Structural Optimization For Seismic Design

Structural Dynamic Systems Computational Techniques and OptimizationAnalysis and Design of Marine StructuresPerformance-Based Seismic Design of Concrete Structures and InfrastructuresBuilding Control with Passive DampersReliability and Optimization of Structural SystemsAn Introduction to Structural OptimizationSeismic Design Aids for Nonlinear Pushover Analysis of Reinforced Concrete and Steel BridgesResearch and Applications in Structural Engineering, Mechanics and ComputationIntelligent Computational Paradigms in Earthquake EngineeringPerformance-Based Seismic Bridge DesignEarthquake Resistant Design of BuildingsDesigning Tall BuildingsAdvances in Metaheuristic Algorithms for Optimal Design of StructuresStructural Design Optimization Considering UncertaintiesStructural Seismic Design Optimization and Earthquake Engineering: Formulations and ApplicationsDesign and Optimization of Metal StructuresReliability and Optimization of Structural SystemsOptimization of Design for Better Structural CapacityCapacity Design and Topology Optimization of Rocking Spine Systems for Nonlinear Earthquake ResponseOptimization of Structural Systems and Industrial ApplicationsOptimization and Anti-optimization of Structures Under UncertaintyOptimization of Seismic Design of Single Column Circular Reinforced Concrete Bridge PiersDesign Optimization of Active and Passive Structural Control SystemsComputational Structural

Dynamics and Earthquake EngineeringEarthquake EngineeringProbabilistic performance-based seismic designIntelligent Computational Paradigms in Earthquake EngineeringRecent Advances in Optimal Structural DesignStructural Fire EngineeringSeismic Design Aids for Nonlinear Pushover Analysis of Reinforced Concrete and Steel BridgesReliability and Optimization of Structural SystemsAdvances in Engineering Structures, Mechanics & ConstructionRecent Developments in Structural OptimizationMetaheuristics and Optimization in Civil EngineeringMeta-heuristic Algorithms for Optimal Design of Real-Size StructuresStructural OptimizationIntegrated Seismic Design of Structure and Control SystemsUse of Shakedown Analysis Technique in Optimum Seismic Design of Moment-resisting Steel StructureOptimization of Structural and Mechanical SystemsASCE Manuals and Reports on Engineering Practice

Structural Dynamic Systems Computational Techniques and Optimization

Introducing important concepts in the study of earthquakes related to retrofitting of structures to be made earthquake resistant. The book investigates the pounding effects on base-isolated buildings, the soil-structure-interaction effects on adjacent buildings due to the impact, the seismic protection of adjacent buildings and the mitigation of earthquakeinduced vibrations of two adjacent structures. These concepts

call for a new understanding of controlled systems with passive-active dampers and semi-active dampers. The passive control strategy of coupled buildings is investigated for seismic protection in comparison to active and semi-active control strategies.

Analysis and Design of Marine Structures

This book contains 38 papers presented at the seventh Working Conference on 'Reliability and Optimization of Structural Systems' held at Boulder, Colorado, USA, on April 2-4, 1996. The Working Conference was organized by the IFIP (International Federation for Information Processing) Working Group 7.5 of Technical Committee 7 and was the seventh in a series of similar conferences. The objectives of the Working Group and hence this publication are: . to promote modern structural systems optimization and reliability theory, . to advance international co-operation in the field of structural system optimization and reliability theory, . to stimulate research, development and application of structural system optimization and reliability theory, . to further dissemination and exchange of information on reliability and optimization of structural systems, and . to encourage education in structural system organization and reliability theory.

Performance-Based Seismic Design of Concrete Structures and Infrastructures

Despite the development of advanced methods,

models, and algorithms, optimization within structural engineering remains a primary method for overcoming potential structural failures. With the overarching goal to improve capacity, limit structural damage, and assess the structural dynamic response, further improvements to these methods must be entertained. Optimization of Design for Better Structural Capacity is an essential reference source that discusses the advancement and augmentation of optimization designs for better behavior of structure under different types of loads, as well as the use of these advanced designs in combination with other methods in civil engineering. Featuring research on topics such as industrial software, geotechnical engineering, and systems optimization, this book is ideally designed for architects, professionals, researchers, engineers, and academicians seeking coverage on advanced designs for use in civil engineering environments.

