing and thermal modernization in existing buildings and urban planning features, machines and mechanisms for construction, as well as efficient economy and energy conservation issues in construction. The contributions, which were selected by means of a rigorous international peer-review process, highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaborations.

The first complete guide to using the Stochastic Finite Element Method for reliability assessment Unlike other analytical reliability estimation techniques, the Stochastic Finite Element Method (SFEM) can be used for both implicit and explicit performance functions, making it a particularly powerful and robust tool for today's engineer. This book, written by two pioneers in SFEM-based methodologies, shows how to use SFEM for the reliability analysis of a wide range of structures. It begins by reviewing essential risk concepts, currently available risk evaluation procedures, and the use of analytical and sampling methods in estimating risk. Next, it introduces SFEM evaluation procedures, with detailed coverage of displacement-based and stress-based deterministic finite element approaches. Linear, nonlinear, static, and dynamic problems are considered separately to demonstrate the robustness of the methods. The risk or reliability estimation procedure for

each case is presented in different chapters, with theory complemented by a useful series of examples. Integrating advanced concepts in risk-based design, finite elements, and mechanics, Reliability Assessment Using Stochastic Finite Element Analysis is vital reading for engineering professionals and students in all areas of the field.

This book introduces the fundamental design concept of Eurocode 3 for current steel structures in building construction, and their practical application. Following a discussion of the basis of design, including the principles of reliability management and the limit state approach, the material standards and their use are detailed. The fundamentals of structural analysis and modeling are presented, followed by the design criteria and approaches for various types of structural members. The theoretical basis and checking procedures are closely tied to the Eurocode requirements. The following chapters expand on the principles and applications of elastic and plastic design, each exemplified by the step-by-step design calculation of a braced steel-framed building and an industrial building, respectively. Besides providing the necessary theoretical concepts for a good understanding, this manual intends to be a supporting tool for the use of practicing engineers. In order of this purpose, throughout the book, numerous worked examples are provided, concerning the analysis of steel structures and the design of elements under several types of actions. These examples will facilitate the acceptance of the code and provide for a smooth transition from earlier national codes to the Eurocode.

This textbook describes the rules for the design of steel and composite building structures according to Eurocodes, covering the structure as a whole, as well as the design of individual structural components and connections. It addresses the following topics: the basis of design in the Eurocodes framework; the loads applied to building structures; the load combinations for the various limit states of design and the main steel properties and steel fabrication methods; the models and methods of structural analysis in combination with the structural imperfections and the cross-section classification according to compactness; the cross-section resistances when subjected to axial and shear forces, bending or torsional moments and to combinations of the above; component design and more specifically the design of components sensitive to instability phenomena, such as flexural, torsional and lateral-torsional buckling (a section is devoted to composite beams); the design of connections and joints executed by bolting or welding, including beam to column connections in frame structures; and alternative configurations to be considered during the conceptual design phase for various types of single or multi-storey buildings, and the design of crane supporting beams. In addition, the fabrication and erection procedures, as well as the related quality requirements and the quality control methods are extensively discussed (including the procedures for bolting, welding and surface protection). The book is supplemented by more than fifty numerical examples that explain in detail the appropriate procedures to deal with each particular problem in the design of steel structures in accordance with Eurocodes. The book is an ideal learning resource for students of structural engineering, as well as a valuable reference for practicing engineers who perform designs on basis of Eurocodes.

This book presents the design of steel structures using finite element methods (FEM) according to the current state of the art in Germany and the rest of Europe. After a short introduction on the basics of the design, this book illustrates the FEM with a focus on internal forces, displacements, critical loads and modal shapes. Next to finite element procedures for linear calculations considering the stress states of normal force, biaxial bending and warping torsion, non-linear calculations and the stability cases of flexural buckling, lateral torsional buckling and plate buckling are concentrated on significantly. In this context, design procedures for stability according to the standard Eurocode 3 is introduced and discussed. In addition, important fundamental issues are covered, such as the determination of cross-section properties as well as the elastic and plastic cross-section resistance. Complementary, finite element procedures for cross sections are dealt with, which will

have an increasing importance in future. This book has evolved within the teaching activities of the authors in the lecture Computer-oriented Design of Steel Structures on the Master's Program Computational Engineering at the University of Bochum. It covers the total variety of demands needed to be discussed for the safe, economic and modern design of steel structures.

