Structural Design Optimization Considering Uncertainties Structures Infrastructures Book Vol 1 Series Series Editor Dan M Frangopol Structures And Infrastructures

In the past, the possibilities of structural optimization were restricted to an optimal choice of profiles and shape. Further improvement can be obtained by selecting appropriate advanced materials and by optimizing the topology, i.e. finding the best position and arrangement of structural elements within a construction. The optimization of structural topology permits the use of optimization algorithms at a very early stage of the design process. The method presented in this book has been developed by Martin Bendsoe in cooperation with other researchers and can be considered as one of the most effective approaches to the optimization of layout and material design.

Handbook of Probabilistic Models carefully examines the application of advanced probabilistic models in conventional engineering fields. In this comprehensive handbook, practitioners, researchers and scientists will find detailed explanations of technical concepts, applications of the proposed methods, and the respective scientific approaches needed to solve the problem. This book provides an interdisciplinary approach that creates advanced probabilistic models for engineering fields, ranging from conventional fields of mechanical engineering and civil engineering, to electronics, electrical, earth sciences, climate, agriculture, water resource, mathematical sciences and computer sciences. Specific topics covered include minimax probability machine regression, stochastic finite element method, relevance vector machine, logistic regression, Monte Carlo simulations, random matrix, Gaussian process regression, Kalman filter, stochastic optimization, maximum likelihood, Bayesian inference, Bayesian update, kriging, copula-statistical models, and more. Explains the application of advanced probabilistic models encompassing multidisciplinary research Applies probabilistic modeling to emerging areas in engineering Provides an interdisciplinary approach to probabilistic models and their applications, thus solving a wide range of practical problems

To implement the proposed probabilistic optimization method, two numerical examples are considered: the Cantilever Beam and the Scratch Drive Actuator (SDA), which is widely used in micro electromechanical systems (MEMS). Simulation results show that using the proposed optimization methodology significantly improves the accuracy of calculation. These results show that the difference between FOSM and FORM is growing by increasing the prescribed reliability for design. Furthermore, it is confirmed that the strain based fatigue approach is a more accurate design optimization criterion, in which both high cycle and low cycle fatigue life requirements, along with the local elastic-plastic analysis, are considered. The simulation results are also verified by Monte Carlo method or by existing data from the literature. This thesis presents a probabilistic optimization methodology for reliable design of structures with fatigue crack initiation constraint. A commonly used design optimization methodology for engineering systems comprises deterministic modeling. However, the existence of uncertainties in physical quantities, such as manufacturing tolerances, material properties, applied loads and fatigue life cycles, requires the probabilistic optimization technique. Moreover, very little research has been conducted to incorporate the fatigue life constraint into design optimization. To overcome this limitation in optimization techniques, a new reliability-based design optimization is proposed considering fatigue strength or fatigue life as a requirement in performance function. In this method, a multivariable objective function is constructed along with nonlinear probabilistic constraints. The probabilistic constraints consist of probability failure as well as fatigue failure criteria. The corresponding fatigue criterion is defined as the crack initiation phase in both stress- and strain-based models, respectively. The elements required for the probabilistic fatigue life calculations are also addressed. The first-order second-moment method (FOSM), first-order reliability method (FORM), and Monte Carlo method are adopted to assess the probability failure based on the concept of reliability indices. This concept is used to approximate the proposed fatigue life performance function about the most probable point. The sequential quadratic optimization technique is employed and a code is developed to solve the nonlinear optimization problem. The illustrative examples explain that the developed probabilistic optimization is not only more accurate and efficient, but it is also more realistic than the deterministic approach. Since reliability and fatigue failure are two important integrated parts in MEMS design, this proposed method can be applied in design optimization of these devices. This kind of methodology in design optimization is very practical and beneficial to industries, particularly in MEMS.

