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Introduction to Optimum Design Introduction to Optimum Design Introduction to Optimum Design Optimal Design Principles of Optimal Design Optimal Design of Experiments Optimal Design of Experiments Optimum Design and Manufacture of Wood Products Crime Reconstruction Optimum Design of Steel Structures Optimum Design of Mechanical Elements Guide to Structural Optimization Optimum Design of Structures Collecting Spatial Data Theory of Optimal Designs Analysis and Optimum Design of Metal Structures The Optimum Shape Topics in Optimal Design Optimal Design of Complex Mechanical Systems Optimum Experimental Designs, with SAS Optimal Design for Nonlinear Response Models Applied Optimal Design Metaheuristic Approaches for Optimum Design of Reinforced Concrete Structures: Emerging Research and Opportunities The Optimal Design of Blocked and Split-Plot Experiments Introduction to Optimum Design(4?) Optimal Design and Retrofit of Energy Efficient Buildings, Communities, and Urban Centers Meta-heuristic Algorithms for Optimal Design of Real-Size Structures The Optimal Design of Chemical Reactors Optimal Design of Queueing Systems Non-Linear Theory of Elasticity and Optimal Design Thermal System Design and Simulation Optimum Designs for Multi-Factor Models Optimum Design of Structures Optimal Design Structural Design Optimization Considering Uncertainties Problems and Methods of Optimal Structural Design Engineering Design Optimization Optimal Engineering Design Advances in Design Optimization Optimal Districting and Territory Design

This volume constitutes an important addition in our Lecture Notes in Engineering Series. The search for optimal structural shapes is at the fourtdation of all engineering analysis. Furthermore el)gineering as a whole can be seen as a process of looking for optimum solutions. The importance of Dr Chibani's work is that it deals with the integrated process of analysing and designing the optimum structure in a single operation. The design shape as well as the usual structural constraints are incQr.porated into the mathematical problem. This approach which is more suitable to computer applications has the difficulty of introducing a large number of variables and constraints equations. To overcome this problcm Dr Chibani proposes to apply a multilevel optimization technique which rcduces the dimensionaiity of a large scalc structural problem. The hook exp.I.111ns how a large optimization problem can be divided into Hcvcral partH of .1 smaller dimension which can then be solved eithcr scquentially or in parallel to obtain the solution of the original problem. Applicationsto these type structures provide a demonstration of the effectiveness of the procedure. 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. This book helps designers and manufacturers to select and develop the most suitable and competitive steel structures, which are safe, fit for production and economic. An optimum design system is used to find the best characteristics of structural models, which guarantee the fulfilment of design and fabrication requirements and minimize the cost function. Realistic numerical models are used as main components of industrial steel structures. Chapter 1 containts some experiences with the optimum design of steel structures Chapter 2 treats some newer mathematical optimization methods. Chapter 3 gives formulae for fabrication times and costs. Chapters 4 deals with beams and columns. Summarizes the Eurocode rules for design. Chapter 5 deals with the design of tubular trusses. Chapter 6 gives the design of frame structures and fire-resistant design rules for a frame. In Chapters 7 some minimum cost design problems of stiffened and cellular plates and shells are worked out for cases of different stiffenings and loads. Chapter 8 gives a cost comparison of cylindrical and conical shells. The book contains a large collection of literatures and a subject list and a name index. Optimal Design and Retrofit of Energy Efficient Buildings, Communities, and Urban Centers presents current techniques and technologies for energy efficiency in buildings. Cases introduce and demonstrate applications in both the design of new buildings and retrofit of existing structures. The book begins with an introduction that includes energy consumption statistics, building energy efficiency codes, and standards and labels from around the world. It then highlights the need for integrated and comprehensive energy analysis approaches. Subsequent sections present an overview of advanced energy efficiency technologies for buildings, including dynamic insulation materials, phase change materials, LED lighting and daylight controls, Life Cycle Analysis, and more. This book provides researchers and professionals with a coherent set of tools and techniques for enhancing energy efficiency in new and existing buildings. The case studies presented help practitioners implement the techniques and technologies in their own projects. Introduces a holistic analysis approach to energy efficiency for buildings using the concept of energy productivity Provides coverage of individual buildings, communities and urban centers Includes both the design of new buildings and retrofitting of existing structures to improve energy efficiency Describes state-of-the-art energy efficiency technologies Presents several cases studies and examples that illustrate the analysis techniques and impact of energy efficiency technologies and controls Principles of Optimal Design puts the concept of optimal design on a rigorous foundation and demonstrates the intimate relationship between the mathematical model that describes a design and the solution methods that optimize it. Since the first edition was published, computers have become ever more