Building Control with Passive Dampers

"This book contains contributions that cover a wide spectrum of very important real-world engineering problems, and explores the implementation of neural networks for the representation of structural responses in earthquake engineering. It assesses the efficiency of seismic design procedures and describes the latest findings in intelligent optimal control systems and their applications in structural engineering"--Provided by publisher.

Reliability and Optimization of Structural

Systems

Nonlinear static monotonic (pushover) analysis has become a common practice in performance-based bridge seismic design. The popularity of pushover analysis is due to its ability to identify the failure modes and the design limit states of bridge piers and to provide the progressive collapse sequence of damaged bridges when subjected to major earthquakes. Seismic Design Aids for Nonlinear Pushover Analysis of Reinforced Concrete and Steel Bridges fills the need for a complete reference on pushover analysis for practicing engineers. This technical reference covers the pushover analysis of reinforced concrete and steel bridges with confined and unconfined concrete column members of either circular or rectangular cross sections as well as steel members of standard shapes. It provides step-by-step procedures for pushover analysis with various nonlinear member stiffness formulations, including: Finite segment–finite string (FSFS) Finite segment–moment curvature (FSMC) Axial load–moment interaction (PM) Constant moment ratio (CMR) Plastic hinge length (PHL) Ranging from the simplest to the most sophisticated, the methods are suitable for engineers with varying levels of experience in nonlinear structural analysis. The authors also provide a downloadable computer program, INSTRUCT (INelastic STRUCTural Analysis of Reinforced-Concrete and Steel Structures), that allows readers to perform their own pushover analyses. Numerous real-world examples demonstrate the accuracy of analytical prediction by comparing

numerical results with full- or large-scale test results. A useful reference for researchers and engineers working in structural engineering, this book also offers an organized collection of nonlinear pushover analysis applications for students.

An Introduction to Structural Optimization

This volume contains papers presented at the 11th scientific meeting of the IFIP working group on reliability and optimization of structural systems. The purpose of Working Group 7.5 is to promote modern structural system reliability and optimization theory and its applications; stimulate research, development, and application; assist and advance research and development; further the dissemination and exchange of information; and encourage education. The main themes include structural reliability methods and applications, engineering risk analysis and decision-making, new optimization techniques and various applications in civil engineering.

Seismic Design Aids for Nonlinear Pushover Analysis of Reinforced Concrete and Steel Bridges

Solid design and craftsmanship are a necessity for structures and infrastructures that must stand up to natural disasters on a regular basis. Continuous research developments in the engineering field are imperative for sustaining buildings against the threat of earthquakes and other natural disasters.

Performance-Based Seismic Design of Concrete Structures and Infrastructures is an informative reference source on all the latest trends and emerging data associated with structural design. Highlighting key topics such as seismic assessments, shear wall structures, and infrastructure resilience, this is an ideal resource for all academicians, students, professionals, and researchers that are seeking new knowledge on the best methods and techniques for designing solid structural designs.

Research and Applications in Structural Engineering, Mechanics and Computation

Rocking spine systems are innovative earthquake-resistant structural systems that dampen seismic shaking through uplift at the base and confine damage to energy-dissipating fuses, thereby significantly reducing the potential of building downtime. Currently, United States building codes and standards provide very limited design guidelines for such systems. This thesis focuses on developing procedures and algorithms for design and optimization of rocking spine systems under nonlinear earthquake response. A new capacity design procedure, the modified modal superposition (MMS) method, is developed for the seismic design of rocking spine systems. The methodology uses an efficient elastic response spectrum analysis to approximate the nonlinear earthquake response through (1) modified boundary conditions to simulate rocking at maximum considered earthquake (MCE) level and (2) a first mode inelastic reduction factor.

