

Multi Objective Optimization Techniques And Applications In Chemical Engineering With Cd Rom Advances In Process Systems Engineering

- Detailed MOEA applications discussed by international experts - State-of-the-art practical insights in tackling statistical optimization with MOEAs - A unique monograph covering a wide spectrum of real-world applications - Step-by-step discussion of MOEA applications in a variety of domains

Optimization has been playing a key role in the design, planning and operation of chemical and related processes for nearly half a century. Although process optimization for multiple objectives was studied by several researchers back in the 1970s and 1980s, it has attracted active research in the last 10 years, spurred by the new and effective techniques for multi-objective optimization. In order to capture this renewed interest, this monograph presents the recent and ongoing research in multi-optimization techniques and their applications in chemical engineering. Following a brief introduction and general review on the development of multi-objective optimization applications in chemical engineering since 2000, the book gives a description of selected multi-objective techniques and then goes on to discuss chemical engineering applications. These applications are from diverse areas within chemical engineering, and are presented in detail. All chapters will be of interest to researchers in multi-objective optimization and/or chemical engineering; they can be read individually and used in one's learning and research. Several exercises are included at the end of many chapters, for use by both practicing engineers and students.

Recent results on non-convex multi-objective optimization problems and methods are presented in this book, with particular attention to expensive black-box objective functions. Multi-objective optimization methods facilitate designers, engineers, and researchers to make decisions on appropriate trade-offs between various conflicting goals. A variety of deterministic and stochastic multi-objective optimization methods are developed in this book. Beginning with basic concepts and a review of non-convex single-objective optimization problems; this book moves on to cover multi-objective branch and bound algorithms, worst-case optimal algorithms (for Lipschitz functions and bi-objective problems), statistical models based algorithms, and probabilistic branch and bound approach. Detailed descriptions of new algorithms for non-convex multi-objective optimization, their theoretical substantiation, and examples for practical applications to the cell formation problem in manufacturing engineering, the process design in chemical engineering, and business process management are included to aide researchers and graduate students in mathematics, computer science, engineering, economics, and business management.

During last 25 years multi-objective optimization has been in the limelight of researchers. Because of practical importance and applications of multi-objective optimization as the most natural way of decision making and real-life optimizing method--growing interests of researchers in this very field of science was a natural consequence and extension of previous research on single-objective optimization techniques. Unfortunately, when searching for the approximation of the Pareto frontier, classical computational methods often prove ineffective for many (real) decision problems. The corresponding models are too complex or the formulas applied too complicated, or it can even occur that some formulations must be rejected in the face of numerical instability of available solvers. Also, because of such a specificity of multi-objective optimization (especially when--as in our case--we are considering multi-objective optimization in the Pareto sense) that we are looking for the whole set of nondominated solutions rather than one single solution--the special attention has been paid on population-based optimization techniques and if so, the most important techniques turned out here to be evolutionary-based methods. Research on applying evolutionary-based methods for solving multi-objective optimization tasks resulted in developing a completely new (and now commonly and very well known) science field: evolutionary multi-objective optimization (EMOO). To confirm above sentences, it is enough to mention statistics regarding at least the number of conference and journal articles, PhD thesis, conferences, books etc. devoted to EMOO and available at <http://delta.cs.cinvestav.mx/soello/EMOO>. After the first stage of research on EMOO when plenty of algorithms were proposed¹, simultaneously with introducing in early 2000s two the most important EMOO algorithms.

Recent Advances in Evolutionary Multi-objective Optimization

Applications and Implementations

Techniques and Applications in Chemical Engineering

Evolutionary Multi-objective Optimization in Uncertain Environments

Multi-objective Optimization Techniques in Electricity Generation Planning

Principles and Case Studies

This book focuses on the most well-regarded and recent nature-inspired algorithms capable of solving optimization problems with multiple objectives. Firstly, it provides preliminaries and essential definitions in multi-objective problems and different paradigms to solve them. It then presents an in-depth explanations of the theory, literature review, and applications of several widely-used algorithms, such as Multi-objective Particle Swarm Optimizer, Multi-Objective Genetic Algorithm and Multi-objective GreyWolf Optimizer Due to the simplicity of the techniques and flexibility, readers from any field of study can employ them for solving multi-objective optimization problem. The book provides the source codes for all the proposed algorithms on a dedicated webpage.