powerful, design engineers are tackling more complex systems, and the term optimization is now routinely used to denote a design process with increased speed and quality. This second edition takes account of these developments and brings the original text thoroughly up to date. The book now includes a discussion of trust region and convex approximation algorithms. A new chapter focuses on how to construct optimal design models. Three new case studies illustrate the creation of optimization models. The final chapter on optimization practice has been expanded to include computation of derivatives, interpretation of algorithmic results, and selection of algorithms and software. Both students and practising engineers will find this book a valuable resource for design project work. This monograph presents state-of-the-art knowledge in wood manufacturing design with a special focus on the elaboration of functional relationships. The authors transfer and apply the method of functional relationships to challenges in wood manufacturing, and the book contains many worked examples which help the reader to better understand the presented method. The topical spectrum includes machining processes, energy consumption, surface quality, hardness and durability properties as well as aesthetical properties. The target audience primarily comprises research experts and practitioners in wood manufacturing, but the book may also be beneficial for graduate students alike. Good,No Highlights,No Markup,all pages are intact, Slight Shelfwear,may have the corners slightly dented, may have slight color changes/slightly damaged spine. This book summarizes advances in a number of fundamental areas of optimization with application in engineering design. The selection of the 'best' or 'optimum' design has long been a major concern of designers and in recent years interest has grown in applying mathematical optimization techniques to design of large engineering and industrial systems, and in using the computer-aided design packages with optimization capabilities which are now available. This book provides a comprehensive treatment of the design of blocked and split-plot experiments. The optimal design approach advocated in the book will help applied statisticians from industry, medicine, agriculture, chemistry and many other fields of study in setting up tailor-made experiments. The book also contains a theoretical background, a thorough review of the recent work in the area of blocked and split-plot experiments, and a number of interesting theoretical results. Mathematics in Science and Engineering, Volume 3: The Optimal Design of Chemical Reactors: A Study in Dynamic Programming covers some of the significant problems of chemical reactor engineering from a unified point of view. This book discusses the principle of optimality in its general baring on chemical processes. Organized into nine chapters, this volume begins with an overview of the whole range of optimal problems in chemical reactor design. This text then provides the fundamental equations for reactions and reactors. Other chapters consider the objective function needed to define a realistic optimal problem and explain separately the main types of chemical reactors and their associated problems. This book discusses as well the three problems with a stochastic element. The final chapter deals with the optimal operation of existing reactors that may be regarded as partial designs in which only some of the variables can be optimally chosen. This book is a valuable resource for chemical engineers. This book presents foundations and practical application of multi-objective optimization methods to Vehicle Design Problems, bolstered with an extensive collection of examples. Opening with a broad theoretical introduction to the optimization of complex mechanical systems and multi-objective optimization methods, the book presents several applications which are extensively exposed here for the first time. The book includes examples of proposed methods to the solution of real vehicle design problems. Optimal Design of Experiments offers a rare blend of linear algebra, convex analysis, and statistics. The optimal design for statistical experiments is first formulated as a concave matrix optimization problem. Using tools from convex analysis, the problem is solved generally for a wide class of optimality criteria such as D-, A-, or E-optimality. The book then offers a complementary approach that calls for the study of the symmetry properties of the design problem, exploiting such notions as matrix majorization and the Kiefer matrix ordering. The results are illustrated with optimal designs for polynomial fit models, Bayes designs, balanced incomplete block designs, exchangeable designs on the cube, rotatable designs on the sphere, and many other examples. Crime Reconstruction, Second Edition is an updated guide to the interpretation of physical evidence, written for the advanced student of forensic science, the practicing forensic generalist and those with multiple forensic specialists. It is designed to assist reconstructionists with understanding their role in the justice system; the development and refinement of case theory’ and the limits of physical evidence interpretation. Chisum and Turvey begin with chapters on the history and ethics of crime reconstruction and then shift to the more applied subjects of reconstruction methodology and practice standards. The volume concludes with chapters on courtroom conduct and evidence admissibility to prepare forensic reconstructionists for what awaits them when they take the witness stand. Crime Reconstruction, Second Edition, remains an unparalleled watershed