This two volume proceedings contains 11 invited keynote papers, 33 invited papers, and 225 contributed papers presented at the Fourth International Conference on Advances in Steel Structures (ICASS '05) held on 13-15 June 2005 in Shanghai, China. ICASS provides a forum for discussion and dissemination by researchers and designers of recent advances in the analysis, behaviour, design and construction of steel structures. Contributions to the papers came from 22 countries around the world and cover a wide spectrum of topics including: Constructional Steel, Hybrid Structures, Nonferrous Metals, Analysis of Beams and Columns, Computations, Frames, Design, Space Structures, Fabrication, along with a variety of other key subjects presented at the conference.

The book introduces all the aspects needed for the safe and economic design and analysis of connections using bolted joints in steel structures. This is not treated according to any specific standard but making comparison among the different norms and methodologies used in the engineering practice, e.g. Eurocode, AISC, DIN, BS. Several examples are solved and illustrated in detail, giving the reader all the tools necessary to tackle also complex connection design problems. The book is introductory but also very helpful to advanced and specialist audiences because it covers a large variety of practice demands for connection design. Parts that are not taken to an advanced level are seismic design, welds, interaction with other materials (concrete, wood), and cold formed connections./p

The book is concerned with design of cold-formed steel structures in building based on the Eurocode 3 package, particularly on EN 1993-1-3. It contains the essentials of theoretical background and design rules for cold-formed steel sections and sheeting, members and connections for building applications. Elaborated examples and design applications - more than 200 pages - are included in the respective chapters in order to provide a better understanding to the reader.

Steel Structures Design using FEM John Wiley & Sons

A crucial element of structural and continuum mechanics, stability theory has limitless applications in civil, mechanical, aerospace, naval and nuclear engineering. This text of unparalleled scope presents a comprehensive exposition of the principles and applications of stability analysis. It has been proven as a text for introductory courses and various advanced courses for graduate students. It is also prized as an exhaustive reference for engineers and researchers. The authors' focus on understanding of the basic principles rather than excessive detailed solutions, and their treatment of each subject proceed from simple examples to general concepts and rigorous formulations. All the results are derived using as simple mathematics as possible. Numerous examples are given and 700 exercise problems help in attaining a firm grasp of this central aspect of solid mechanics. The book is an unabridged republication of the 1991 edition by Oxford University Press and the 2003 edition by Dover, updated with 18 pages of end notes.

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.

Detailing a number of structural analysis problems such as residual welding stresses and distortions and behaviour of thin-walled rods loaded in bending, this text also explores mathematical function minimization methods, expert systems and optimum design of welded box beams.

First book to discuss the analysis of structural steel connections by Finite Element Analysis—which provides fast, efficient, and flexible checking of these vital structural components. The analysis of steel structures is complex—much more so than the analysis of similar concrete structures. There are no universally accepted rules for the analysis of connections in steel structures or the analysis of the stresses transferred from one connection to another. This book presents a general approach to steel connection analysis and check, which is the result of independent research that began more than fifteen years ago. It discusses the problems of connection analysis and describes a generally applicable methodology, based on Finite Element Analysis, for analyzing the connections in steel structures. That methodology has been implemented in software successfully, providing a fast, automatic, and flexible route to the design and analysis of the connections in steel structures. Steel Connection Analysis explains several general methods which have been researched and programmed during many years, and that can be used to tackle the problem of connection analysis in a very general way, with a limited and automated computational effort. It also covers several problems related to steel connection analysis automation. Uses Finite Element Analysis to discuss the analysis of structural steel connections. Analysis is applicable to all connections in steel structures. The methodology is the basis of the commercially successful CSE connection analysis software. Analysis is fast and flexible. Structural engineers, fabricators, software developing firms, university researchers, and advanced students of civil and structural engineering will all benefit from Steel Connection Analysis.

Traditionally, engineers have used laboratory testing to investigate the behavior of metal structures and systems. These numerical models must be carefully developed, calibrated and validated against the available physical test results. They are commonly complex and very expensive. From concept to assembly, Finite Element Analysis and Design of Metal Structures provides civil and structural engineers with the concepts and procedures needed to build accurate numerical models without using expensive laboratory testing methods. Professionals and researchers will find Finite Element Analysis and Design of Metal Structures a valuable guide to finite elements in terms of its applications. Presents design examples for metal tubular connections. Simplified review for general steps of finite element analysis. Commonly used linear and nonlinear analyses in finite element modeling. Realistic examples of concepts and procedures for Finite Element Analysis and Design. This volume contains the papers presented at IALCCE2018, the Sixth International Symposium on Life-Cycle Civil Engineering (IALCCE2018), held in Ghent, Belgium, October 28-31, 2018. It consists of a book of extended abstracts and a USB device with full papers including the Fazlur R. Khan lecture, 8 keynote lectures, and 390 technical papers from all over the world. Contributions relate to design, inspection, assessment, maintenance or optimization in the framework of life-cycle analysis of civil engineering structures and infrastructure systems. Life-cycle aspects that are developed and discussed range from structural safety and durability to sustainability, serviceability, robustness and resilience. Applications relate to buildings, bridges and viaducts, highways and runways, tunnels and underground structures, off-shore and marine structures, dams and hydraulic structures, prefabricated design, infrastructure systems, etc. During the IALCCE2018 conference a particular focus is put on the cross-fertilization between different sub-areas of expertise and the development of an overall vision for life-cycle analysis in civil engineering. The aim of the editors is to provide a valuable source of cutting edge information for anyone interested in life-cycle analysis and assessment in civil engineering, including researchers, practising engineers, consultants, contractors, decision makers and representatives from local authorities.