The methodology is extended to coupled and stacked rocking braced frames, as well as strongback systems, with various hysteretic and viscous dampers. Using nonlinear dynamic analyses on a set of seven archetype frames ranging from 6 to 18 stories, the MMS procedure is shown to accurately capture higher modes effects and estimate axial brace and column forces. A reliability analysis conducted supports applying a load amplification factor of 1.3 for scaling the MMS seismic forces to design the steel braced frame as force-controlled components. A new dynamic topology optimization methodology, called the sum of modal compliances (SMC), is introduced for seismic loading. Recently developed dynamic topology optimization procedures for linear elastic response in the frequency domain are compared and contrasted. The novel procedure is applied to the design of lateral bracing system of high-rise buildings for various earthquake hazards and yields important considerations of the influence of higher modes on the overall dynamic response of the system. The efficiency of the SMC optimization algorithm is demonstrated on a 3D high-rise building with over one million degrees of freedom. Using the modified modal superposition as inspiration, the dynamic topology optimization procedure is extended to design of the elastic spine in rocking braced frames for nonlinear earthquake response. The extruded optimized bracing pattern is compared to a conventional X-bracing system using nonlinear dynamic analyses. An optimization framework is proposed for selecting the number, location and properties of nonlinear dampers in stacked rocking systems, where the total overturning moment in the

spine is minimized, subjected to interstory drift and hinge rotation constraints. A ground motion selection routine is developed to facilitate the optimization by estimating the median dynamic response under earthquakes. Algorithmic procedures are developed to solve the structural optimization problem using both modified sequential linear programming (SLP) method and particle swarm optimization (PSO). On a 20-story dual rocking hinge case study, the SLP algorithm is shown to converge to the optimum with less than 40 nonlinear dynamic analyses compared to over 4,000 for an exhaustive search. For a 20-story stacked rocking system with N arbitrary hinges, the SLP optimization yields three rocking joints, whereby the total overturning moment in the spine is reduced by half compared to the initial design, while maintaining drift limits below 2.5% at MCE level. Overall, this thesis introduces design and optimization procedures for both the rocking spine and nonlinear articulated hinges. This research project demonstrates the advantages of rocking spine systems for improved seismic performance and introduces novel optimization algorithms for structural design under earthquake loading.

Intelligent Computational Paradigms in Earthquake Engineering

The structural optimization procedure presented in this book makes it possible to achieve seismic protection through integrated structural/control system design. In particular, it is explained how slender structural systems with a high seismic

performance can be achieved through inclusion of viscous and viscoelastic dampers as an integral part of the system. Readers are provided with essential introductory information on passive structural control and passive energy dissipation systems. Dynamic analyses of both single and multiple degree of freedom systems are performed in order to verify the achievement of pre-assigned performance targets, and it is explained how the optimal integrated design methodology, also relevant to retrofitting of existing buildings, should be applied. The book illustrates how structural control research is opening up new possibilities in structural forms and configurations without compromising structural performance.

Performance-Based Seismic Bridge Design

Earthquake Resistant Design of Buildings

A typical engineering task during the development of any system is, among others, to improve its performance in terms of cost and response. Improvements can be achieved either by simply using design rules based on the experience or in an automated way by using optimization methods that lead to optimum designs. Design Optimization of Active and Passive Structural Control Systems includes Earthquake Engineering and Tuned Mass Damper research topics into a volume taking advantage of the connecting link between them, which is optimization. This is a publication addressing

the design optimization of active and passive control systems. This title is perfect for engineers, professionals, professors, and students alike, providing cutting edge research and applications.

Designing Tall Buildings

This book presents the proceedings of an International Conference on Advances in Engineering Structures, Mechanics & Construction, held in Waterloo, Ontario, Canada, May 14-17, 2006. The contents include contains the texts of all three plenary presentations and all seventy-three technical papers by more than 153 authors, presenting the latest advances in engineering structures, mechanics and construction research and practice.