collaborative effort by internationally known, qualified, and respected forensic science practitioner holding generations of case experience among them. Forensic pioneer such as W. Jerry Chisum, John D. DeHaan, John I. Thorton, and Brent E. Turvey contribute chapters on crime scene investigation, arson reconstruction, trace evidence interpretation, advanced bloodstain interpretation, and ethics. Other chapters cover the subjects of shooting incident reconstruction, interpreting digital evidence, staged crime scenes, and examiner bias. Rarely have so many forensic giants collaborated, and never before have the natural limits of physical evidence been made so clear. Updates to the majority of chapters, to comply with the NAS Report New chapters on forensic science, crime scene investigation, wound pattern analysis, sexual assault reconstruction, and report writing Updated with key terms, chapter summaries, discussion questions, and a comprehensive glossary; ideal for those teaching forensic science and crime reconstruction subjects at the college level Provides clear practice standards and ethical guidelines for the practicing forensic scientist In real applications most experimental situations are influenced by a large number of different factors. In these settings the design of an experiment leads to challenging optimization problems, even if the underlying relationship can be described by a linear model. Based on recent research, this book introduces the theory of optimum designs for complex models and develops general methods of reduction to marginal problems for large classes of models with relevant interaction structures. Introduction to Optimum Design is the most widely used textbook in engineering optimization and optimum design courses. It is intended for use in a first course on engineering design and optimization at the undergraduate or graduate level within engineering departments of all disciplines, but primarily within mechanical, aerospace and civil engineering. The basic approach of the text is to describe an organized approach to engineering design optimization in a rigorous yet simplified manner, illustrate various concepts and procedures with simple examples, and demonstrate their applicability to engineering design problems. Formulation of a design problem as an optimization problem is emphasized and illustrated throughout the text. Excel and MATLAB are featured throughout as learning and teaching aids. The 3rd edition has been reorganized and enhanced with new material, making the book even more appealing to instructors regardless of the level they teach the course. Examples include moving the introductory chapter on Excel and MATLAB closer to the front of the book and adding an early chapter on practical design examples for the more introductory course, and including a final chapter on advanced topics for the purely graduate level course. Basic concepts of optimality conditions and numerical methods are described with simple and practical examples, making the material highly teachable and learnable. Applications of the methods for structural, mechanical, aerospace and industrial engineering problems. Introduction to MATLAB Optimization Toolbox. Optimum design with Excel Solver has been expanded into a full chapter. Practical design examples introduce students to usage of optimization methods early in the book. New material on several advanced optimum design topics serves the needs of instructors teaching more advanced courses. The First Comprehensive Book on the Subject Focusing on the underlying structure of a system, Optimal Design of Queueing Systems explores how to set the parameters of a queueing system, such as arrival and service rates, before putting it into operation. It considers various objectives, comparing individually optimal (Nash equilibrium), socially optimal, class optimal, and facility optimal flow allocations. After an introduction to basic design models, the book covers the optimal arrival rate model for a single-facility, single-class queue as well as dynamic algorithms for finding individually or socially optimal arrival rates and prices. It then examines several special cases of multiclass queues, presents models in which the service rate is a decision variable, and extends models and techniques to multifacility queueing systems. Focusing on networks of queues, the final chapters emphasize the qualitative properties of optimal solutions. Written by a long-time, recognized researcher on models for the optimal design and control of queues and networks of queues, this book frames the issues in the general setting of a queueing system. It shows how design models can control flow to achieve a variety of objectives. In order to select an optimal structure among possible similar structures, one needs to compare the elastic behavior of the structures. A new criterion that describes elastic behavior is the rate of change of deformation. Using this criterion, the safe dimensions of a structure that are required by the stress distributed in a structure can be calculated. The new non-linear theory of elasticity allows one to determine the actual individual limit of elasticity/failure of a structure using a simple non-destructive method of measurement of deformation on the model of a structure while presently it can be done only with a destructive test for each structure. For building and explaining the theory, a new logical structure was introduced as the basis of the theory. One of the important physical implications of this logic is that it describes mathematically the universal domain of the possible stable physical relations. Based on course-tested material, this rigorous yet accessible graduate textbook covers both fundamental and advanced optimization theory and algorithms. It covers a wide range of numerical methods and topics, including both gradient-based and gradient-free algorithms, multidisciplinary design optimization, and uncertainty, with