The aim of this book is to review recent research and technical advances, including the progress in design codes, related to the engineering applications of light gauge metal sections made in carbon, high strength and stainless steel, as well as aluminium alloys. Included is a review of the new technologies for connections of light gauge metal members. Main advanced applications, for residential, non residential and

industrial buildings and pallet rack systems are also covered. For the first time, this book takes into account all the metallic materials now used more and more for structural components. The book will be of great interest not only for researchers but also for design engineers faced to the use of new metallic materials in modern structural applications.

Combining a theoretical background with engineering practice, *Design of Steel-Concrete Composite Bridges to Eurocodes* covers the conceptual and detailed design of composite bridges in accordance with the Eurocodes. Bridge design is strongly based on prescriptive normative rules regarding loads and their combinations, safety factors, material proper

The 5th International Conference on Civil Engineering and Urban Planning (CEUP2016) was held in Xi'an, China on August 23 – 26, 2016. CEUP2016 gathered outstanding scientists and researchers worldwide to exchange and discuss new findings in civil engineering and urban planning associated with transportation and environmental topics. The conference program committee is also greatly honored to have four renowned experts for taking time off to present their keynotes to the conference. The conference had received a total of 410 submissions, which after peer review by the Technical Program Committee, only 108 were selected to be included in this conference proceedings, which covers Architecture and Urban Planning; Civil Engineering and Transportation Engineering.

The Objective of this book is to guide structural engineering students and engineering professionals into the process of roof members design and calculations for steel framed buildings. This book covers gravity and lateral loads calculations in accordance with ASCE7-10, how to calculate snow drift loads, moment frames and braced frames lateral load analysis using the slope deflection methods and unit load methods. Moment connections calculations according to AISC Design Guides, and roof members design subjected to both axial and flexural bending. This book also covers over 230 different sections details done in CAD and REVIT for roof framing. Details such as roof beams and joists attachment into a brick and metal studs walls, CMU walls, concrete and wood walls, connections detailing whether it is a moment or shear connection, existing roof joists web and chord reinforcement, and roof trusses section details.

Marine Structural Design, Second Edition, is a wide-ranging, practical guide to marine structural analysis and design, describing in detail the application of modern structural engineering principles to marine and offshore structures. Organized in five parts, the book covers basic structural design principles, strength, fatigue and fracture, and reliability and risk assessment, providing all the knowledge needed for limit-state design and re-assessment of existing structures. Updates to this edition include new chapters on structural health monitoring and risk-based decision-making, arctic marine structural development, and the addition of new LNG ship topics, including composite materials and structures, uncertainty analysis, and green ship concepts. Provides the structural design principles, background theory, and know-how needed for marine and offshore structural design by analysis Covers strength, fatigue and fracture, reliability, and risk assessment together in one resource, emphasizing practical considerations and applications Updates to this edition include new chapters on structural health monitoring and risk-based decision making, and new content on arctic marine structural design

An industrial book that analyses various theoretical problems, optimizes numerical applications and addresses industrial problems such as belt-conveyor bridge, pipeline, wind turbine power, large-span suspended roof and offshore jacket member. Multi-storey frames and pressure vessel-supporting frames are discussed in detail. The book's emphasis is on economy and cost calculation, making it possible to compare costs and make significant savings in the design stages, by, for example, comparing the costs of stiffened and un-stiffened structural versions of plates and shells. In this respect, this book will be an invaluable aid for designers, students, researchers and manufacturers to find better, optimal, competitive structural solutions. Emphasis is placed on economy and cost calculation, making it possible to compare costs and make significant savings in the design stages of metal structures. Optimizes numerical applications and analyses various theoretical and industrial problems, such as belt-conveyor bridge, pipeline, wind turbine power, large-span suspended roof and offshore jacket member. An invaluable aid for designers, students, researchers and manufacturers to find better, optimal, competitive structural solutions.

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