Advances in Metaheuristic Algorithms for Optimal Design of Structures

Structural Design Optimization Considering Uncertainties

This book provides a discussion of the general impact of WTO membership on both sides of the Taiwan Strait, and addresses the political and economic impact on cross-Strait relations of common membership. The book begins with an introduction which analyzes the state of cross-Strait economic and political relations on the eve of dual accession to the WTO and briefly introduces the chapters which follow. The first chapter discusses the concessions made by

both sides in their accession agreements and is followed by two chapters which describe the manner in which the Taiwan economy was reformed to achieve compliance as well as the specific, restrictive trade regime that was put into place to manage mainland trade. The next two chapters deal with the implications of that restrictive trade regime for the Taiwan economy in Asia and with the nature of the interactions between the two sides within the WTO. The final four chapters of the volume examine the impact of membership on four sectors of the economy: finance; agriculture; electronics and automobiles. There is a post-script which briefly covers developments since the chapters were completed.

Structural Seismic Design Optimization and Earthquake Engineering: Formulations and Applications

Today's biggest structural engineering challenge is to design better structures, and a key issue is the need to take an integrated approach which balances control of costs with the requirement for handling earthquakes and other dynamic forces. Structural optimization is based on rigorous mathematical formulation and requires computation algorithms for sizing structural elements and synthesizing systems. Now that the right software and enough computing power are readily available, professionals can now develop a suite of alternative designs and a select suitable one. A thoroughly-written and practical book on structural optimization is long overdue. This solid

book comprehensively presents current optimization strategies, illustrated with sufficient examples of the design of elements and systems and presenting descriptions of the process and results. Emphasis is given to dynamic loading, in particular to seismic forces. Researchers and practising engineers will find this book an excellent reference, and advanced undergraduates or graduate students can use it as a resource for structural optimization design.

Design and Optimization of Metal Structures

This second edition of Designing Tall Buildings, an accessible reference to guide you through the fundamental principles of designing high-rises, features two new chapters, additional sections, 400 images, project examples, and updated US and international codes. Each chapter focuses on a theme central to tall-building design, giving a comprehensive overview of the related architecture and structural engineering concepts. Author Mark Sarkisian, PE, SE, LEED® AP BD+C, provides clear definitions of technical terms and introduces important equations, gradually developing your knowledge. Projects drawn from SOM’s vast portfolio of built high-rises, many of which Sarkisian engineered, demonstrate these concepts. This book advises you to consider the influence of a particular site's geology, wind conditions, and seismicity. Using this contextual knowledge and analysis, you can determine what types of structural solutions are best suited for a tower on that site. You can then conceptualize and

devise efficient structural systems that are not only safe, but also constructible and economical. Sarkisian also addresses the influence of nature in design, urging you to integrate structure and architecture for buildings of superior performance, sustainability, and aesthetic excellence.

Reliability and Optimization of Structural Systems

Nonlinear static monotonic (pushover) analysis has become a common practice in performance-based bridge seismic design. The popularity of pushover analysis is due to its ability to identify the failure modes and the design limit states of bridge piers and to provide the progressive collapse sequence of damaged bridges when subjected to major earthquakes. Seismic Design Aids for Nonlinear Pushover Analysis of Reinforced Concrete and Steel Bridges fills the need for a complete reference on pushover analysis for practicing engineers. This technical reference covers the pushover analysis of reinforced concrete and steel bridges with confined and unconfined concrete column members of either circular or rectangular cross sections as well as steel members of standard shapes. It provides step-by-step procedures for pushover analysis with various nonlinear member stiffness formulations, including: Finite segment–finite string (FSFS) Finite segment–moment curvature (FSMC) Axial load–moment interaction (PM) Constant moment ratio (CMR) Plastic hinge length (PHL) Ranging from the simplest to the most sophisticated, the methods are

suitable for engineers with varying levels of experience in nonlinear structural analysis. The authors also provide a downloadable computer program, INSTRUCT (INelastic STRUCTural Analysis of Reinforced-Concrete and Steel Structures), that allows readers to perform their own pushover analyses. Numerous real-world examples demonstrate the accuracy of analytical prediction by comparing numerical results with full- or large-scale test results. A useful reference for researchers and engineers working in structural engineering, this book also offers an organized collection of nonlinear pushover analysis applications for students.