instruction on how to determine which algorithm should be used for a given application. It also provides an overview of models and how to prepare them for use with numerical optimization, including derivative computation. Over 400 high-quality visualizations and numerous examples facilitate understanding of the theory, and practical tips address common issues encountered in practical engineering design optimization and how to address them. Numerous end-of-chapter homework problems, progressing in difficulty, help put knowledge into practice. Accompanied online by a solutions manual for instructors and source code for problems, this is ideal for a one- or two-semester graduate course on optimization in aerospace, civil, mechanical, electrical, and chemical engineering departments. "This is an engaging and informative book on the modern practice of experimental design. The authors' writing style is entertaining, the consulting dialogs are extremely enjoyable, and the technical material is presented brilliantly but not overwhelmingly. The book is a joy to read. Everyone who practices or teaches DOE should read this book." - Douglas C. Montgomery, Regents Professor, Department of Industrial Engineering, Arizona State University "It's been said: 'Design for the experiment, don't experiment for the design.' This book ably demonstrates this notion by showing how tailor-made, optimal designs can be effectively employed to meet a client's actual needs. It should be required reading for anyone interested in using the design of experiments in industrial settings." —Christopher J. Nachtsheim, Frank A Donaldson Chair in Operations Management, Carlson School of Management, University of Minnesota This book demonstrates the utility of the computer-aided optimal design approach using real industrial examples. These examples address questions such as the following: How can I do screening inexpensively if I have dozens of factors to investigate? What can I do if I have day-to-day variability and I can only perform 3 runs a day? How can I do RSM cost effectively if I have categorical factors? How can I design and analyze experiments when there is a factor that can only be changed a few times over the study? How can I include both ingredients in a mixture and processing factors in the same study? How can I design an experiment if there are many factor combinations that are impossible to run? How can I make sure that a time trend due to warming up of equipment does not affect the conclusions from a study? How can I take into account batch information in when designing experiments involving multiple batches? How can I add runs to a botched experiment to resolve ambiguities? While answering these questions the book also shows how to evaluate and compare designs. This allows researchers to make sensible trade-offs between the cost of experimentation and the amount of information they obtain. Optimization methods are perceived to be at the heart of computer methods for designing engineering systems. With these optimization methods, the designer can evaluate more alternatives, resulting in a better and more cost-effective design. This guide describes the use of modern optimization methods with simple yet meaningful structural design examples. Optimum solutions are obtained and, where possible, compared with the solutions obtained using traditional design procedures. Introduction to Optimum Design, Fourth Edition, carries on the tradition of the most widely used textbook in engineering optimization and optimum design courses. It is intended for use in a first course on engineering design and optimization at the undergraduate or graduate level in engineering departments of all disciplines, with a primary focus on mechanical, aerospace, and civil engineering courses. Through a basic and organized approach, the text describes engineering design optimization in a rigorous, yet simplified manner, illustrates various concepts and procedures with simple examples, and demonstrates their applicability to engineering design problems. Formulation of a design problem as an optimization problem is emphasized and illustrated throughout the text using Excel and MATLAB as learning and teaching aids. This fourth edition has been reorganized, rewritten in parts, and enhanced with new material, making the book even more appealing to instructors regardless of course level. Includes basic concepts of optimality conditions and numerical methods that are described with simple and practical examples, making the material highly teachable and learnable Presents applications of optimization methods for structural, mechanical, aerospace, and industrial engineering problems Provides practical design examples that introduce students to the use of optimization methods early in the book Contains chapter on several advanced optimum design topics that serve the needs of instructors who teach more advanced courses This book covers a wide range of topics in both discrete and continuous optimal designs. The topics discussed include designs for regression models, covariates models, models with trend effects, and models with competition effects. The prerequisites are a basic course in the design and analysis of experiments and some familiarity with the concepts of optimality criteria. Introduction to Optimum Design, Third Edition describes an organized approach to engineering design optimization in a rigorous yet simplified manner. It illustrates various concepts and procedures with simple examples and demonstrates their applicability to engineering design problems. Formulation of a design problem as an optimization problem is emphasized and illustrated throughout the text. Excel and MATLAB® are featured as learning and teaching aids. Basic concepts of optimality conditions and numerical methods are described