Metaheuristics are widely used to solve important practical combinatorial optimization problems. Many new multicast applications emerging from the Internet--such as TV over the Internet, radio over the Internet, and multipoint video streaming--require reduced bandwidth consumption, end-to-end delay, and packet loss ratio. It is necessary to design an

This collection of recent studies spans a range of computational intelligence applications, emphasizing their application to challenging real-world problems. Covers Intelligent agent-based algorithms, Hybrid intelligent systems, Machine learning and more.

Multiobjective optimization deals with solving problems having not only one, but multiple, often conflicting, criteria. Such problems can arise in practically every field of science, engineering and business, and the need for efficient and reliable solution methods is increasing. The task is challenging due to the fact that, instead of a single optimal solution, multiobjective optimization results in a number of solutions with different trade-offs among criteria, also known as Pareto optimal or efficient solutions. Hence, a decision maker is needed to provide additional preference information and to identify the most satisfactory solution. Depending on the paradigm used, such information may be introduced before, during, or after the optimization process. Clearly, research and application in multiobjective optimization involve expertise in optimization as well as in decision support. This state-of-the-art survey originates from the International Seminar on Practical Approaches to Multiobjective Optimization, held in Dagstuhl Castle, Germany, in December 2006, which brought together leading experts from various contemporary multiobjective optimization fields, including evolutionary multiobjective optimization (EMO), multiple criteria decision making (MCDM) and multiple criteria decision aiding (MCDA). This book gives a unique and detailed account of the current status of research and applications in the field of multiobjective optimization. It contains 16 chapters grouped in the following 5 thematic sections: Basics on Multiobjective Optimization; Recent Interactive and Preference-Based Approaches; Visualization of Solutions; Modelling, Implementation and Applications; and Quality Assessment, Learning, and Future Challenges.

Issues and Algorithms

Theory of Multiobjective Optimization

Multi-objective Optimization: Techniques And Applications In Chemical Engineering (Second Edition)

Fuzzy Logic for Planning and Decision Making

Multi-Objective Optimization Problems

Multi-Objective Optimization in Computer Networks Using Metaheuristics

Multi-Objective Combinatorial Optimization Problems and Solution Methods discusses the results of a recent multi-objective combinatorial optimization achievement that considered metaheuristic, mathematical programming, heuristic, hyper heuristic and hybrid approaches. In other words, the book presents various multi-objective combinatorial optimization issues that may benefit from different methods in theory and practice. Combinatorial optimization problems appear in a wide range of applications in operations research, engineering, biological sciences and computer science, hence many optimization approaches have been developed that link the discrete universe to the continuous universe through geometric, analytic and algebraic techniques. This book covers this important topic as computational optimization has become increasingly popular as design optimization and its applications in engineering and industry have become ever more important due to more stringent design requirements in modern engineering practice. Presents a collection of the most up-to-date research, providing a complete overview of multi-objective combinatorial optimization problems and applications Introduces new approaches to handle different engineering and science problems, providing the field with a collection of related research not already covered in the primary literature Demonstrates the efficiency and power of the various algorithms, problems and solutions, including numerous examples that illustrate concepts and algorithms

Multi-Objective Optimization in Theory and Practice is a traditional two-part approach to solving multi-objective optimization (MOO) problems namely the use of classical methods and evolutionary algorithms. This first book is devoted to classical methods including the extended simplex method by Zeleny and preference-based techniques. This part covers three main topics through nine chapters. The first topic focuses on the design of such MOO problems, their complexities including nonlinearities and uncertainties, and optimality theory. The second topic introduces the founding solving methods including the extended simplex method to linear MOO problems and weighting objective methods. The third topic deals with particular structures of MOO problems, such as mixed-integer programming, hierarchical programming, fuzzy logic programming, and bimatrix games. **Multi-Objective Optimization in Theory and Practice** is a user-friendly book with detailed, illustrated calculations, examples, test functions, and small-size applications in Mathematica® (among other mathematical packages) and from scholarly literature. It is an essential handbook for students and teachers involved in advanced optimization courses in engineering, information science, and mathematics degree programs.