This book provides theories on non-parametric shape optimization problems, systematically keeping in mind readers with an engineering background. Non-parametric shape optimization problems are defined as problems of finding the shapes of domains in which boundary value problems of partial differential equations are defined. In these problems, optimum shapes are obtained from an arbitrary form without any geometrical parameters previously assigned. In particular, problems in which the optimum shape is sought by making a hole in domain are called topology optimization problems. Moreover, a problem in which the optimum shape is obtained based on domain variation is referred to as a shape optimization problem of domain variation type, or a shape optimization problem in a limited sense. Software has been developed to solve these problems, and it is being used to seek practical optimum shapes. However, there are no books explaining such theories beginning with their foundations. The structure of the book is shown in the Preface. The theorems are built up using mathematical results. Therefore, a mathematical style is introduced, consisting of definitions and theorems to summarize the key points. This method of expression is advanced as provable facts are clearly shown. If something to be investigated is contained in the framework of mathematics, setting up a theory using theorems prepared by great mathematicians is thought to be an extremely effective approach. However, mathematics attempts to heighten the level of abstraction in order to understand many things in a unified fashion. This characteristic may baffle readers with an engineering background. Hence in this book, an attempt has been made to provide explanations in engineering terms, with examples from mechanics, after accurately denoting the provable facts using definitions and theorems.

ABSTRACT: Uncertainties exist practically everywhere from structural design to manufacturing, product lifetime service, and maintenance. Uncertainties can be introduced by errors in modeling and simulation; by manufacturing imperfections (such as variability in material properties and structural geometric dimensions); and by variability in loading. Structural design by safety factors using nominal values without considering uncertainties may lead to designs that are either unsafe, or too conservative and thus not efficient. The focus of this dissertation is reliability-based design optimization (RBDO) of composite structures. Uncertainties are modeled by the probabilistic distributions of random variables.

Evolutionary Structural Optimization (ESO) is a design method based on the simple concept of gradually removing inefficient material from a structure as it is being designed. Through this method, the resulting structure will evolve towards its optimum shape. The latest techniques and results of ESO are presented here, illustrated by numerous clear and detailed examples. Sections cover the fundamental aspects of the method, the application to multiple load cases and multiple support environments, frequency optimization, stiffness and displacement constraints, buckling, jointed frame structures, shape optimization, and stress reduction. This is followed by a section describing Evolve97, a software package which will allow readers to try the ideas of ESO themselves and to solve their optimization problems. This software is provided on a computer diskette which accompanies the book.

In this book, the authors present in detail several recent methodologies and algorithms that they developed during the last fifteen years. The deterministic methods account for uncertainties through empirical safety factors, which implies that the actual uncertainties in materials, geometry and loading are not truly considered. This problem becomes much more complicated when considering biomechanical applications where a number of uncertainties are encountered in the design of prosthesis systems. This book implements improved numerical strategies and algorithms that can be applied to biomechanical studies.

A rigorous yet accessible graduate textbook covering both fundamental and advanced optimization theory and algorithms.

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.

While numerous advanced statistical approaches have recently been developed for quantitative trait loci (QTL) mapping, the methods are scattered throughout the literature. Statistical Methods for QTL Mapping brings together many recent statistical techniques that address the data complexity of QTL mapping. After introducing basic genetics topics and statistical principles, the author discusses the principles of quantitative genetics, general statistical issues of QTL mapping, commonly used one-dimensional QTL mapping approaches, and multiple interval mapping methods. He then explains how to use a feature selection approach to tackle a QTL mapping problem with dense markers. The book also provides comprehensive coverage of Bayesian models and MCMC algorithms and describes methods for multi-trait QTL mapping and eQTL mapping, including meta-trait methods and multivariate sequential procedures. This book emphasizes the modern statistical methodology for QTL mapping as well as the statistical issues that arise during this process. It gives the necessary biological background for statisticians without training in genetics and, likewise, covers statistical thinking and principles for geneticists. Written primarily for geneticists and statisticians specializing in QTL mapping, the book can also be used as a supplement in graduate courses or for self-study by PhD students working on QTL mapping projects.

The field of structural optimization is still a relatively new field undergoing rapid changes in methods and focus. Until recently there was a severe imbalance between the enormous amount of literature on the subject, and the paucity of applications to practical design problems. This imbalance is being gradually redressed now. There is still no shortage of new publications, but there are also exciting applications of the methods of structural optimizations in the automotive, aerospace, civil engineering, machine design and other engineering fields. As a result of the growing pace of applications, research into structural optimization methods is increasingly driven by real-life problems. Most engineers who design structures employ complex general-purpose software packages for structural analysis. Often they do not have any access to the source the details of program, and even more frequently they have only scant knowledge of the structural analysis algorithms used in this software packages. Therefore the major challenge faced by researchers in structural optimization is to develop methods that are suitable for use with such software packages. Another major challenge is the high computational cost associated with the analysis of many complex real-life problems. In many cases the engineer who has the task of designing a structure cannot afford to analyze it more than a handful of times.