Optimization of Design for Better Structural Capacity

"This book contains contributions that cover a wide spectrum of very important real-world engineering problems, and explores the implementation of neural networks for the representation of structural responses in earthquake engineering. It assesses the efficiency of seismic design procedures and describes the latest findings in intelligent optimal control systems and their applications in structural engineering"--Provided by publisher.

Capacity Design and Topology Optimization of Rocking Spine Systems for Nonlinear Earthquake Response

"TRB's National Cooperative Highway Research Program (NCHRP) Synthesis 440, Performance-Based

Seismic Bridge Design (PBSD) summarizes the current state of knowledge and practice for PBSD. PBSD is the process that links decision making for facility design with seismic input, facility response, and potential facility damage. The goal of PBSD is to provide decision makers and stakeholders with data that will enable them to allocate resources for construction based on levels of desired seismic performance"--Publisher's description.

Optimization of Structural Systems and Industrial Applications

This volume contains 28 papers by renowned international experts on the latest advances in structural reliability methods and applications, engineering risk analysis and decision making, new optimization techniques and various applications in civil engineering. Moreover, several contributions focus on the assessment and optimization of existing str

Optimization and Anti-optimization of Structures Under Uncertainty

Optimization of Seismic Design of Single Column Circular Reinforced Concrete Bridge Piers

Throughout the past few years, there has been extensive research done on structural design in terms

of optimization methods or problem formulation. But, much of this attention has been on the linear elastic structural behavior, under static loading condition. Such a focus has left researchers scratching their heads as it has led to vulnerable structural configurations. What researchers have left out of the equation is the element of seismic loading. It is essential for researchers to take this into account in order to develop earthquake resistant real-world structures. Structural Seismic Design Optimization and Earthquake Engineering: Formulations and Applications focuses on the research around earthquake engineering, in particular, the field of implementation of optimization algorithms in earthquake engineering problems. Topics discussed within this book include, but are not limited to, simulation issues for the accurate prediction of the seismic response of structures, design optimization procedures, soft computing applications, and other important advancements in seismic analysis and design where optimization algorithms can be implemented. Readers will discover that this book provides relevant theoretical frameworks in order to enhance their learning on earthquake engineering as it deals with the latest research findings and their practical implementations, as well as new formulations and solutions.

Design Optimization of Active and Passive Structural Control Systems

The increasing necessity to solve complex problems in Structural Dynamics and Earthquake Engineering

requires the development of new ideas, innovative methods and numerical tools for providing accurate numerical solutions in affordable computing times. This book presents the latest scientific developments in Computational Dynamics, Stochastic Dynam

Computational Structural Dynamics and Earthquake Engineering

Earthquake Engineering

The volume presents a collaboration between internationally recognized experts on anti-optimization and structural optimization, and summarizes various novel ideas, methodologies and results studied over 20 years. The book vividly demonstrates how the concept of uncertainty should be incorporated in a rigorous manner during the process of designing real-world structures. The necessity of anti-optimization approach is first demonstrated, then the anti-optimization techniques are applied to static, dynamic and buckling problems, thus covering the broadest possible set of applications. Finally, anti-optimization is fully utilized by a combination of structural optimization to produce the optimal design considering the worst-case scenario. This is currently the only book that covers the combination of optimization and anti-optimization. It shows how various optimization techniques are used in the novel anti-optimization technique, and how the structural optimization can be exponentially enhanced by incorporating the concept of worst-case

scenario, thereby increasing the safety of the structures designed in various fields of engineering.