Real-world engineering problems often require concurrent optimization of several design objectives, which are conflicting in cases. This type of optimization is generally called multi-objective or multi-criterion optimization. The area of research that applies evolutionary methodologies to multi-objective optimization is of special and growing interest. It brings a viable computational solution to many real-world problems. Generally, multi-objective engineering problems do not have a straightforward optimal design. These kinds of problems usually inspire several solutions of equal efficiency, which achieve different trade-offs. Decision makers' preferences are normally used to select the most adequate design. Such preferences may be dictated before or after the optimization takes place. They may also be introduced interactively at different levels of the optimization process. Multi-objective optimization methods can be subdivided into classical and evolutionary. The classical methods usually aim at a single solution while the evolutionary methods provide a whole set of so-called Pareto-optimal solutions. **Evolutionary Multi-Objective System Design: Theory and Applications** provides a representation of the state-of-the-art in evolutionary multi-objective optimization research area and related new trends. It reports many innovative designs yielded by the application of such optimization methods. It also presents the application of multi-objective optimization to the following problems: Embrittlement of stainless steel coated electrodes Learning fuzzy rules from imbalanced datasets Combining multi-objective evolutionary algorithms with collective intelligence Fuzzy gain scheduling control Smart placement of roadside units in vehicular networks

Combining multi-objective evolutionary algorithms with quasi-simplex local search Design of robust substitution boxes Protein structure prediction problem Core assignment for efficient network-on-chip-based system design

This book is aimed at undergraduate and graduate students in applied mathematics or computer science, as a tool for solving real-world design problems. The present work covers fundamentals in multi-objective optimization and applications in mathematical and engineering system design using a new optimization strategy, namely the Self-Adaptive Multi-objective Optimization Differential Evolution (SA-MODE) algorithm. This strategy is proposed in order to reduce the number of evaluations of the objective function through dynamic update of canonical Differential Evolution parameters (population size, crossover probability and perturbation rate). The methodology is applied to solve mathematical functions considering test cases from the literature and various engineering systems design, such as cantilevered beam design, biochemical reactor, crystallization process, machine tool spindle design, rotary dryer design, among others.

Multi-Objective Optimization using Artificial Intelligence Techniques

Multi-Objective Optimization

New Multi-Objective Optimization Techniques and Their Application to Complex Chemical Engineering Problems

Evolutionary Multi-Criterion Optimization

Multiobjective Optimization

MULTI-OBJECTIVE OPTIMIZATION USING EVOLUTIONARY ALGORITHMS

Multi-objective optimization (MO) is a fast-developing field in computational intelligence research. Giving decision makers more options to choose from using some post-analysis preference information, there are a number of competitive MO techniques with an increasingly large number of MO real-world applications. Multi-Objective Optimization in Computational Intelligence: Theory and Practice explores the theoretical, as well as empirical, performance of MOs on a wide range of optimization issues including combinatorial, real-valued, dynamic, and noisy problems. This book provides scholars, academics, and practitioners with a fundamental, comprehensive collection of research on multi-objective optimization techniques, applications, and practices.

"Optimization is now essential in the design, planning and operation of chemical and related processes. Although process optimization for multiple objectives was studied in the 1970s and 1980s, it has attracted active research in the last 15 years, spurred by the new and effective techniques for multi-objective optimization (MOO). To capture this renewed interest, this monograph presents recent research in MOO techniques and applications in chemical engineering. Following a brief introduction and review of MOO applications in chemical engineering since 2000, the book presents selected MOO techniques and many chemical engineering applications in detail. In this second edition, several chapters from the first edition have been updated, one chapter is completely revised and three new chapters have been added. One of the new chapters describes three MS Excel programs useful for MOO of application problems. All the chapters will be of interest to researchers in MOO and/or chemical engineering. Several exercises are included at the end of many chapters, for use by both practicing engineers and students."--Publisher's website.

This book constitutes the refereed proceedings of the 10th International Conference on Parallel Problem Solving from Nature, PPSN 2008, held in Dortmund, Germany, in September 2008. The 114 revised full papers presented were carefully reviewed and selected from 206 submissions. The conference covers a wide range of topics, such as evolutionary computation, quantum computation, molecular computation, neural computation, artificial life, swarm intelligence, artificial ant systems, artificial immune systems, self-organizing systems, emergent behaviors, and applications to real-world problems. The paper are organized in topical sections on formal theory, new techniques, experimental analysis, multiobjective optimization, hybrid methods, and applications.

For reasons both financial and environmental, there is a perpetual need to optimize the design and operating conditions of industrial process systems in order to improve their performance, energy efficiency, profitability, safety and reliability.