Matrix Methods for Advanced Structural Analysis covers in detail the theoretical concepts related to rockbursts, and introduces the current computational modeling techniques and laboratory tests available. The second part is devoted to case studies in mining (coal and metal) and tunneling environments worldwide. The third part covers the most recent advances in measurement and monitoring. Special focus is given to the interpretation of signals and reliability of systems. The following part addresses warning and risk mitigation through the proposition of a single risk assessment index and a comprehensive warning index to portray the stress status of the rock and a successful case study. The final part of the book discusses mitigation including best practices for distressing and efficiently supporting rock. Provides a brief historical overview of methods of static analysis, programming principles and suggestions for the rational use of computer programs Provides MATLAB® oriented software for the analysis of beam-like structures Covers the principal steps of the Direct Stiffness Method presented for plane trusses, plane framed structures, space trusses and space framed 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, fi

Proceedings of SPIE present the original research papers presented at SPIE conferences and other high-quality conferences in the broad-ranging fields of optics and photonics. These books provide prompt access to the latest innovations in research and technology in their respective fields. Proceedings of SPIE are among the most cited references in patent literature.

sections dealing with fuzzy functions and fuzzy random functions are certain to be of special interest. The reader is expected to be in command of the knowledge gained in a basic university mathematics course, with the inclusion of stochastic elements. A specification of uncertainty in any particular case is often difficult. For this reason Chaps. 3 and 4 are devoted solely to this problem. The derivation of fuzzy variables for representing informal and lexical uncertainty reflects the subjective assessment of objective conditions in the form of a membership function. Techniques for modeling fuzzy random variables are presented for data that simultaneously exhibit stochastic and nonstochastic properties. The application of fuzzy randomness is demonstrated in three fields of civil engineering and computational mechanics: structural analysis, safety assessment, and design. The methods of fuzzy structural analysis and fuzzy probabilistic structural analysis developed in Chap. 5 are applicable without restriction to arbitrary geometrically and physically nonlinear problems. The most important forms of the latter are the Fuzzy Finite Element Method (FFEM) and the Fuzzy Stochastic Finite Element Method (FSFEM).

Collection of selected, peer reviewed papers from the 2013 2nd International Conference on Machine Design and Manufacturing Engineering (ICMDME 2013), May 1-2, 2013, Jeju Island, South Korea. Volume is indexed by Thomson Reuters CPCI-S (WoS). The 275 papers are grouped as follows: Chapter 1: Design of Machines, Mechanisms and Industrial Devices; Chapter 2: Computational Technologies and Computer-Aided Design in Mechanical Engineering; Chapter 3: Researches, Modeling and Analysis of Machines and Mechanisms; Chapter 4: Automotive Engineering; Chapter 5: Technologies and Organization of Production in Mechanical Engineering; Chapter 6: Sensors, Detection and Measuring Technologies; Chapter 7: Robotics, Automation and Control System; Chapter 8: Applied Materials Science and Chemical Engineering; Chapter 9: Product Design; Chapter 10: Other Themes of Research.

This book provides an insight on advanced methods and concepts for the design and analysis of structures against earthquake loading. This second volume is a collection of 28 chapters written by leading experts in the field of structural analysis and earthquake engineering. Emphasis is given on current state-of-the-art methods and concepts in computing methods and their application in engineering practice. The book content is suitable for both practicing engineers and academics, covering a wide variety of topics in an effort to assist the timely dissemination of research findings for the mitigation of seismic risk. Due to the devastating socioeconomic consequences of seismic events, the topic is of great scientific interest and is expected to be of valuable help to scientists and engineers. The chapters of this volume are extended versions of selected papers presented at the COMPDYN 2011 conference, held in the island of Corfu, Greece, under the auspices of the European Community on Computational Methods in Applied Sciences (ECCOMAS).

