OMB No. 7030954768835

Nonlinear And Mixed Integer Optimization Fundamentals And Applications Topics In Chemical Engineering

FICO® Xpress Mosel #16: Mixed Integer Nonlinear Programming The Art of Linear Programming Marc Pfetsch - Presolving for Mixed-Integer Semidefinite Optimization Mixed Integer Nonlinear Programming for Energy Storage Optimization (Linear \u0026 Mixed Integer Programming) for Pythonistas, with John Curry Marianna De Santis- Exact approaches for multiobjective mixed integer nonlinear programming problems ML/DO 10: Nonlinear and Mixed Integer MPC 1.1: Intro to LP and MIP Mixed Integer Linear Programming (MILP) Tutorial Vinod Nair: \"Solving Mixed Integer Programs Using Neural Networks\" Martin Schmidt: Multilevel Mixed-Integer Nonlinear Optimization for Electricity Market Design Jean Pauphilet A Unified Approach to Mixed-Integer Optimization Nonlinear Formulations\u0026Scalable Algo Mixed-integer Linear Programming Reformulations for Some Nonlinear Discrete Design Optimization Problems
Supplement Volume B
Part II: Optimal Design and Control
Modeling and Solving Linear Programming with R
Theory of Linear and Integer Programming
Julia Programming for Operations Research
Mixed Integer Nonlinear Programming
Theory and Applications
50 Years of Integer Programming 1958-2008
Large Scale Optimization in Supply Chains and Smart Manufacturing
Selected Papers of the Annual International Conference of the German Operations Research Society (GOR), Dresden, Germany, September 4-6, 2019
From Theory to Implementation
Modeling and Solution
Global Optimization in Engineering Design
Chemical Production Scheduling
Theory and Practice
Integer Programming

Nonlinear And Mixed Integer Optimization Fundamentals And Applications Topics In Chemical Engineering ***OMB No. 7030954768835 edited by***

JOEL TRISTEN

Mixed-integer Linear Programming Reformulations for Some Nonlinear Discrete Design Optimization Problems Springer Science & Business Media
Christian Kirches develops a fast numerical algorithm of wide applicability that efficiently solves mixed-integer nonlinear optimal control problems. He uses convexification and relaxation techniques to obtain computationally tractable reformulations for which feasibility and optimality certificates can be given even after discretization and rounding.
Supplement Volume B Springer Science & Business Media
This is a supplementary volume to the major three-volume Handbook of Combinatorial Optimization set. It can also be regarded as a stand-alone volume presenting chapters dealing with various aspects of the subject in a self-contained way.
Part II: Optimal Design and Control Springer Science & Business Media
An accessible treatment of the modeling and solution of integer programming problems, featuring modern applications and software In order to fully comprehend the algorithms associated with integer programming, it is important to understand not only how algorithms work, but also why they work. Applied Integer Programming features a unique emphasis on this point, focusing on problem modeling and solution using commercial software. Taking an application-oriented approach, this book addresses the art and science of mathematical modeling related to the mixed integer programming (MIP) framework and discusses the algorithms and associated practices that enable those models to be solved most efficiently. The book begins with coverage of successful applications, systematic modeling procedures, typical model types, transformation of non-MIP models, combinatorial optimization problem models, and automatic preprocessing to obtain a better formulation. Subsequent chapters present algebraic and geometric basic concepts of linear programming theory and network flows needed for understanding integer programming. Finally, the book concludes with classical and modern solution approaches as well as the key components for building an integrated software system capable of solving large-scale integer programming and combinatorial optimization problems. Throughout the book, the authors demonstrate essential concepts through numerous examples and figures. Each new concept or algorithm is accompanied by a numerical example, and, where applicable, graphics are used to draw together diverse problems or approaches into a unified whole. In addition, features of solution approaches found in today's commercial software are identified throughout the book. Thoroughly classroom-tested, Applied Integer Programming is an excellent book for integer programming courses at the upper-undergraduate and graduate levels. It also serves as a well-organized reference for professionals, software developers, and analysts who work in the fields of applied mathematics, computer science, operations research, management science, and engineering and use integer-programming techniques to model and solve real-world optimization problems.
Modeling and Solving Linear Programming with R Springer
Nonlinearoptimizationproblemscontainingbothcontinuousanddiscretevariables are called mixed integer nonlinear programs (MINLP). Such problems arise in many ?elds, such as process industry, engineering design, communications, and ?nance. There is currently a huge gap between MINLP and mixed integer linear programming(MIP) solvertechnology.With a modernstate-of-the-artMIP solver itispossibletosolvemodelswithmillionsofvariablesandconstraints,whereasthe dimensionofsolvableMINLPsisoftenlimitedbyanumberthatissmallerbythree or four orders of magnitude. It is theoretically possible to approximate a general MINLP by a MIP with arbitrary precision. However, good MIP approximations are usually much larger than the original problem. Moreover, the approximation of nonlinear functions by piecewise linear functions can be di?cult and ti- consuming. In this book relaxation and decomposition methods for solving nonconvex structured MINLPs are proposed. In particular, a generic branch-cut-and-price (BCP) framework for MINLP is presented. BCP is the underlying concept in almost all modern MIP solvers. Providing a powerful decomposition framework for both sequential and parallel solvers, it made the success of the current MIP technology possible. So far generic BCP frameworks have been developed only for MIP, for example,COIN/BCP (IBM, 2003) andABACUS (OREAS GmbH, 1999). In order to generalize MIP-BCP to MINLP-BCP, the following points have to be taken into account: • A given (sparse) MINLP is reformulated as a block-separable program with linear coupling constraints.The block structure makes it possible to generate Lagrangian cuts and to apply Lagrangian heuristics. • In order to facilitate the generation of polyhedral relaxations, nonlinear c- vex relaxations are constructed. • The MINLP separation and pricing subproblems for generating cuts and columns are solved with specialized MINLP solvers.
Theory of Linear and Integer Programming Springer Nature
In this thesis we study how to solve some nonconvex optimization problems by using methods that capitalize on the success of Linear Programming (LP) based solvers for Mixed Integer Linear Programming (MILP). A common aspect of our solution approaches is the use, development and analysis of small but strong extended LP/MILP formulations and approximations.