with simple and practical examples, making the material highly teachable and learnable Includes applications of optimization methods for structural, mechanical, aerospace, and industrial engineering problems Introduction to MATLAB Optimization Toolbox Practical design examples introduce students to the use of optimization methods early in the book New example problems throughout the text are enhanced with detailed illustrations Optimum design with Excel Solver has been expanded into a full chapter New chapter on several advanced optimum design topics serves the needs of instructors who teach more advanced courses 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. Updated and expanded new edition of this unique book of basic techniques and practical applications (including important new developments) for the optimal design of mechanical elements in realistic design settings. Reviews necessary background information, explains the method of optimum design (MOD) and automated optimal design (AOD), and covers optimization problems both for simple and complex mechanical elements. Many simple illustrative examples and practical exercises. This book contains the papers presented at the International Symposium, "The Optimum Shape: Automated Structural Design," held at the General Motors Research Laboratories on September 3D-October 1, 1985. This was the 30th symposium in a series which the Research Laboratories began sponsoring in 1957. Each symposium has focused on a topic that is both under active study at the Research Laboratories and is also of interest to the larger technical community. While attempts to produce a structure

which performs a certain task with the minimum amount of resources probably predates recorded civilization, the idea of coupling formal optimization techniques with computer-based structural analysis techniques was first proposed in the early 1960s. Although it was recognized at this time that the most fundamental description of the problem would be in terms of the shape or contours of the structure, much of the early work described the problem in terms of structural sizing parameters instead of geometrical descriptions. Within the past few years, several research groups have started to explore this more fundamental area of shape design. Initial research has raised many new questions about appropriate selection of design variables, methods of calculating derivatives, and generation of the underlying analysis problem. The book is concerned with the statistical theory for locating spatial sensors. It bridges the gap between spatial statistics and optimum design theory. After introductions to those two fields the topics of exploratory designs and designs for spatial trend and variogram estimation are treated. Special attention is devoted to describing new methodologies to cope with the problem of correlated observations. Prior to the 1970's a substantial literature had accumulated on the theory of optimal design, particularly of optimal linear regression design. To a certain extent the study of the subject had been piecemeal, different criteria of optimality having been studied separately. Also to a certain extent the topic was regarded as being largely of theoretical interest and as having little value for the practising statistician. However during this decade two significant developments occurred. It was observed that the various different optimality criteria had several mathematical properties in common; and general algorithms for constructing optimal design measures were developed. From the first of these there emerged a general theory of remarkable simplicity and the second at least raised the possibility that the theory would have more practical value. With respect to the second point there does remain a limiting factor as far as designs that are optimal for parameter estimation are concerned, and this is that the theory assumes that the model be collected is known a priori. This of course underlying data to is seldom the case in practice and it often happens that designs which are optimal for parameter estimation allow no possibility of model validation. For this reason the theory of design for parameter estimation may well have to be combined with a theory of model validation before its practical potential is fully realized. Nevertheless discussion in this monograph is limited to the theory of design optimal for parameter estimation. Reinforced concrete structures are one of the major structural types and must adhere to design regulation codes. It is ideal to find the best design (section dimension, material type, and amount of reinforcement) with the minimum cost providing the design constraints (design formulation considering loading of structure). Metaheuristic methods inspired by natural phenomena can consider design constraints by combining the analyses of formulation of reinforced concrete structures with an iterative numerical algorithm using several convergence options of random generation of candidate design solutions. Metaheuristic Approaches for Optimum Design of Reinforced Concrete Structures: Emerging Research and Opportunities is a pivotal reference source that focuses on several metaheuristic algorithms and the design of several types of structural members. Additionally, retrofit applications and seismic design issues are considered for readers in earthquake zones. Highlighting a wide range of topics including algorithms, design variables, and retrofit design, this book is ideally designed for architects, engineers, urban designers, government officials, policymakers, researchers, academicians, and students. 