Structural design optimization is a useful computational tool to improve the performance of a structural system, develop non-intuitive solutions to a problem, and explore a design space. It has been predominantly developed for and applied to static scenarios. Although a wide variety of systems can be optimized under static conditions, situations where time-dependent and inertial effects need to be taken into consideration often necessitate the use of dynamic solution techniques. These situations include designing for impacts, controlling elastic wave propagation, and mitigating noise and vibration. For these cases, a dynamic response optimization method should be employed. Similarly, most designs are optimized under deterministic conditions. This can be problematic, because without considering the randomness and uncertainty often present in reality, the final solution will most likely be sub-optimal and could end in failure. To address these topics, this work develops a finite-element-based structural topology optimization framework capable of solving transient dynamic problems in the time domain under both deterministic and uncertain conditions. The components of the optimization framework are the primal analysis solved using a Newmark method, the sensitivity analysis performed using the adjoint variable method, the gradient-based optimization routine conducted with the method of moving asymptotes, and the uncertainty module which utilizes a non-intrusive polynomial chaos expansion approach to handle any sources of uncertainty in the material properties, load, boundary conditions, etc. In this density-based topology optimization approach, the solid isotropic material with penalization scheme and a design variable filter are used to prevent instability in the solution, to ensure mesh-independence, and to reduce the presence of intermediate volume fractions in the final design. Examples are solved to illustrate when dynamic response optimization is necessary, how its results compare to a statically optimized case, some of its notable characteristics, and the importance of considering uncertainty in optimization.

Die robuste Optimierung bezieht Unsicherheiten der Eingangsvariablen in den Optimierungsprozess ein und bestimmt Lösungen, die unempfindlich gegenüber diesen Schwankungen sind. Sie besitzt einen hohen Anwendungsbezug, da streuende Parameter, wie etwa Fertigungstoleranzen oder Schwankungen in den Materialeigenschaften, in vielen industriellen Anwendungen eine Rolle spielen. In dieser Dissertation wird eine Methodik für die robuste Optimierung mit Quantilmaßen auf globalen Metamodellen entwickelt. Sie ist zugeschnitten auf die Situation, dass nur wenige Funktionsauswertungen zur Verfügung stehen. In der Praxis ist dies immer dann der Fall, wenn ein komplexes System- oder Prozessverhalten nur über aufwändige Computersimulationen oder Experimente erfasst werden kann.

Structural optimization is currently attracting considerable attention. Interest in - search in optimal design has grown in connection with the rapid development of aeronautical and space technologies, shipbuilding, and design of precision mach- ery. A special ?eld in these investigations is devoted to structural optimization with incomplete information (incomplete data). The importance of these investigations is explained as follows. The conventional theory of optimal structural design - sumes precise knowledge of material parameters, including damage characteristics and loadings applied to the structure. In practice such precise knowledge is seldom available. Thus, it is important to be able to predict the sensitivity of a designed structure to random ?uctuations in the environment and to variations in the material properties. To design reliable structures it is necessary to apply the so-called gu- anteed approach, based on a “worst case scenario” or a more optimistic probabilistic approach, if we have additional statistical data. Problems of optimal design with incomplete information also have consid- able theoretical importance. The introduction and investigations into new types of mathematical problems are interesting in themselves. Note that some ga- theoretical optimization problems arise for which there are no systematic techniques of investigation. This monograph is devoted to the exposition of new ways of formulating and solving problems of structural optimization with incomplete information. We recall some research results concerning the optimum shape and structural properties of bodies subjected to external loadings.

This book contains the edited version of some Plenary and Keynote Lectures presented at the III European Conference on Computational Mechanics: Solids, Structures and Coupled Problems in Engineering (ECCM-2006), held in the National Laboratory of Civil Engineering, Lisbon, Portugal, 5th- 8th June 2006. It reflects the state-of-the-art overview of a very wide ranging area of engineering.

