

Mathematical Optimization Models And Methods Diva Portal

Peter Kall and János Mayer are distinguished scholars and professors of Operations Research and their research interest is particularly devoted to the area of stochastic optimization. Stochastic Linear Programming is a definitive presentation and discussion of the theoretical properties of the models, the conceptual algorithmic approaches, and the computational issues relating to the implementation of these methods to solve problems that are stochastic in nature.

Here is a collection of nonlinear optimization applications from the real world, expressed in the General Algebraic Modeling System (GAMS). The concepts are presented so that the reader can quickly modify and update them to represent real-world situations.

This book contains selected papers from the presentations given at the 7th EURO-Working Group Meeting on 'Transportation, which took place at the Helsinki University of Technology (HUT), Finland, during August 2-4, 1999. Altogether 31 presentations were given and 14 full papers have been selected in this publication through a peer review process coordinated by the editors. The papers in this book cover a wide range of transportation problems from the simulation of railway traffic to optimum congestion tolling and mode choice modeling with stated preference data. In general, the variety of papers clearly demonstrates the wide areas of interest of people who are involved in the research of transportation systems and their operation. They as well demonstrate the importance and possibilities of modeling and theoretical approaches in the analysis of transportation systems and problem solving. Most of the papers are purely theoretical in nature, that is, they present a theoretical model with only a hypothetical example of application. There are, however, some papers, which are closer to the practice or describe applications of and give interesting results of studies made by known methodologies. It is especially noteworthy, that half of the accepted papers deal with planning and operation of public transport.

Optimization models play an increasingly important role in financial decisions. This is the first textbook devoted to explaining how recent advances in optimization models, methods and software can be applied to solve problems in computational finance more efficiently and accurately. Chapters discussing the theory and efficient solution methods for all major classes of optimization problems alternate with chapters illustrating their use in modeling problems of mathematical finance. The reader is guided through topics such as volatility estimation, portfolio optimization problems and constructing an index fund, using techniques such as nonlinear optimization models, quadratic programming formulations and integer programming models respectively. The book is based on Master's courses in

financial engineering and comes with worked examples, exercises and case studies. It will be welcomed by applied mathematicians, operational researchers and others who work in mathematical and computational finance and who are seeking a text for self-learning or for use with courses.

Models and Techniques for Transportation Systems

Multiobjective Linear Programming

Deterministic Operations Research

Aimms Optimization Modeling

Analysis, Mathematical Modeling, Control and Optimization

Optimization Models

This book systematically discusses nonlinear interval optimization design theory and methods. Firstly, adopting a mathematical programming theory perspective, it develops an innovative mathematical transformation model to deal with general nonlinear interval uncertain optimization problems, which is able to equivalently convert complex interval uncertain optimization problems to simple deterministic optimization problems. This model is then used as the basis for various interval uncertain optimization algorithms for engineering applications, which address the low efficiency caused by double-layer nested optimization. Further, the book extends the nonlinear interval optimization theory to design problems associated with multiple optimization objectives, multiple disciplines, and parameter dependence, and establishes the corresponding interval optimization models and solution algorithms. Lastly, it uses the proposed interval uncertain optimization models and methods to deal with practical problems in mechanical engineering and related fields, demonstrating the effectiveness of the models and methods. Merging logic and mathematics in deductive inference—an innovative, cutting-edge approach. Optimization methods for logical inference? Absolutely, say Vijay Chandru and John Hooker, two major contributors to this rapidly expanding field. And even though "solving logical inference problems with optimization methods may seem a bit like eating sauerkraut with chopsticks. . . it is the mathematical structure of a problem that determines whether an optimization model can help solve it, not the context in which the problem occurs." Presenting powerful, proven optimization techniques for logic inference problems, Chandru and Hooker show how optimization models can be used not only to solve problems in artificial intelligence and mathematical programming, but also have tremendous application in complex systems in general.

They survey most of the recent research from the past decade in logic/optimization interfaces, incorporate some of their own results, and emphasize the types of logic most receptive to optimization methods—propositional logic, first order predicate logic, probabilistic and related logics, logics that combine evidence such as Dempster-Shafer theory, rule systems with confidence factors, and constraint logic programming systems. Requiring no background in logic and clearly explaining all topics from the ground up, *Optimization Methods for Logical Inference* is an invaluable guide for scientists and students in diverse fields, including operations research, computer science, artificial intelligence, decision support systems, and engineering. This accessible textbook demonstrates how to recognize, simplify, model and solve optimization problems – and apply these principles to new projects.