Julia Programming for Operations Research

Springer Science & Business Media
Linear programming is one of the most extensively used techniques in the toolbox of quantitative methods of optimization. One of the reasons of the popularity of linear programming is that it allows to model a large variety of situations with a simple framework. Furthermore, a linear program is relatively easy to solve. The simplex method allows to solve most linear programs efficiently, and the Karmarkar interior-point method allows a more efficient solving of some kinds of linear programming. The power of linear programming is greatly enhanced when came the opportunity of solving integer and mixed integer linear programming. In these models all or some of the decision variables are integers, respectively. In this book we provide a brief introduction to linear programming, together with a set of exercises that introduce some applications of linear programming. We will also provide an introduction to solve linear programming in R. For each problem a possible solution through linear programming is introduced, together with the code to solve it in R and its numerical solution.
Mixed Integer Nonlinear Programming Springer Science & Business Media
tutorial speakers for their e?orts. We also thank the tutorial chair Gilles Pesant for his help in organizing this event.
Theory and Applications John Wiley & Sons
Disjunctive Programming is a technique and a discipline initiated by the author in the early 1970's, which has become a central tool for solving nonconvex optimization problems like pure or mixed integer programs, through convexification (cutting plane) procedures combined with enumeration. It has played a major role in the revolution in the state of the art of Integer Programming that took place roughly during the period 1990-2010. The main benefit that the reader may acquire from reading this book is a deeper understanding of the theoretical underpinnings and of the applications potential of disjunctive programming, which range from more efficient problem formulation to enhanced modeling capability and improved solution methods for integer and combinatorial optimization. Egon Balas is University Professor and Lord Professor of Operations Research at Carnegie Mellon University's Tepper School of Business.
50 Years of Integer Programming 1958-2008 Springer Nature
Integer Programming: Theory and Practice contains refereed articles that explore both theoretical aspects of integer programming as well as major applications. This volume begins with a description of new constructive and iterative search methods for solving the Boolean optimization problem (BOOP). Following a review of recent developments on convergent Lagrangian techniques that use objective level-cut and domain-cut methods to solve separable nonlinear integer-programming problems, the book discusses the generalized assignment problem (GAP). The final theoretical chapter analyzes the use of decomposition methods to obtain bounds on the optimal value of solutions to integer linear-programming problems. The first application article contains models and solution algorithms for the rescheduling of airlines following the temporary closure of airports. The next chapters deal with the determination of an optimal mix of chartered and self-owned vessels needed to transport a product. The book then presents an application of integer programming that involves the capture, storage, and transmission of large quantities of data collected during testing scenarios involving military applications related to vehicles, medicine, equipment, missiles, and aircraft. The next article develops an integer linear-programming model to determine the assortment of products that must be carried by stores within a retail chain to maximize profit, and the final article contains an overview of noncommercial software tools for the solution of mixed-integer linear programs (MILP). The authors purposefully include applications and theory that are usually not found in contributed books in order to appeal to a wide variety of researchers and practitioners.
Large Scale Optimization in Supply Chains and Smart Manufacturing Changhyun Kwon
The vast majority of important applications in science, engineering and applied science are characterized by the existence of multiple minima and maxima, as well as first, second and higher order saddle points. The area of Deterministic Global Optimization introduces theoretical, algorithmic and computational ad vances that (i) address the computation and characterization of global minima and maxima, (ii) determine valid lower and upper bounds on the global minima and maxima, and (iii) address the enclosure of all solutions of nonlinear con strained systems of equations. Global optimization applications are widespread in all disciplines and they range from atomistic or molecular level to process and product level representations. The primary goal of this