Probabilistic performance-based seismic design

Conventional seismic design has been based on structural strength in the initial design of structures, resulting in lateral force resisting systems with sufficient strength to be able to absorb and dissipate the seismic. For important structures such as urban high speed road systems, high rise buildings, hospitals, airports and other essential structures which must be quite functional after an earthquake, modern seismic structural design techniques have been developed with a view toward eliminating or significantly reducing seismic damage to such structures. This volume is a comprehensive treatment of the issues involved in modern seismic design techniques for structure with a view to significantly enhancing their capability of surviving earthquakes to an adequate degree, i.e., enhancing the ability of structural systems to withstand high level earthquakes.

Intelligent Computational Paradigms in Earthquake Engineering

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

Recent Advances in Optimal Structural Design

'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.

Structural Fire Engineering

Seismic Design Aids for Nonlinear Pushover Analysis of Reinforced Concrete and Steel Bridges

This timely book deals with a current topic, i.e. the applications of metaheuristic algorithms, with a primary focus on optimization problems in civil engineering. The first chapter offers a concise overview of different kinds of metaheuristic algorithms, explaining their advantages in solving complex engineering problems that cannot be effectively tackled by traditional methods, and citing the most important works for further reading. The remaining chapters report on advanced studies on the applications of certain metaheuristic algorithms to specific engineering problems. Genetic algorithm, bat algorithm, cuckoo search, harmony search and simulated annealing are just some of the methods presented and discussed step by step in real-application contexts, in which they are often used in combination with each other. Thanks to its synthetic yet meticulous and practice-oriented approach, the book is a perfect guide for graduate students, researchers and professionals willing to applying metaheuristic algorithms in civil engineering and other related engineering fields, such as mechanical,

transport and geotechnical engineering. It is also a valuable aid for both lectures and advanced engineering students.

Reliability and Optimization of Structural Systems

This book has grown out of lectures and courses given at Linköping University, Sweden, over a period of 15 years. It gives an introductory treatment of problems and methods of structural optimization. The three basic classes of geometrical - timization problems of mechanical structures, i. e. , size, shape and topology op- mization, are treated. The focus is on concrete numerical solution methods for d- crete and (?nite element) discretized linear elastic structures. The style is explicit and practical: mathematical proofs are provided when arguments can be kept e- mentary but are otherwise only cited, while implementation details are frequently provided. Moreover, since the text has an emphasis on geometrical design problems, where the design is represented by continuously varying—frequently very many— variables, so-called ?rst order methods are central to the treatment. These methods are based on sensitivity analysis, i. e. , on establishing ?rst order derivatives for - jectives and constraints. The classical ?rst order methods that we emphasize are CONLIN and MMA, which are based on explicit, convex and separable appro- mations. It should be remarked that the classical and frequently used so-called op- mality criteria method is also of this kind. It may also be noted in this context that zero order methods such as response surface

methods, surrogate models, neural n- works, genetic algorithms, etc. , essentially apply to different types of problems than the ones treated here and should be presented elsewhere.

Advances in Engineering Structures, Mechanics & Construction

In the last ten to fifteen years a vast amount of research has been undertaken to improve on earlier methods for analysing the seismic reliability of structures. These efforts focused on identifying aspects of prominent relevance and disregarding the inessential ones, with the goal of producing methods that are both more efficient and easier to use in practice. Today this goal can be said to be substantially achieved. During these years scientific activity covered all of the many aspects involved in such a multi-disciplinary problem, ranging from seismology, to geotechnics, to structural analysis and economy, all of them to be consistently organised into a probabilistic framework. As the output of this research was dispersed into a multitude of technical papers, fib Commission 7 thought it worthwhile to select the essential aspects of this large body of knowledge and to present them into a coherent and accessible document for structural engineers. To this end a task group of specialists was formed, whose qualifications come from their personal involvement in the above-mentioned developments throughout this period of time. From its inception the group decided that the bulletin should have had a distinct educational character and provide a clear overview of

the methods available. The outcome is a compact volume that starts by introducing the concepts and definitions of performance-based engineering, continues with two chapters on assessment and design, respectively, presenting the methods in detail accompanied by illustrative examples, and concludes with an appendix with sample programming excerpts for their implementation. It is believed that at present fib Bulletin 68 represents a unique compendium on probabilistic performance-based seismic design.