This book provides a complete and comprehensive reference/guide to Pyomo (Python Optimization Modeling Objects) for both beginning and advanced modelers, including students at the undergraduate and graduate levels, academic researchers, and practitioners. The text illustrates the breadth of the modeling and analysis capabilities that are supported by the software and support of complex real-world applications. Pyomo is an open source software package for formulating and solving large-scale optimization and operations research problems. The text begins with a tutorial on simple linear and integer programming models. A detailed reference of Pyomo's modeling components is illustrated with extensive examples, including a discussion of how to load data from data sources like spreadsheets and databases. Chapters describing advanced modeling capabilities for nonlinear and stochastic optimization are also included. The Pyomo software provides familiar modeling features within Python, a powerful dynamic programming language that has a very clear, readable syntax and intuitive object orientation. Pyomo includes Python classes for defining sparse sets, parameters, and variables, which can be used to formulate algebraic expressions that define objectives and constraints. Moreover, Pyomo can be used from a command-line interface and within Python's interactive command environment, which makes it easy to create Pyomo models, apply a variety of optimizers, and examine solutions. The software supports a different modeling approach than commercial AML (Algebraic Modeling Languages) tools, and is designed for flexibility, extensibility, portability, and maintainability but also maintains the central ideas in modern AMLs.

In Honor of Ivan V. Sergienko's 80th Birthday

Linear and Quadratic Models

Models and Applications

Mathematical Methods on Optimization in Transportation Systems

Decomposition Techniques in Mathematical Programming

This book introduces the reader to the field of multiobjective optimization through problems with simple structures, namely those in which the objective function and constraints are linear. Fundamental notions as well as state-of-the-art advances are presented in a comprehensive way and illustrated with the help of numerous examples. Three of the most popular methods for solving multiobjective linear problems are explained, and exercises are provided at the end of each chapter, helping students to grasp and apply key concepts and methods to more complex problems. The book was motivated by the fact that the majority of the practical problems we encounter in management science, engineering or operations research involve conflicting criteria and therefore it is more convenient to formulate them as multicriteria optimization models, the solution concepts and methods of which cannot be treated using traditional mathematical programming approaches.

The AIMMS Optimization Modeling book provides not only an introduction to modeling but also a suite of worked examples. It is aimed at users who are new to modeling and those who have limited modeling experience. Both the basic concepts of optimization modeling and more advanced modeling techniques are discussed. The Optimization Modeling book is AIMMS version independent.

Entropy optimization is a useful combination of classical engineering theory (entropy) with mathematical optimization. The resulting entropy optimization models have proved their usefulness with successful applications in areas such as image reconstruction, pattern recognition, statistical inference, queuing theory, spectral analysis, statistical mechanics, transportation planning, urban and regional planning, input-output analysis, portfolio investment, information analysis, and linear and nonlinear programming.

While entropy optimization has been used in different fields, a good number of applicable solution methods have been loosely constructed without sufficient mathematical treatment. A systematic presentation with proper mathematical treatment of this material is needed by practitioners and researchers alike in all application areas. The purpose of this book is to meet this need. Entropy Optimization and Mathematical Programming offers perspectives that meet the needs of diverse user communities so that the users can apply entropy optimization techniques with complete comfort and

ease. With this consideration, the authors focus on the entropy optimization problems in finite dimensional Euclidean space such that only some basic familiarity with optimization is required of the reader.

"Mathematical Optimization and Economic Analysis" is a self-contained introduction to various optimization techniques used in economic modeling and analysis such as geometric, linear, and convex programming and data envelopment analysis. Through a systematic approach, this book demonstrates the usefulness of these mathematical tools in quantitative and qualitative economic analysis. The book presents specific examples to demonstrate each technique's advantages and applicability as well as numerous applications of these techniques to industrial economics, regulatory economics, trade policy, economic sustainability, production planning, and environmental policy. Key Features include: - A detailed presentation of both single-objective and multiobjective optimization; - An in-depth exposition of various applied optimization problems; - Implementation of optimization tools to improve the accuracy of various economic models; - Extensive resources suggested for further reading. This book is intended for graduate and postgraduate students studying quantitative economics, as well as economics researchers and applied mathematicians. Requirements include a basic knowledge of calculus and linear algebra, and a familiarity with economic modeling.