Today's business environment involves design decisions with significant uncertainty. To succeed, decision-makers should replace deterministic methods with a risk-based approach that accounts for the decision maker‘s risk tolerance. In many problems, it is impractical to collect data because rare or one-time events are involved. Therefore, we need a

Briefly, the two basic questions that this research is supposed to answer are: 1. Howmuch fiber is needed and how fibers should be distributed through a fiber reinforced composite (FRC) structure in order to obtain the optimal and reliable structural response? 2. How do uncertainties influence the optimization results and reliability of the structure? Giving answer to the above questions a double stage sequential optimization algorithm for finding the optimal content of short fiber reinforcements and their distribution in the composite structure, considering uncertain design parameters, is presented. In the first stage, the optimal amount of short fibers in a FRC structure with uniformly distributed fibers is conducted in the framework of a Reliability Based Design Optimization (RBDO) problem. Presented model considers material, structural and modeling uncertainties. In the second stage, the fiber distribution optimization (with the aim to further increase in structural reliability) is performed by defining a fiber distribution function through a Non-Uniform Rational BSpline (NURBS) surface. The advantages of using the NURBS surface as a fiber distribution function include: using the same data set for the optimization and analysis; high convergence rate due to the smoothness of the NURBS; mesh independency of the optimal layout; no need for any post processing technique and its non-heuristic nature. The output of stage 1 (the optimal fiber content for homogeneously distributed fibers) is considered as the input of stage 2. The output of stage 2 is the Reliability Index (b) of the structure with the optimal fiber content and distribution. First order reliability method (in order to approximate the limit state function) as well as different material models including Rule of Mixtures, Mori-Tanaka, energy-based approach and stochastic multi-scales are implemented in different examples. The proposed combined model is able to capture the role of available uncertainties in FRC structures through a computationally efficient algorithm using all sequential, NURBS and sensitivity based techniques. The methodology is successfully implemented for interfacial shear stress optimization in sandwich beams and also for optimization of the internal cooling channels in a ceramic matrix composite. Finally, after some changes and modifications by combining Isogeometric Analysis, level set and point wise density mapping techniques, the computational framework is extended for topology optimization of piezoelectric / flexoelectric materials.

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.

This book contains thirty-five selected papers presented at the International Conference on Evolutionary and Deterministic Methods for Design, Optimization and Control with Applications to Industrial and Societal Problems (EUROGEN 2017). This was one of the Thematic Conferences of the European Community on Computational Methods in Applied Sciences (ECCOMAS). Topics treated in the various chapters reflect the state of the art in theoretical and numerical methods and tools for optimization, and engineering design and societal applications. The volume focuses particularly on intelligent systems for multidisciplinary design optimization (mdo) problems based on multi-hybridized software, adjoint-based and one-shot methods, uncertainty quantification and optimization, multidisciplinary design optimization, applications of game theory to industrial optimization problems, applications in structural and civil engineering optimum design and surrogate models based optimization methods in aerodynamic design.

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.

Containing the proceedings of the 5th International Conference on Computer Aided Optimum Design of Structures, this volume looks at recent advances in structural optimization and demonstrates how optimization can best be applied to engineering practice.

The considerable influence of inherent uncertainties on structural behavior has led the engineering community to recognize the importance of a stochastic approach to structural problems. Issues related to uncertainty quantification and its influence on the reliability of the computational models are continuously gaining in significance. In particular, the problems of dynamic response analysis and reliability assessment of structures with uncertain system and excitation parameters have been the subject of continuous research over the last two decades as a result of the increasing availability of powerful computing resources and technology. This book is a follow up of a previous book with the same subject (ISBN 978-90-481-9986-0) and focuses on advanced computational methods and software tools which can highly assist in tackling complex problems in stochastic dynamic/seismic analysis and design of structures. The selected chapters are authored by some of the most active scholars in their respective areas and represent some of the most recent developments in this field. The book consists of 21 chapters which can be grouped into several thematic topics including dynamic analysis of stochastic systems, reliability-based design, structural control and health monitoring, model updating, system identification, wave propagation in random media, seismic fragility analysis and damage assessment. This edited book is primarily intended for researchers and post-graduate students who are familiar with the fundamentals and wish to study or to advance the state of the art on a particular topic in the field of computational stochastic structural dynamics. Nevertheless, practicing engineers could benefit as well from it as most code provisions tend to incorporate probabilistic concepts in the analysis and design of structures.