book is three fold : first, to introduce the reader to the basics of deterministic global optimization; second, to present important theoretical and algorithmic advances for several classes of mathematical prob lems that include biconvex and bilinear; problems, signomial problems, general twice differentiable nonlinear problems, mixed integer nonlinear problems, and the enclosure of all solutions of nonlinear constrained systems of equations; and third, to tie the theory and methods together with a variety of important applications.

Selected Papers of the Annual International Conference of the German Operations Research Society (GOR), Dresden, Germany, September 4-6, 2019 Springer

Last Updated: December 2020 Based on Julia v1.3+ and JuMP v0.21+ The main motivation of writing this book was to help the author himself. He is a professor in the field of operations research, and his daily activities involve building models of mathematical optimization, developing algorithms for solving the problems, implementing those algorithms using computer programming languages, experimenting with data, etc. Three languages are involved: human language, mathematical language, and computer language. His team of students need to go over three different languages, which requires "translation" among the three languages. As this book was written to teach his research group how to translate, this book will also be useful for anyone who needs to learn how to translate in a similar situation. The Julia Language is as fast as C, as convenient as MATLAB, and as general as Python with a flexible algebraic modeling language for mathematical optimization problems. With the great support from Julia developers, especially the developers of the JuMP—Julia for Mathematical Programming—package, Julia makes a perfect tool for students and professionals in operations research and related areas such as industrial engineering, management science, transportation engineering, economics, and regional science. For more information, visit: http://www.chkwon.net/julia

From Theory to Implementation

Springer Science & Business Media

A comprehensive introduction to the tools, techniques and applications of convex optimization.

Modeling and Solution Springer Science & Business Media

This book presents a structured approach to formulate, model, and solve mathematical optimization problems for a wide range of real world situations. Among the problems covered are production, distribution and supply chain planning, scheduling, vehicle routing, as well as cutting stock, packing, and nesting. The optimization techniques used to solve the problems are primarily linear, mixed-integer linear, nonlinear, and mixed integer nonlinear programming. The book also covers important considerations for solving real-world optimization problems, such as dealing with valid inequalities and symmetry during the modeling phase, but also data interfacing and visualization of results in a more and more digitized world. The broad range of ideas and approaches presented helps the reader to learn how to model a variety of problems from process industry, paper and metals industry, the energy sector, and logistics using mathematical optimization techniques.

Global Optimization in Engineering Design Nonlinear and Mixed-Integer OptimizationFundamentals and Applications

Filling a void in chemical engineering and optimization literature, this book presents the theory and methods for nonlinear and mixed-integer optimization, and their applications in the important area of process synthesis. Other topics include modeling issues in process synthesis, and optimization-based approaches in the synthesis of heat recovery systems, distillation-based systems, and reactor-based systems. The basics of convex analysis and nonlinear optimization are also covered and the elementary concepts of mixed-integer linear optimization are introduced. All chapters have several illustrations and geometrical interpretations of the material as well as suggested problems. Nonlinear and Mixed-Integer Optimization will prove to be an invaluable source--either as a textbook or a reference--for researchers and graduate students interested in continuous and discrete nonlinear optimization issues in engineering design, process synthesis, process operations, applied mathematics, operations research, industrial management, and systems engineering.