Practical Python AI Projects

Mathematical Optimization Models and Methods for Open-pit Mining

Mathematical Optimization and Economic Analysis

Pyomo – Optimization Modeling in Python

Optimization for Decision Making

Stochastic Linear Programming

Mathematical optimization is used in nearly all computer graphics applications, from computer vision to animation. This book teaches readers the core set of techniques that every computer graphics professional should understand in order to envision and expand the boundaries of what is possible in their work. Study of this authoritative reference will help readers develop a very powerful tool- the ability to create and decipher mathematical models that can better realize solutions to even the toughest problems confronting computer graphics community today. *Distills down a vast and complex world of information on optimization into one short, self-contained volume especially for computer graphics

****Helps CG professionals identify the best technique for solving particular problems quickly, by categorizing the most effective algorithms by application *Keeps readers current by supplementing the focus on key, classic methods with special end-of-chapter sections on cutting-edge developments This book is open access under a CC BY-NC 4.0 license. This revised, updated textbook presents a systems approach to the planning, management, and operation of water resources infrastructure in the environment. Previously published in 2005 by UNESCO and Deltares (Delft Hydraulics at the time), this new edition, written again with contributions from Jerry R. Stedinger, Jozef P. M. Dijkman, and Monique T. Villars, is aimed equally at students and professionals. It introduces readers to the concept of viewing issues involving water resources as a system of multiple interacting components and scales. It offers guidelines for initiating and carrying out water resource system planning and management projects. It introduces alternative optimization, simulation, and statistical methods useful for project identification, design, siting, operation and evaluation and for studying post-planning issues. The authors cover both basin-wide and urban water issues and present ways of identifying and evaluating alternatives for addressing multiple-purpose and multi-objective water quantity and quality management challenges. Reinforced with cases studies, exercises, and media supplements throughout, the text is ideal for upper-level undergraduate and graduate courses in water resource planning and management as well as for practicing planners and engineers in the field.***

Mathematical Models and Algorithms for Power System Optimization helps readers build a thorough understanding of new technologies and world-class practices developed by the State Grid Corporation of China, the organization responsible for the world's largest power distribution network. This reference covers three areas: power operation planning, electric grid investment and operational planning and power system control. It introduces economic dispatching, generator maintenance scheduling, power flow, optimal load flow, reactive power planning, load frequency control and transient stability, using mathematic models including optimization, dynamic, differential and difference equations. Provides insights on the development of new mathematical models of power system optimization Analyzes power systems comprehensively to create novel mathematic models and algorithms for issues related to the planning operation of power systems Includes research on the optimization of power systems and related practical research projects carried out since 1981

Optimization methods play a central role in financial modeling. This textbook is devoted to explaining

how state-of-the-art optimization theory, algorithms, and software can be used to efficiently solve problems in computational finance. It discusses some classical mean-variance portfolio optimization models as well as more modern developments such as models for optimal trade execution and dynamic portfolio allocation with transaction costs and taxes. Chapters discussing the theory and efficient solution methods for the main classes of optimization problems alternate with chapters discussing their use in the modeling and solution of central problems in mathematical finance. This book will be interesting and useful for students, academics, and practitioners with a background in mathematics, operations research, or financial engineering. The second edition includes new examples and exercises as well as a more detailed discussion of mean-variance optimization, multi-period models, and additional material to highlight the relevance to finance.

Nonlinear Optimization Applications Using the GAMS Technology

Optimization Models and Methods for Communication Network Design and Routing

Mathematical Models and Algorithms for Power System Optimization

Multiobjective Optimization: Behavioral and Computational Considerations

Basic Optimization Theory and Gradient-Based Algorithms

Water Resource Systems Planning and Management

Appendices A Rotastore A. 1 Tabular Results for Different Models A. 2 Tabular Results for Different Algorithms B OptiTrans B. 1 Input Data B. 1. 1 Input Data Common to all Solution Approaches B. 1. 2 Specific Input Data for the MILP Model and the Column Enumeration Approach B. 1. 3 Specific Input Data for the Heuristic Methods B. 1. 3. 1 Penalty Criteria B. 1. 3. 2 Control Parameters of the OptiTrans Software B. 2 Tabular Results B. 2. 1 Tabular Results for the MILP Model B. 2. 2 Tabular Results for the Heuristic Methods B. 2. 2. 1 Input Data for a Whole Day - Offline Analysis B. 2. 2. 2 Results for CIH and SA References Index Preface This book covers the analysis and development of online algorithms involving exact optimization and heuristic techniques, and their application to solve two real life problems. The first problem is concerned with a complex technical system: a special carousel based high-speed storage system - Rotastore. It is shown that this logistic problem leads to an NP-hard Batch Presorting Problem (BPSP) which is not easy to solve optimally in offline situations. We consider a polynomial case and develop an exact algorithm for offline situations. Competitive analysis showed that the proposed online algorithm is 312-competitive. Online algorithms with lookahead improve the online solutions in particular cases. If the capacity constraint on additional storage is neglected the problem has a totally unimodular polyhedron.