Recent Developments in Structural Optimization

Prepared by the Fire Protection Committee of the Structural Engineering Institute of ASCE Structural Fire Engineering provides best practices for the field of performance-based structural fire engineering design. When structural systems are heated by fire, they experience thermal effects that are not contemplated by conventional structural engineering design. Traditionally, structural fire protection is prescribed for structures after they have been optimized for ambient design loads, such as gravity, wind, and seismic, among others. This century-old prescriptive framework endeavors to reduce the heating of individual structural components with the intent of mitigating the risk of structural failure under fire exposure. Accordingly, the vulnerability of buildings to structural failure from uncontrolled fire varies across jurisdictions-which have differing structural design requirements for ambient loads-and as a function of building system and component

configuration. As an alternative approach, Standard ASCE 7-16 permits the application of performance-based structural fire design (also termed structural fire engineering design) to evaluate the performance of structural systems explicitly under fire exposure in a similar manner as other design loads are treated in structural engineering practice. Structural fire engineering design is the calculated design of a structure to withstand the thermal load effects of fire, which have the potential to alter the integrity of a structure, based on specific performance criteria. This manual, MOP 138, addresses the current practice, thermal and structural analysis methods, and available information to support structural fire engineering design. It covers - Background information on the protection of structures from fire and the effects of fire on different types of construction, - Key distinctions between standard fire resistance design and structural fire engineering design, - Guidance for evaluating thermal boundary conditions on a structure because of fire exposure and on conducting heat transfer calculations based on the material thermal properties, - Performance objectives for structures under fire exposure, and - Analysis techniques that can be used to quantify structural response to fire effects. This Manual of Practice is a valuable resource for structural engineers, architects, building officials, and academics concerned with performance-based design for structural fire safety.

Metaheuristics and Optimization in Civil Engineering

The recent introduction of active and passive structural control methods has given structural designers powerful tools for performance-based design. However, structural engineers often lack the tools for the optimal selection and placement of such systems. In Building Control with Passive Dampers , Takewaki brings together most the reliable, state-of-the-art methods in practice around the world, arming readers with a real sense of how to address optimal selection and placement of passive control systems. The first book on optimal design, sizing, and location selection of passive dampers Combines theory and practical applications Describes step-by-step how to obtain optimal damper size and placement Covers the state-of-the-art in optimal design of passive control Integrates the most reliable techniques in the top literature and used in practice worldwide Written by a recognized expert in the area MATLAB code examples available from the book's Companion Website This book is essential for post-graduate students, researchers, and design consultants involved in building control. Professional engineers and advanced undergraduates interested in seismic design, as well as mechanical engineers looking for vibration damping techniques, will also find this book a helpful reference. Code examples available at www.wiley.com/go/takewaki

Meta-heuristic Algorithms for Optimal Design of Real-Size Structures

Uncertainties play a dominant role in the design and optimization of structures and infrastructures. In

optimum design of structural systems due to variations of the material, manufacturing variations, variations of the external loads and modelling uncertainty, the parameters of a structure, a structural system and its environment are not given, fixed coefficients, but random variables with a certain probability distribution. The increasing necessity to solve complex problems in Structural Optimization, Structural Reliability and Probabilistic Mechanics, requires the development of new ideas, innovative methods and numerical tools for providing accurate numerical solutions in affordable computing times. This book presents the latest findings on structural optimization considering uncertainties. It contains selected contributions dealing with the use of probabilistic methods for the optimal design of different types of structures and various considerations of uncertainties. The first part is focused on reliability-based design optimization and the second part on robust design optimization. Comprising twenty-one, self-contained chapters by prominent authors in the field, it forms a complete collection of state-of-the-art theoretical advances and applications in the fields of structural optimization, structural reliability, and probabilistic computational mechanics. It is recommended to researchers, engineers, and students in civil, mechanical, naval and aerospace engineering and to professionals working on complicated costs-effective design problems.