However, with most chemical engineering application problems having many variables with complex inter-relationships, meeting these optimization objectives can be challenging. This is where Multi-Objective Optimization (MOO) is useful to find the optimal trade-offs among two or more conflicting objectives. This book provides an overview of the recent developments and applications of MOO for modeling, design and operation of chemical, petrochemical, pharmaceutical, energy and related processes. It then covers important theoretical and computational developments as well as specific applications such as metabolic reaction networks, chromatographic systems, CO2 emissions targeting for petroleum refining units, ecodesign of chemical processes, ethanol purification and cumene process design. Multi-Objective Optimization in Chemical Engineering: Developments and Applications is an invaluable resource for researchers and graduate students in chemical engineering as well as industrial practitioners and engineers involved in process design, modeling and optimization.

Concepts and Self-Adaptive Parameters with Mathematical and Engineering Applications

Handbook of Materials Modeling

Agent-Based Co-Evolutionary Techniques for Solving Multi-Objective Optimization Problems

Theoretical Advances and Applications

Multi-objective Optimization

Evolutionary Multi-Objective System Design

Evolutionary algorithms are relatively new, but very powerful techniques used to find solutions to many real-world search and optimization problems. Many of these problems have multiple objectives, which leads to the need to obtain a set of optimal solutions, known as effective solutions. It has been found that using evolutionary algorithms is a highly effective way of finding multiple effective solutions in a single simulation run. Comprehensive coverage of this growing area of research Carefully introduces each algorithm with examples and in-depth discussion Includes many applications to real-world problems, including engineering design and scheduling Includes discussion of advanced topics and future research Can be used as a course text or for self-study Accessible to those with limited knowledge of classical multi-objective optimization and evolutionary algorithms The integrated presentation of theory, algorithms and examples will benefit those working and researching in the areas of optimization, optimal design and evolutionary computing. This text provides an excellent introduction to the use of evolutionary algorithms in multi-objective optimization, allowing use as a graduate course text or for self-study.

Problems with multiple objectives and criteria are generally known as multiple criteria optimization or multiple criteria decision-making (MCDM) problems. So far, these types of problems have typically been modelled and solved by means of linear programming. However, many real-life phenomena are of a nonlinear nature, which is why we need tools for nonlinear programming capable of handling several conflicting or incommensurable objectives. In this case, methods of traditional single objective optimization and linear programming are not enough; we need new ways of thinking, new concepts, and new methods - nonlinear multiobjective optimization. Nonlinear Multiobjective Optimization provides an extensive, up-to-date, self-contained and consistent survey, review of the literature and of the state of the art on nonlinear (deterministic) multiobjective optimization, its methods, its theory and its background. The amount of literature on multiobjective optimization is immense. The treatment in this book is based on approximately 1500 publications in English printed mainly after the year 1980.

Problems related to real-life applications often contain irregularities and nonsmoothnesses. The treatment of nondifferentiable multiobjective optimization in the literature is rather rare. For this reason, this book contains material about the possibilities, background, theory and methods of nondifferentiable multiobjective optimization as well. This book is intended for both researchers and students in the areas of (applied) mathematics, engineering, economics, operations research and management science; it is meant for both professionals and practitioners in many different fields of application. The intention has been to provide a consistent summary that may help in selecting an appropriate method for the problem to be solved. It is hoped the extensive bibliography will be of value to researchers.

Presents a multi-objective design approach to the many power magnetic devices in use today Power Magnetic Devices: A Multi-Objective Design Approach addresses the design of power magnetic devicesincluding inductors, transformers, electromagnets, and rotating electric machinery/using a structured design approach based on formal single- and multi-objective optimization. The book opens with a discussion of evolutionary-computing-based optimization. Magnetic analysis techniques useful to the design of all the devices considered in the book are then set forth. This material is then used for inductor design so readers can start the design process. Core loss is next considered; this material is used to support transformer design. A chapter on force and torque production feeds into a chapter on electromagnet design. This is followed by chapters on rotating machinery and the design of a permanent magnet AC machine. Finally, enhancements to the design process including thermal analysis and AC conductor losses due to skin and proximity effects are set forth. Power Magnetic Devices: Focuses on the design process as it relates to power magnetic devices such as inductors, transformers, electromagnets, and rotating machinery Offers a structured design approach based on single- and multi-objective optimization Helps experienced designers take advantage of new techniques which can yield superior designs with less engineering time Provides numerous case studies throughout the book to facilitate readers' comprehension of the analysis and design process Includes Powerpoint-slide-based student and instructor lecture notes and MATLAB-based examples, toolboxes, and design codes Designed to support the educational needs of students, Power Magnetic Devices: A Multi-Objective Design Approach also serves as a valuable reference tool for practicing engineers and designers. MATLAB examples are available via the book support site.