Discover the art and science of solving artificial intelligence problems with Python using optimization modeling. This book covers

the practical creation and analysis of mathematical algebraic models such as linear continuous models, non-obviously linear continuous models, and pure linear integer models. Rather than focus on theory, Practical Python AI Projects, the product of the author's decades of industry teaching and consulting, stresses the model creation aspect; contrasting alternate approaches and practical variations. Each model is explained thoroughly and written to be executed. The source code from all examples in the book is available, written in Python using Google OR-Tools. It also includes a random problem generator, useful for industry application or study. What You Will Learn Build basic Python-based artificial intelligence (AI) applications Work with mathematical optimization methods and the Google OR-Tools (Optimization Tools) suite Create several types of projects using Python and Google OR-Tools Who This Book Is For Developers and students who already have prior experience in Python coding. Some prior mathematical experience or comfort level may be helpful as well.

Throughout the development of mathematical programming researchers have paid great attention to problems that are described by a single objective that can only be achieved subject to satisfying a set of restrictions or constraints. Recently, it has been recognized that the use of a single objective limits the applicability of In reality, many multiobjective mathematical programming models. situations exist and frequently these multiple objectives are in direct conflict. Research on multiobjective problems can be broken down into two broad categories: multiobjective optimization and multicriterion decision theory. Multiobjective optimization models are based on techniques such as linear programming. In general, the multiobjective optimization problem can be defined as finding a feasible alternative that yields the most preferred set of values for the objective functions. This problem differs from a single objective because subjective methods are required to determine which alternative is most preferred. A body of literature parallel to that in multiobjective optimization has been developing in the area of multicriterion decision theory. These models are based on classical decision analysis, particularly utility theory. One focus of this research has been the development and testing of procedures for estimating multiattribute utility functions that are consistent with rational decision maker behavior. A utility function provides a model of a decision maker's choice among alternatives. This literature is directly applicable to multiobjective optimization and provides much needed insight into the subjective character of that problem.

This book contains the written versions of main lectures presented at the Advanced Study Institute (ASI) on Computational Mathematical Programming, which was held in Bad Windsheim, Germany F. R., from July 23 to August 2, 1984, under the sponsorship of NATO. The ASI was organized by the Committee on Algorithms (COAL) of the Mathematical Programming Society. Co-directors were Karla Hoffmann (National Bureau of Standards, Washington, U.S.A.) and Jan Teigen (Rabobank Nederland, Zeist, The Netherlands). Ninety participants coming from about 20 different countries attended the ASI and contributed their efforts to achieve a highly interesting and stimulating meeting. Since 1947 when the first linear programming technique was developed, the importance of optimization models and their mathematical solution methods has steadily increased, and now plays a leading role in

applied research areas. The basic idea of optimization theory is to minimize (or maximize) a function of several variables subject to certain restrictions. This general mathematical concept covers a broad class of possible practical applications arising in mechanical, electrical, or chemical engineering, physics, economics, medicine, biology, etc. There are both industrial applications (e.g. design of mechanical structures, production plans) and applications in the natural, engineering, and social sciences (e.g. chemical equilibrium problems, christollography problems).

Online Storage Systems and Transportation Problems with Applications

Mathematical Models of Optimization Problems with Google OR-Tools

Models, Theory, and Computation

Models and Methods

Practical Mathematical Optimization

Nonlinear Optimization

Linear programming (LP), modeling, and optimization are very much the fundamentals of OR, and no academic program is complete without them. No matter how highly developed one's LP skills are, however, if a fine appreciation for modeling isn't developed to make the best use of those skills, then the truly 'best solutions' are often not realized, and efforts go wasted. Katta Murty studied LP with George Dantzig, the father of linear programming, and has written the graduate-level solution to that problem. While maintaining the rigorous LP instruction required, Murty's new book is unique in his focus on developing modeling skills to support valid decision making for complex real world problems. He describes the approach as 'intelligent modeling and decision making' to emphasize the importance of employing the best expression of actual problems and then applying the most computationally effective and efficient solution technique for that model.