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.

Performance-Based Optimization of Structures introduces a method to bridge the gap between structural optimization theory and its practical application to structural engineering. The Performance-Based Optimization (PBO) method combines modern structural optimisation theory with performance based design concepts to produce a powerful technique for use in structural design. This book provides the latest PBO techniques for achieving optimal topologies and shapes of continuum structures with stress, displacement and mean compliance constraints. The emphasis is strongly placed on practical applications of automated PBO techniques to the strut-and-tie modelling of structural concrete, which includes reinforced and prestressed concrete structures. Basic concepts underlying the development of strut-and-lie models, design optimization procedure, and detailing of structural concrete are described in detail. Alternative approaches to topology optimization are also introduced. The book contains numerous practical design examples illustrating the nature of the load transfer mechanism of structures.

Evolutionary Topology Optimization of Continuum Structures treads new ground with a comprehensive study on the techniques and applications of evolutionary structural optimization (ESO) and its later version bi-directional ESO (BESO) methods. Since the ESO method was first introduced by Xie and Steven in 1992 and the publication of their well-known book Evolutionary Structural Optimization in 1997, there have been significant improvements in the techniques as well as important practical applications. The authors present these developments, illustrated by numerous interesting and detailed examples. They clearly demonstrate that the evolutionary structural optimization method is an effective approach capable of solving a wide range of topology optimization problems, including structures with geometrical and material nonlinearities, energy absorbing devices, periodical structures, bridges and buildings. Presents latest developments and applications in this increasingly popular & maturing optimization approach for engineers and architects; Authored by leading researchers in the field who have been working in the area of ESO and BESO developments since their conception; Includes a number of test problems for students as well as a chapter of case studies that includes several recent practical projects in which the authors have been involved; Accompanied by a website housing ESO/BESO computer programs at http://www.wiley.com/go/huang and test examples, as well as a chapter within the book giving a description and step-by-step instruction on how to use the software package BESO2D. Evolutionary Topology Optimization of Continuum Structures will appeal to researchers and graduate students working in structural design and optimization, and will also be of interest to civil and structural engineers, architects and mechanical engineers involved in creating innovative and efficient structures.

In this work, contributes to the optimization of local continuous fiber reinforcement patches, under consideration of manufacturing constraints. This approach requires specific optimization strategies. Therefore, an multi-objective optimization strategy for the placement of local reinforcement patches, under consideration of manufacturing constraints, has been developed. During the multi objective optimization, structural and process related objectives are considered.

Bridge Maintenance, Safety, Management and Life-Cycle Optimization contains the lectures and papers presented at IABMAS 2010, the Fifth International Conference of the International Association for Bridge Maintenance and Safety (IABMAS), held in Philadelphia, Pennsylvania, USA from July 11 through 15, 2010. All major aspects of bridge maintenance, safety, management and life-cycle optimization are addressed including advanced and high performance materials, ageing of bridges, assessment and evaluation, bridge codes, bridge diagnostics, bridge management systems, bridge security, composites, design for durability, deterioration modeling, emerging technologies, fatigue, field testing, financial planning, health monitoring, innovations, inspection, life-cycle performance, load capacity assessment, loads, maintenance strategies, new technical and materials concepts, non-destructive testing, optimization strategies, prediction of future traffic demands, rehabilitation, reliability and risk management, repair, replacement, residual service life, safety and serviceability, service life prediction, strengthening, sustainable materials for bridges, sustainable bridges, whole-life costing, and multi-criteria optimization, among others. Bridge Maintenance, Safety, Management and Life-Cycle Optimization consists of a book of abstracts and a CD-ROM containing the full text of the lectures and papers presented at IABMAS 2010. This set provides both an up-to-date overview of the field of bridge engineering and significant contributions to the process of making more rational decisions in bridge maintenance, safety, security, serviceability, risk-based management, and health monitoring using traditional and emerging technologies for the purpose of enhancing the welfare of society.

It is challenging at best to find a resource that provides the breadth of information necessary to develop a successful micro electro mechanical system (MEMS) design. Micro Electro Mechanical System Design is that resource. It is a comprehensive, single-source guide that explains the design process by illustrating the full range of issues involved,