A Rigorous Mathematical Approach To Identifying A Set Of Design Alternatives And Selecting The Best Candidate From Within That Set, Engineering Optimization Was Developed As A Means Of Helping Engineers To Design Systems That Are Both More Efficient And Less Expensive And To Develop New Ways Of Improving The Performance Of Existing Systems.Thanks To The Breathtaking Growth In Computer Technology That Has Occurred Over The Past Decade, Optimization Techniques Can Now Be Used To Find Creative Solutions To Larger, More Complex Problems Than Ever Before. As A Consequence, Optimization Is Now Viewed As An Indispensable Tool Of The Trade For Engineers Working In Many Different Industries, Especially The Aerospace, Automotive, Chemical, Electrical, And Manufacturing Industries.In Engineering Optimization, Professor Singiresu S. Rao Provides An Application-Oriented Presentation Of The Full Array Of Classical And Newly Developed Optimization Techniques Now Being Used By Engineers In A Wide Range Of Industries. Essential Proofs And Explanations Of The Various Techniques Are Given In A Straightforward, User-Friendly Manner, And Each Method Is Copiously Illustrated With Real-World Examples That Demonstrate How To Maximize Desired Benefits While Minimizing Negative Aspects Of Project Design.Comprehensive, Authoritative, Up-To-Date, Engineering Optimization Provides In-Depth Coverage Of Linear And Nonlinear Programming, Dynamic Programming, Integer Programming, And Stochastic Programming Techniques As Well As Several Breakthrough Methods, Including Genetic Algorithms, Simulated Annealing, And Neural Network-Based And Fuzzy Optimization Techniques.Designed To Function Equally Well As Either A Professional Reference Or A Graduate-Level Text, Engineering Optimization Features Many Solved Problems Taken From Several Engineering Fields, As Well As Review Questions, Important Figures, And Helpful References.Engineering Optimization Is A Valuable Working Resource For Engineers Employed In Practically All Technological Industries. It Is Also A Superior Didactic Tool For Graduate Students Of Mechanical, Civil, Electrical, Chemical And Aerospace Engineering.

Multi-Objective Optimization using Evolutionary Algorithms

Search Methodologies

Increasing Capacity, Service Level and Safety with Optimization Algorithms

Computational Intelligence in Optimization

Evolutionary to Hybrid Framework

Parallel Problem Solving from Nature - PPSN X

Special Features: · Includes many applications to real-world problems such as engineering design and scheduling. · Provides discussions of advanced topics and future research. · Contains exercises and solutions to enhance the material. · Written in way that is accessible to those with limited knowledge of classical multi-objective optimization and evolutionary algorithms.

The first edition of Search Methodologies: Introductory Tutorials in Optimization and Decision Support Techniques was originally put together to offer a basic introduction to the various search and optimization techniques that students might need to use during their research, and this new edition continues this tradition. Search Methodologies has been expanded and brought completely up to date, including new chapters covering scatter search, GRASP, and very large neighborhood search. The chapter authors are drawn from across Computer Science and Operations Research and include some of the world's leading authorities in their field. The book provides useful guidelines for implementing the methods and frameworks described and offers valuable tutorials to students and researchers in the field. "As I embarked on the pleasant journey of reading through the chapters of this book, I became convinced that this is one of the best sources of introductory material on the search methodologies topic to be found. The book's subtitle, "Introductory Tutorials in Optimization and Decision Support Techniques", aptly describes its aim, and the editors and contributors to this volume have achieved this aim with remarkable success. The chapters in this book are exemplary in giving useful guidelines for implementing the methods and frameworks described." Fred Glover, Leeds School of Business, University of Colorado Boulder, USA "[The book] aims to present a series of well written tutorials by the leading experts in their fields. Moreover, it does this by covering practically the whole possible range of topics in the discipline. It enables students and practitioners to study and appreciate the beauty and the power of some of the computational search techniques that are able to effectively navigate through search spaces that are sometimes inconceivably large. I am convinced that this second edition will build on the success of the first edition and that it will prove to be just as popular." Jacek Blazewicz, Institute of Computing Science, Poznan University of Technology and Institute of Bioorganic Chemistry, Polish Academy of Sciences