Structural Optimization

Research and Applications in Structural Engineering, Mechanics and Computation contains the Proceedings of the Fifth International Conference on Structural Engineering, Mechanics and Computation (SEMC 2013, Cape Town, South Africa, 2-4 September 2013). Over 420 papers are featured. Many topics are covered, but the contributions may be seen to fall

Integrated Seismic Design of Structure and Control Systems

The contributions in this book discuss large-scale problems like the optimal design of domes, antennas, transmission line towers, barrel vaults and steel frames with different types of limitations such as strength, buckling, displacement and natural frequencies. The authors use a set of definite algorithms for the optimization of all types of structures. They also add a new enhanced version of VPS and information about configuration processes to all chapters. Domes are of special interest to engineers as they enclose a maximum amount of space with a minimum surface and have proven to be very economical in terms of consumption of constructional materials. Antennas and transmission line towers are the one of the most popular structure since these steel lattice towers are inexpensive, strong, light and wind resistant. Architects and engineers choose barrel vaults as viable and often highly suitable forms for covering not only low-cost industrial buildings, warehouses, large-span hangars, indoor sports stadiums, but also large cultural and leisure centers. Steel buildings are preferred in

residential as well as commercial buildings due to their high strength and ductility particularly in regions which are prone to earthquakes.

Use of Shakedown Analysis Technique in Optimum Seismic Design of Moment-resisting Steel Structure

This book presents efficient metaheuristic algorithms for optimal design of structures. Many of these algorithms are developed by the author and his colleagues, consisting of Democratic Particle Swarm Optimization, Charged System Search, Magnetic Charged System Search, Field of Forces Optimization, Dolphin Echolocation Optimization, Colliding Bodies Optimization, Ray Optimization. These are presented together with algorithms which were developed by other authors and have been successfully applied to various optimization problems. These consist of Particle Swarm Optimization, Big Bang-Big Crunch Algorithm, Cuckoo Search Optimization, Imperialist Competitive Algorithm, and Chaos Embedded Metaheuristic Algorithms. Finally a multi-objective optimization method is presented to solve large-scale structural problems based on the Charged System Search algorithm. The concepts and algorithms presented in this book are not only applicable to optimization of skeletal structures and finite element models, but can equally be utilized for optimal design of other systems such as hydraulic and electrical networks.

Optimization of Structural and

Mechanical Systems

Sponsored by the Technical Committee on Structural Design of the Technical Administrative Committee on Analysis and Computation of the Technical Activities Division of the Structural Engineering Institute of ASCE. This report documents the dramatic new developments in the field of structural optimization over the last two decades. Changes in both computational techniques and applications can be seen by developments in computational methods and solution algorithms, the role of optimization during the various stages of structural design, and the stochastic nature of design in relation to structural optimization. Topics include: Ømethods for discrete variable structural optimization; Ødecomposition methods in structural optimization; Østate of the art on the use of genetic algorithms in design of steel structures; Øconceptual design optimization of engineering structures; Øtopology and geometry optimization of trusses and frames; Øevolutionary structural optimization; Ødesign and optimization of semi-rigid framed structures; Øoptimized performance-based design for buildings; Ømulti-objective optimum design of seismic-resistant structures; and Øreliability- and cost-oriented optimal bridge maintenance planning. The book concludes with an extensive bibliography of journal papers on structural optimization published between 1987 and 1999.

ASCE Manuals and Reports on Engineering Practice

A unified presentation of engineering seismology and earthquake-resistant design, this book presents a wide ranging coverage of the whole subject of earthquake engineering so that the reader is given a clear appreciation of earthquakes before dealing with their effects on structures. In addition, newer mathematical modelling techniques are introduced which can be powerful tools for assessing and dealing with the risks associated with design and construction in seismic regions.