Optimization is the act of obtaining the "best" result under given circumstances. In design, construction, and maintenance of any engineering system, engineers must make technological and managerial decisions to minimize either the effort or cost required or to maximize benefits. There is no single method available for solving all optimization problems efficiently. Several optimization methods have been developed for different types of problems. The optimum-seeking methods are mathematical programming techniques (specifically, nonlinear programming techniques). Nonlinear Optimization: Models and Applications presents the concepts in several ways to foster understanding. Geometric interpretation: is used to re-enforce the concepts and to foster understanding of the mathematical procedures.

The student sees that many problems can be analyzed, and approximate solutions found before analytical solutions techniques are applied. Numerical approximations: early on, the student is exposed to numerical techniques. These numerical procedures are algorithmic and iterative. Worksheets are provided in Excel, MATLAB®, and Maple™ to facilitate the procedure. Algorithms: all algorithms are provided with a step-by-step format. Examples follow the summary to illustrate its use and application. Nonlinear Optimization: Models and Applications: Emphasizes process and interpretation throughout Presents a general classification of optimization problems Addresses situations that lead to models illustrating many types of optimization problems Emphasizes model formulations Addresses a special class of

problems that can be solved using only elementary calculus Emphasizes model solution and model sensitivity analysis About the author: William P. Fox is an emeritus professor in the Department of Defense Analysis at the Naval Postgraduate School. He received his Ph.D. at Clemson University and has taught at the United States Military Academy and at Francis Marion University where he was the chair of mathematics. He has written many publications, including over 20 books and over 150 journal articles. Currently, he is an adjunct professor in the Department of Mathematics at the College of William and Mary. He is the emeritus director of both the High School Mathematical Contest in Modeling and the Mathematical Contest in Modeling.

Optimization and Operations Research is a component of Encyclopedia of Mathematical Sciences in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. The Theme on Optimization and Operations Research is organized into six different topics which represent the main scientific areas of the theme: 1. Fundamentals of Operations Research; 2. Advanced Deterministic Operations Research; 3. Optimization in Infinite Dimensions; 4. Game Theory; 5. Stochastic Operations Research; 6. Decision Analysis, which are then expanded into multiple subtopics, each as a chapter. These four volumes are aimed at the following five major target audiences: University and College students Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers and NGOs.

This textbook is intended for an introductory graduate level on process control, taught in most engineering curricula. It focuses on the statistical techniques and methods of control and system optimization needed for the mathematical modeling, analysis, simulation, control and optimization of multivariable manufacturing processes. In four sections, it covers: Relevant mathematical methods, including random events, variables and processes, and their characteristics; estimation and confidence intervals; Bayes applications; correlation and regression analysis; statistical cluster analysis; and singular value decomposition for classification applications. Mathematical description of manufacturing processes, including static and dynamic models; model validation; confidence intervals for model parameters; principal component analysis; conventional and recursive least squares procedures; nonlinear least squares; and continuous-time, discrete-time, s-domain and Z-domain models. Control of manufacturing processes, including transfer function/transfer matrix models; state-variable models; methods of discrete-time classical control; state variable discrete-time control; state observers/estimators in control systems; methods of decoupling control; and methods of adaptive control. Methods and applications of system optimization, including unconstrained and constrained optimization; analytical and numerical optimization procedures; use of penalty functions; methods of linear programming; gradient methods; direct search methods; genetic optimization; methods and applications of dynamic programming; and applications to estimation, design, control, and planning. Each section of the book will include end-of-chapter exercises, and the book will be suitable for any systems, electrical, chemical, or industrial engineering program, as it focuses on the processes themselves, and not on the product being manufactured. Students will be able to obtain a mathematical model of any manufacturing process, to design a computer-based control system for a particular continuous manufacturing process, and be able to formulate an engineering problem in terms of optimization, as well as the ability to choose and apply the appropriate optimization technique.