Evolutionary algorithms are sophisticated search methods that have been found to be very efficient and effective in solving complex real-world multi-objective problems where conventional optimization tools fail to work well. Despite the tremendous amount of work done in the development of these algorithms in the past decade, many researchers assume that the optimization problems are deterministic and uncertainties are rarely examined. The primary motivation of this book is to provide a comprehensive introduction on the design and application of evolutionary algorithms for multi-objective optimization in the presence of uncertainties. In this book, we hope to expose the readers to a range of optimization issues and concepts, and to encourage a greater degree of appreciation of evolutionary computation techniques and the exploration of new ideas that can better handle uncertainties. "Evolutionary Multi-Objective Optimization in Uncertain Environments: Issues and Algorithms" is intended for a wide readership and will be a valuable reference for engineers, researchers, senior undergraduates and graduate students who are interested in the areas of evolutionary multi-objective optimization and uncertainties.

The design of most modern engineering systems entails the consideration of a good trade-off between the several targets requirements to be satisfied along the system life such as high reliability, low redundancy and low operational costs. These aspects are often in conflict with one another, hence a compromise solution has to be sought. Innovative computing techniques, such as genetic algorithms, swarm intelligence, differential evolution, multi-objective evolutionary optimization, just to name few, are of great help in founding effective and reliable solution for many engineering problems. Each chapter of this book attempts to using an innovative computing technique to elegantly solve a different engineering problem.

Power Magnetic Devices

Engineering Optimization

10th International Conference Dortmund, Germany, September 13-17, 2008 Proceedings

4th International Conference, EMO 2007, Matsushima, Japan, March 5-8, 2007, Proceedings

Evolutionary Algorithms for Solving Multi-Objective Problems

Introductory Tutorials in Optimization and Decision Support Techniques

Multi-Objective Optimization in Theory and Practice is a simplified two-part approach to multi-objective optimization (MOO) problems. This second part focuses on the use of metaheuristic algorithms in more challenging practical cases. The book includes ten chapters that cover several advanced MOO techniques. These include the determination of Pareto-optimal sets of solutions, metaheuristic algorithms, genetic search algorithms and evolution strategies, decomposition algorithms, hybridization of different metaheuristics, and many-objective (more than three objectives) optimization and parallel computation. The final section of the book presents information about the design and types of fifty test problems for which the Pareto-optimal front is approximated. For each of them, the package NSGA-II is used to approximate the Pareto-optimal front. It is an essential handbook for students and teachers involved in advanced optimization courses in engineering, information science and mathematics degree programs.

This textbook is a second edition of Evolutionary Algorithms for Solving Multi-Objective Problems, significantly expanded and adapted for the classroom. The various features of multi-objective evolutionary algorithms are presented here in an innovative and student-friendly fashion, incorporating state-of-the-art research. The book disseminates the application of evolutionary algorithm techniques to a variety of practical problems. It contains exhaustive appendices, index and bibliography and links to a complete set of teaching tutorials, exercises and solutions.

This book covers the most recent advances in the field of evolutionary multiobjective optimization. With the aim of drawing the attention of up-and coming scientists towards exciting prospects at the forefront of computational intelligence, the authors have made an effort to ensure that the ideas conveyed herein are accessible to the widest audience. The book begins with a summary of the basic concepts in multi-objective optimization. This is followed by brief discussions on various algorithms that have been proposed over the years for solving such problems, ranging from classical (mathematical) approaches to sophisticated evolutionary ones that are capable of seamlessly tackling practical challenges such as non-convexity, multi-modality, the presence of multiple constraints, etc. Thereafter, some of the key emerging aspects that are likely to shape future research directions in the field are presented. These include: optimization in dynamic environments, multi-objective bilevel programming, handling high dimensionality under many objectives, and evolutionary multitasking. In addition to theory and methodology, this book describes several real-world applications from various domains, which will expose the readers to the versatility of evolutionary multi-objective optimization.