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. Optimal Design for Nonlinear Response Models discusses the theory and applications of model-based experimental design with a strong emphasis on biopharmaceutical studies. The book draws on the authors' many years of experience in academia and the pharmaceutical industry. While the focus is on nonlinear models, the book begins with an explanation of The author offers a systematic and careful development of many aspects of structural optimization, particularly for beams and plates. Some of the results are new and some have appeared only in specialized Soviet journals, or as pro ceedings of conferences, and are not easily accessible to Western engineers and mathematicians. Some aspects of the theory presented here, such as optimiza tion of anisotropic properties of elastic structural elements, have not been con sidered to any extent by Western research engineers. The author's treatment is "classical", i.e., employing classical analysis. Classical calculus of variations, the complex variables approach, and the Kolosov Muskhelishvili theory are the basic techniques used. He derives many results that are of interest to practical structural engineers, such as optimum designs of structural elements submerged in a flowing fluid (which is of obvious interest in aircraft design, in ship building, in designing turbines, etc.). Optimization with incomplete information concerning the loads (which is the case in a great majority of practical design considerations) is treated thoroughly. For example, one can only estimate the weight of the traffic on a bridge, the wind load, the additional loads if a river floods, or possible earthquake loads. Thermal System Design and Simulation covers the fundamental analyses of thermal energy systems that enable users to effectively formulate their own simulation and optimal design procedures. This reference provides thorough guidance on how to formulate optimal design constraints and develop strategies to solve them with minimal computational effort. The book uniquely illustrates the methodology of combining information flow diagrams to simplify system simulation procedures needed in optimal design. It also includes a comprehensive presentation on dynamics of thermal systems and the control systems needed to ensure safe operation at varying loads. Designed to give readers the skills to develop their own customized software for simulating and designing thermal systems, this book is relevant for anyone interested in obtaining an advanced knowledge of thermal system analysis and design. Contains detailed models of simulation for equipment in the most commonly used thermal engineering systems Features illustrations for the methodology of using information flow diagrams to simplify system simulation procedures Includes comprehensive global case studies of simulation and optimization of thermal systems There has been an enormous growth in recent years in the literature on discrete optimal designs. The optimality problems have been formulated in various models arising in the experimental designs and substantial progress has been made towards solving some of these. The subject has now reached a stage of completeness which calls for a self-contained monograph on this topic. The aim of this monograph is to present the state of the art and to focus on more recent advances in this rapidly developing area. We start with a discussion of statistical optimality criteria in Chapter One. Chapters Two and Three deal with optimal block designs. Row-column designs are dealt with in Chapter Four. In Chapter Five we deal with optimal designs with mixed effects models. Repeated measurement designs are considered in Chapter Six. Chapter Seven deals with some special situations and Weighing designs are dis cussed in Chapter Eight. We have endeavoured to include all the major developments that have taken place in the last three decades. The book should be of use to research workers in several areas including combinatorics as well as to the experimenters in diverse fields of applications. Since the details of the construction of the designs are available in excellent books, we have only pointed out the designs which have optimality proper ties. We believe, this will be adequate for the experimenters. Optimal Structural Design can be referred to as one of the most important and promising branches of applied mathematics and mechanics. This book reflects the culmination of Russian activity in the field of optimal structural design. This book highlights recent advances in the field of districting, territory design, and zone design. Districting problems deal essentially with tactical decisions, and involve mainly dividing a set of geographic units into clusters or territories subject to some planning requirements. This book presents models, theory, algorithms (exact or heuristic), and applications that would bring research on districting systems up-to-date and define the state-of-the-art. Although papers have addressed real-world problems that require districting or territory division decisions, this is the first comprehensive book that directly addresses these problems. The chapters capture the diverse nature of districting applications, as the book is divided into three different areas of research. Part I covers recent up-to-date surveys on important areas of districting such as police districting, health care districting, and districting algorithms based on computational geometry. Part II focuses on recent advances on theory, modeling, and algorithms including mathematical programming and heuristic approaches, and finally, Part III contains successful applications in real-world districting cases. Experiments in the field and in the laboratory cannot avoid random error and statistical methods are essential for their efficient design and analysis. Authored by leading experts in key fields, this text provides many examples of SAS code, results, plots and tables, along with a fully supported website.