Optimization Methods in Metabolic Networks

Robust and Online Large-Scale Optimization

Optimization Models and Methods for Equilibrium Traffic Assignment

An Introduction

Engineering and Science Applications

Optimization Methods and Applications

Provides a tutorial on the computational tools that use mathematical optimization concepts and representations for the curation, analysis and redesign of metabolic networks Organizes, for the first time, the fundamentals of mathematical optimization in the context of metabolic network analysis Reviews the fundamentals of different classes of optimization problems including LP, MILP, MLP and MINLP Explains the most efficient ways of formulating a biological problem using mathematical optimization Reviews a variety of relevant problems in metabolic network curation, analysis and redesign with an emphasis on details of optimization formulations Provides a detailed treatment of bilevel optimization techniques for computational strain design and other relevant problems This book considers a broad range of areas from decision making methods applied in the contexts of Risk, Reliability and Maintenance (RRM). Intended primarily as an update of the 2015 book Multicriteria and Multiobjective Models for Risk, Reliability and Maintenance Decision Analysis, this edited work provides an integration of applied probability and decision making. Within applied probability, it primarily includes decision analysis and reliability theory, amongst other topics closely related to risk analysis and maintenance. In decision making, it includes multicriteria decision making/aiding (MCDM/A) methods and optimization models. Within MCDM, in addition to decision analysis, some of the topics related to mathematical programming areas are considered, such as multiobjective linear programming, multiobjective nonlinear programming, game theory and negotiations, and multiobjective optimization. Methods related to these topics have been applied to the context of RRM. In MCDA, several other methods are considered, such as outranking methods, rough sets and constructive approaches. The book addresses an innovative treatment of decision making in RRM, improving the integration of fundamental concepts from both areas of RRM and decision

making. This is accomplished by presenting current research developments in decision making on RRM. Some pitfalls of decision models on practical applications on RRM are discussed and new approaches for overcoming those drawbacks are presented. Uniquely blends mathematical theory and algorithm design for understanding and modeling real-world problems Optimization modeling and algorithms are key components to problem-solving across various fields of research, from operations research and mathematics to computer science and engineering. Addressing the importance of the algorithm design process. Deterministic Operations Research focuses on the design of solution methods for both continuous and discrete linear optimization problems. The result is a clear-cut resource for understanding three cornerstones of deterministic operations research: modeling real-world problems as linear optimization problem; designing the necessary algorithms to solve these problems; and using mathematical theory to justify algorithmic development. Treating real-world examples as mathematical problems, the author begins with an introduction to operations research and optimization modeling that includes applications from sports scheduling in the airline industry. Subsequent chapters discuss algorithm design for continuous linear optimization problems, covering topics such as convexity, Farkas' Lemma, and the study of polyhedral sets before culminating in a discussion of the Simplex Method. The book also addresses linear programming duality theory and its use in algorithm design as well as the Dual Simplex Method, Dantzig-Wolfe decomposition, and a primal-dual interior point algorithm. The final chapters present network optimization and integer programming problems, highlighting various specialized topics including label-correcting algorithms for the shortest path problem, preprocessing and probing in integer programming, lifting of valid inequalities, and branch and cut algorithms. Concepts and approaches are introduced by outlining examples that demonstrate and motivate theoretical concepts. The accessible presentation of advanced ideas makes core aspects easy to understand and encourages readers to understand how to think about the problem, not just what to think. Relevant historical summaries can be found throughout the book, and each chapter is designed as the continuation of the "story" of how to both model and solve optimization problems by using the specific problems-

linear and integer programs-as guides. The book's various examples are accompanied by the appropriate models and calculations, and a related Web site features these models along with Maple™ and MATLAB® content for the discussed calculations. Thoroughly class-tested to ensure a straightforward, hands-on approach, Deterministic Operations Research is an excellent book for operations research of linear optimization courses at the upper-undergraduate and graduate levels. It also serves as an insightful reference for individuals working in the fields of mathematics, engineering, computer science, and operations research who use and design algorithms to solve problem in their everyday work. This book presents the theoretical details and computational performances of algorithms used for solving continuous nonlinear optimization applications imbedded in GAMS. Aimed toward scientists and graduate students who utilize optimization methods to model and solve problems in mathematical programming, operations research, business, engineering, and industry, this book enables readers with a background in nonlinear optimization and linear algebra to use GAMS technology to understand and utilize its important capabilities to optimize algorithms for modeling and solving complex, large-scale, continuous nonlinear optimization problems or applications. Beginning with an overview of constrained nonlinear optimization methods, this book moves on to illustrate key aspects of mathematical modeling through modeling technologies based on algebraically oriented modeling languages. Next, the main feature of GAMS, an algebraically oriented language that allows for high-level algebraic representation of mathematical optimization models, is introduced to model and solve continuous nonlinear optimization applications. More than 15 real nonlinear optimization applications in algebraic and GAMS representation are presented which are used to illustrate the performances of the algorithms described in this book. Theoretical and computational results, methods, and techniques effective for solving nonlinear optimization problems, are detailed through the algorithms MINOS, KNITRO, CONOPT, SNOPT and IPOPT which work in GAMS technology.