Optimization is now essential in the design, planning and operation of chemical and related processes. Although process optimization for multiple objectives was studied in the 1970s and 1980s, it has attracted active research in the last 15 years, spurred by the new and effective techniques for multi-objective optimization (MOO). To capture this renewed interest, this monograph presents recent research in MOO techniques and applications in chemical engineering. Following a brief introduction and review of MOO applications in chemical engineering since 2000, the book presents selected MOO techniques and many chemical engineering applications in detail. In this second edition, several chapters from the first edition have been updated, one chapter is completely revised and three new chapters have been added. One of the new chapters describes three MS Excel programs useful for MOO of application problems. All the chapters will be of interest to researchers in MOO and/or chemical engineering.

Several exercises are included at the end of many chapters, for use by both practicing engineers and students.

Multi-objective Management in Freight Logistics

Interactive and Evolutionary Approaches

Theory and Applications

Theory and Practice

Multi-Objective Optimization in Computational Intelligence: Theory and Practice

Multi-Objective Optimization in Chemical Engineering

The Handbook of Materials Modeling, 2nd edition is a six-volume major reference serving a steadily growing community at the intersection of two mainstreams of global research: computational science and materials science and technology. This extensively expanded new edition reflects the significant developments in all aspects of computational materials research over the past decade, featuring progress in simulations at multiple scales and increasingly more realistic materials models. Thematically separated into two mutually dependent sets - "Methods: Theory and Modeling (MTM)" and "Applications: Current and Emerging Materials (ACE)" - the handbook runs the entire gamut from theory and methods to simulations and applications. Readers benefit from its in-depth coverage of a broad methodological spectrum extending from advanced atomistic simulations of rare events to data-driven artificial intelligence strategies for materials informatics in the set MTM, as well as forefront emphasis on materials of far-ranging societal importance such as photovoltaics and energy-relevant oxides, and cutting-edge applications to materials for spintronic devices, graphene, cement, and glasses in the set ACE. The thorough, interconnected coverage of methods and applications, together with a line-up of internationally acclaimed editors and authors, will ensure the Handbook of Material Modeling's standing as an enduring source of learning and inspiration for a global community of computational materials scientists.

Evolutionary Multi-Objective Optimization is an expanding field of research. This book brings a collection of papers with some of the most recent advances in this field. The topic and content is currently very fashionable and has immense potential for practical applications and includes contributions from leading researchers in the field. Assembled in a compelling and well-organised fashion, Evolutionary Computation Based Multi-Criteria Optimization will prove beneficial for both academic and industrial scientists and engineers engaged in research and development and application of evolutionary algorithm based MCO. Packed with must-find information, this book is the first to comprehensively and clearly address the issue of evolutionary computation based MCO, and is an essential read for any researcher or practitioner of the technique.

This book starts with the basic concepts of Fuzzy Logic: the membership function, the intersection and the union of fuzzy sets, fuzzy numbers, and the extension principle underlying the algorithmic operations. Several chapters are devoted to applications of Fuzzy Logic in Operations Research: PERT planning with uncertain activity durations, Multi-Criteria Decision Analysis (MCDA) with vague preferential statements, and Multi-Objective Optimization (MOO) with weighted degrees of satisfaction. New items are: Fuzzy PERT using activity durations with triangular membership functions, Fuzzy SMART with a sensitivity analysis based upon Fuzzy Logic, the Additive and the Multiplicative AHP with a similar feature, ELECTRE using the ideas of the AHP and SMART, and a comparative study of the ideal-point methods for MOO. Finally, earlier studies of colour perception illustrate the attempts to find a physiological basis for the set-theoretical and the algorithmic operations in Fuzzy Logic. The last chapter also discusses some key issues in linguistic categorization and the prospects of Fuzzy Logic as a multi-disciplinary research activity. Audience: Researchers and students working in applied mathematics, operations research, management science, business administration, econometrics, industrial engineering, information systems, artificial intelligence, mathematical psychology, and psycho-physics.

This text offers many multiobjective optimization methods accompanied by analytical examples, and it treats problems not only in engineering but also operations research and management. It explains how to choose the best method to solve a problem and uses three primary application examples: optimization of the numerical simulation of an industrial process; sizing of a telecommunication network; and decision-aid tools for the sorting of bids.