Chemical Production Scheduling Springer Science & Business Media

Mixed-Integer Nonlinear Programs (MINLPs) are used to model many applied problems. However, finding a global optimal solution to such problems is difficult due to the combined presence of integer variables and nonlinear functions. If a MINLP has special structure, one can exploit the structure and develop a specialized approach that has potential to solve the problem more efficiently than a general-purpose solver. In this thesis, we study MINLPs with three different structures. We first consider a class of MINLPs in which the set defined by the nonlinear constraint functions is convex, but the nonlinear functions may not be convex. Existing solution approaches for convex MINLPs are not guaranteed to find the global optimal solution of such problems. We propose two linearization-based methods to solve this class of problems. We prove the method finds an optimal solution using a finite number of nodes and cuts. Computational results show our methods are as efficient as the existing methods while solving this more general problem class. Second, we study a network design problem in which an operator wants to open facilities and determine their size to satisfy demand of customers. Customers face congestion at the facilities they send their demand to, which depends on total usage of facility. We model this problem as a Mixed-Integer Bilevel Program (MIBP) which can be reformulated as a nonconvex MINLP, but is difficult to solve by general purpose solvers. Hence, we propose a Lagrangian relaxation approach which finds a candidate feasible solution along with a lower bound that can be used to validate the solution quality. We find that the method can efficiently find provably high quality solutions even for large instances. Finally, we study optimization problems having a nonconvex monotone objective function that is computationally expensive to evaluate. Such problems can be solved using cuts known as "integer L-shaped cuts.'' We exploit the monotonicity structure to derive a stronger version of these cuts, and explore the use of mixing inequalities to further tighten the relaxation. Computational studies show that the strengthened cuts yield improved computational performance, but the impact of mixing inequalities is marginal.

Theory and Practice CRC Press

This book gathers a selection of peer-reviewed papers presented at the International Conference on Operations Research (OR 2019), which was held at Technische Universität Dresden, Germany, on September 4-6, 2019, and was jointly organized by the German Operations Research Society (GOR) the Austrian Operations Research Society (ÖGOR), and the Swiss Operational Research Society (SOR/ASRO). More than 600 scientists, practitioners and students from mathematics, computer science, business/economics and related fields attended the conference and presented more than 400 papers in plenary presentations, parallel topic streams, as well as special award sessions. The respective papers discuss classical mathematical optimization, statistics and simulation techniques. These are complemented by computer science methods, and by tools for processing data, designing and implementing information systems. The book also examines recent advances in information technology, which allow big data volumes to be processed and enable real-time predictive and prescriptive business analytics to drive decisions and actions. Lastly, it includes problems modeled and treated while taking into account uncertainty, risk management, behavioral issues, etc.

Integer Programming Springer

Nonlinear and Mixed-Integer OptimizationFundamentals and ApplicationsOxford University Press on Demand

Mixed-integer Optimization Techniques for the Design and Scheduling of Batch Processes Oxford University Press on Demand

Most global optimization literature focuses on theory. This book, however, contains descriptions of new implementations of general-purpose or problem-specific global optimization algorithms. It discusses existing software packages from which the entire community can learn. The contributors are experts in the discipline of actually getting global optimization to work, and the book provides a source of ideas for people needing to implement global optimization software.

Advances and Trends in Optimization with Engineering Applications Springer

Interest in constrained optimization originated with the simple linear pro gramming model since it was practical and perhaps the only computationally tractable model at the time. Constrained linear optimization models were soon adopted in numerous application areas and are perhaps the most widely used mathematical models in operations research and management science at the time of this writing. Modelers have, however, found the assumption of linearity to be overly restrictive in expressing the real-world phenomena and problems in economics, finance, business, communication, engineering design, computational biology, and other areas that frequently demand the use of nonlinear expressions and discrete variables in optimization models. Both of these extensions of the linear programming model are NP-hard, thus representing very challenging problems. On the brighter side, recent advances in algorithmic and computing technology make it possible to re visit these problems with the hope of solving practically relevant problems in reasonable amounts of computational time. Initial attempts at solving nonlinear programs concentrated on the de velopment of local optimization methods guaranteeing globality under the assumption of convexity. On the other hand, the integer programming liter ature has concentrated on the development of methods that ensure global optima. The aim of this book is to marry the advancements in solving nonlinear and integer programming models and to develop new results in the more general framework of mixed-integer nonlinear programs (MINLPs) with the goal of devising practically efficient global optimization algorithms for MINLPs.

An Introduction with Case Studies and Solutions in Various Algebraic Modeling Languages Springer Science & Business Media

In this book, theory of large scale optimization is introduced with case studies of real-world problems and applications of structured mathematical modeling. The large scale optimization methods are represented by various theories such as Benders' decomposition, logic-based Benders' decomposition, Lagrangian relaxation, Dantzig –Wolfe decomposition, multi-tree decomposition, Van Roy' cross decomposition and parallel decomposition for mathematical programs such as mixed integer nonlinear programming and stochastic programming. Case studies of large scale optimization in supply chain management, smart manufacturing, and Industry 4.0 are investigated with efficient implementation for real-time solutions. The features of case studies cover a wide range of fields including the Internet of things, advanced transportation systems, energy management, supply chain networks, service systems, operations management, risk management, and financial and sales management. Instructors, graduate students, researchers, and practitioners, would benefit from this book finding the applicability of large scale optimization in asynchronous parallel optimization, real-time distributed network, and optimizing the knowledge-based expert system for convex and non-convex problems.