Applied Probability Models with Optimization Applications
Nonlinear Interval Optimization for Uncertain Problems
An Essay for the Design of Computer-Based Modeling Tools

OPTIMIZATION AND OPERATIONS RESEARCH – Volume I

Optimization Methods for Logical Inference

Models and Methods in Linear Optimization

Optimization is of central concern to a number of disciplines. Operations Research and Decision Theory are often considered to be identical with optimization. But also in other areas such as engineering design, regional policy, logistics and many others, the search for optimal solutions is one of the prime goals. The methods and models which have been used over the last decades in these areas have primarily been "hard" or "crisp", i. e. the solutions were considered to be either feasible or unfeasible, either above a certain aspiration level or below. This dichotomous structure of methods very often forced the modeller to approximate real problem situations of the more-or-less type by yes-or-no-type models, the solutions of which might turn out not to be the solutions to the real problems. This is particularly true if the problem consideration includes vaguely defined relationships, human evaluations, uncertainty due to inconsistent or incomplete evidence, if natural language has to be modelled or if state variables can only be described approximately. Until recently everything which was not known with certainty, i. e. which was not known to be either true or false or which was known to either happen with certainty or to be impossible to occur, was modelled by means of probabilities. This is particularly true for uncertainties concerning the occurrence of events.

Optimization Models and Methods for Equilibrium Traffic Assignment Springer Nature

Computer-based mathematical modeling - the technique of representing and managing models in machine-readable form - is still in its infancy despite the many powerful mathematical software packages already available which can solve astonishingly complex and large models. On the one hand, using mathematical and logical notation, we can formulate models which cannot be solved by any computer in reasonable time - or which cannot even be solved by any method. On the other hand, we can solve certain classes of much larger models than we can practically handle and manipulate without heavy programming. This is especially true in operations research where it is common to solve models with thousands of variables. Even today, there are no general modeling tools that accompany the whole modeling process from start to finish, that is to say, from model creation to report writing. This book proposes a framework for computer-based modeling. More precisely, it puts forward a modeling language as a kernel representation for mathematical models. It presents a general specification for modeling tools. The book does not expose any solution methods or algorithms which may be useful in solving models, neither is it a treatise on how to build them. No help is intended for the modeler by giving practical modeling exercises, although several models will be presented in order to illustrate the framework. Nevertheless, a short introduction to the modeling process is given in order to expound the necessary

background for the proposed modeling framework.

In this thesis, we study the open-pit design problem, the open-pit mining scheduling problem, and the open-pit design problem with geological and price uncertainty. These problems give rise to (mixed) discrete optimization models that in real-life settings are large scale and computationally challenging.

Multicriteria and Optimization Models for Risk, Reliability, and Maintenance Decision Analysis

An Introduction to Methods, Models, and Applications

Mathematical Optimization in Computer Graphics and Vision

Introduction to Process Control

Mathematical Modeling and Optimization

Optimization Models and Mathematical Solutions

This book is focused on the discussion of the traffic assignment problem, the mathematical and practical meaning of variables, functions and basic principles. This work gives information about new approaches, methods and algorithms based on original methodological technique, developed by authors in their publications for the past several years, as well as corresponding prospective implementations. The book may be of interest to a wide range of readers, such as civil engineering students, traffic engineers, developers of traffic assignment algorithms etc. The obtained results here are to be used in both practice and theory. This book is devoted to the traffic assignment problem, formulated in a form of nonlinear optimization program. The most efficient solution algorithms related to the problem are based on its structural features and practical meaning rather than on standard nonlinear optimization techniques or approaches. The authors have carefully considered the meaning of the traffic assignment problem for efficient algorithms development.