Nonlinear Multiobjective Optimization

Multi-Objective Combinatorial Optimization Problems and Solution Methods

Goal Programming Based Multi-Objective Optimization Techniques of Task Allocation in Distributed Environment

Applications: Current and Emerging Materials

Applications of Multi-objective Evolutionary Algorithms

Multi-Objective Optimization in Theory and Practice II: Metaheuristic Algorithms

In a distributed computing system (DCS), we need to allocate a number of tasks to different processors for execution. The problem of task assignment in heterogeneous computing systems has been studied for many years with many variations and to accomplish various objectives, such as throughput maximization, reliability maximization, and cost minimization. There are also exists a set of system constraints related to memory and communication link capacity. Most of the existing approaches for task allocation deal with a single objective only. In this project we construct the task allocation problem as a multi-objective optimization problem to consider system constraints. The goal programming technique is used with pre-emptive priority structure to find the optimal allocation that not only optimize system reliability but also optimize memory as well as path load. The genetic algorithm is used to find the optimal allocations. Genetic algorithm is used to find the optimal allocations.

In this book, we study theoretical and practical aspects of computing methods for mathematical modelling of nonlinear systems. A number of computing techniques are considered, such as methods of operator approximation with any given accuracy; operator interpolation techniques including a non-Lagrange interpolation; methods of system representation subject to constraints associated with concepts of causality, memory and stationarity; methods of system representation with an accuracy that is the best within a given class of models; methods of covariance matrix estimation; methods for low-rank matrix approximations; hybrid methods based on a combination of iterative procedures and best operator approximation; and methods for information compression and filtering under condition that a filter model should satisfy restrictions associated with causality and different types of memory. As a result, the book represents a blend of new methods in general computational analysis, and specific, but also generic, techniques for study of systems theory and its particular branches, such as optimal filtering and information compression. - Best operator approximation, - Non-Lagrange interpolation, - Generic Karhunen-Loeve transform - Generalised low-rank matrix approximation - Optimal data compression - Optimal nonlinear filtering

The content of this book is motivated by the recent changes in global markets and the availability of new transportation services. Indeed, the complexity of current supply chains suggests to decision makers in logistics to work with a set of efficient (Pareto-optimal) solutions, mainly to capture different economical aspects that, in general, one optimal solution related to a single objective function is not able to capture - timely. Motivated by these reasons, we study freight transportation systems with a specific focus on multi-objective modelling. The goal is to provide decision makers with new methods and tools to implement multi-objective optimization models in logistics. The book combines theoretical aspects with applications, showing the advantages and the drawbacks of adopting scalarization techniques, and when it is worthwhile to reduce the problem to a goal-programming one. Also, we show - applications where more than one decision maker evaluates the effectiveness of the logistic system and thus a multi-level programming is sought to attain meaningful solutions. After presenting the general working framework, we analyze logistic - issues in a maritime terminal. Next, we study multi-objective route planning, relying on the application of hazardous material transportation. Then, we examine freight distribution on a smaller scale, as for the case of goods distribution in metropolitan areas. Finally, we present a human-workforce problem arising in logistic platforms. The general approach followed in the text is that of presenting mathematics, algorithms and the related experimentations for each problem.

This book brings together the latest findings on efficient solutions of multi/many-objective optimization problems from the leading researchers in the field. The focus is on solving real-world optimization problems using strategies ranging from evolutionary to hybrid frameworks, and involving various computation platforms. The topics covered include solution frameworks using evolutionary to hybrid models in application areas like Analytics, Cancer Research, Traffic Management, Networks and Communications, E-Governance, Quantum Technology, Image Processing, etc. As such, the book offers a valuable resource for all postgraduate students and researchers interested in exploring solution frameworks for multi/many-objective optimization problems.

Evolutionary Multiobjective Optimization

Multi-Objective Optimization in Theory and Practice I: Classical Methods

Innovative Computing Methods and Their Applications to Engineering Problems

Developments and Applications

A Multi-Objective Design Approach

Non-Convex Multi-Objective Optimization

This book constitutes the refereed proceedings of the 4th International Conference on Evolutionary Multi-Criterion Optimization, EMO 2007, held in Matsushima, Japan in March 2007. The 65 revised full papers presented together with 4 invited papers are organized in topical sections on algorithm design, algorithm improvements, alternative methods, applications, engineering design, many objectives, objective handling, and performance assessments.