Optimization plainly dominates the design, planning, operation, and control of engineering systems. This is a book on optimization that considers particular cases of optimization problems, those with a decomposable structure that can be advantageously exploited. Those decomposable optimization problems are ubiquitous in engineering and science applications. The book considers problems with both complicating constraints and complicating variables, and analyzes linear and nonlinear problems, with and without integer variables. The decomposition techniques analyzed include Dantzig-Wolfe, Benders, Lagrangian relaxation, Augmented Lagrangian decomposition, and others. Heuristic techniques are also considered. Additionally, a comprehensive sensitivity analysis for characterizing the solution of optimization problems is carried out. This material is particularly novel and of high practical interest. This book is built based on many clarifying, illustrative, and computational examples, which facilitate the learning procedure. For the sake of clarity, theoretical concepts and computational algorithms are assembled based on these examples. The results are simplicity, clarity, and easy-learning. We feel that this book is needed by the engineering community that has to tackle complex optimization problems, particularly by practitioners and researchers in Engineering, Operations Research, and Applied Economics. The descriptions of most decomposition techniques are available only in complex and specialized mathematical journals, difficult to understand by engineers. A book describing a wide range of decomposition techniques, emphasizing problem-solving, and appropriately blending theory and application, was not previously available.

Researchers and practitioners in computer science, optimization, operations research and mathematics will find this book useful as it

illustrates optimization models and solution methods in discrete, non-differentiable, stochastic, and nonlinear optimization. Contributions from experts in optimization are showcased in this book showcase a broad range of applications and topics detailed in this volume, including pattern and image recognition, computer vision, robust network design, and process control in nonlinear distributed systems. This book is dedicated to the 80th birthday of Ivan V. Sergienko, who is a member of the National Academy of Sciences (NAS) of Ukraine and the director of the V.M. Glushkov Institute of Cybernetics. His work has had a significant impact on several theoretical and applied aspects of discrete optimization, computational mathematics, systems analysis and mathematical modeling.

This monograph provides both a unified account of the development of models and methods for the problem of estimating equilibrium traffic flows in urban areas and a survey of the scope and limitations of present traffic models. The development is described and analyzed by the use of the powerful instruments of nonlinear optimization and mathematical programming within the field of operations research. The first part is devoted to mathematical models for the analysis of transportation network equilibria; the second deals with methods for traffic equilibrium problems. This title will interest readers wishing to extend their knowledge of equilibrium modeling and analysis and of the foundations of efficient optimization methods adapted for the solution of large-scale models. In addition to its value to researchers, the treatment is suitable for advanced graduate courses in transportation, operations research, and quantitative economics.

Computational Mathematical Programming

The Traffic Assignment Problem

Optimization Models Using Fuzzy Sets and Possibility Theory

Modeling technology for practical engineering problems

Multicriteria Optimization

Optimization Methods in Finance

This book presents basic optimization principles and gradient-based algorithms to a general audience, in a brief and easy-to-read form. It enables professionals to apply optimization theory to engineering, physics, chemistry, or business economics.

Decision makers in many areas, from industry to engineering and the social sector, face an increasing need to consider multiple, conflicting objectives in their decision processes. In many cases these real world decision problems can be formulated as multicriteria mathematical optimization models. The solution of such models requires appropriate techniques to compute so called efficient, or Pareto optimal, or compromise solutions that - unlike traditional mathematical programming methods - take the contradictory nature of the criteria into account. This book provides the necessary mathematical foundation of multicriteria optimization to solve nonlinear, linear and combinatorial problems with multiple criteria. Motivational examples illustrate the use of multicriteria optimization in practice.

Numerous illustrations and exercises as well as an extensive bibliography are provided. In the new edition a chapter on optimality conditions has been added. The linear programming part has been extended and includes new developments. Moreover, motivational examples are now introducing the majority of chapters.

Includes bibliographical references and index.

Scheduled transportation networks give rise to very complex and large-scale network optimization problems requiring innovative solution techniques and ideas from mathematical optimization and theoretical computer science. Examples of scheduled transportation include bus, ferry, airline, and railway networks, with the latter being a prime application domain that provides a fair amount of the most complex and largest instances of such optimization problems. Scheduled transport optimization deals with planning and scheduling problems over several time horizons, and substantial progress has been made for strategic planning and scheduling problems in all transportation domains. This state-of-the-art survey presents the outcome of an open call for contributions asking for either research papers or state-of-the-art survey articles. We received 24 submissions that underwent two rounds of the standard peer-review process, out of which 18 were finally accepted for publication. The volume is organized in four parts: Robustness and Recoverability, Robust Timetabling and Route Planning, Robust Planning Under Scarce Resources, and Online Planning: Delay and Disruption Management.

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