Multiobjective Decision Making Theory And Methodol

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Multiobjective Decision Support for Environmental Management Springer
This first-rate text explores the theory and methodology of systems engineering in evaluating alternative courses of action and associated decision-making policies. It treats criteria as multidimensional, rather than scalar, in the development of normative theories. These contribute to a behavioral theory of decision making and provide guidance for exercising judgment. An introductory discussion of the systemic approach to judgment and decision is followed by explorations of psychological value measurements, utility, classical decision analysis, and vector optimization theory. The second section chiefly deals with methods of assessing and evaluating alternatives, including both noninteractive and interactive methods. A taxonomy and a comparative evaluation of methods conclude the text.
New Concepts and Trends of Hybrid Multiple Criteria Decision Making Springer Science & Business Media
Multi-objective programming (MOP) can simultaneously optimize multi-objectives in mathematical programming models, but the optimization of multi-objectives triggers the issue of Pareto solutions and complicates the derived answers. To address these problems, researchers often incorporate the concepts of fuzzy sets and evolutionary algorithms

into MOP models. Focusing on the methodologies and applications of this field, Fuzzy Multiple Objective Decision Making presents mathematical tools for complex decision making. The first part of the book introduces the most popular methods used to calculate the solution of MOP in the field of multiple objective decision making (MODM). The authors describe multi-objective evolutionary algorithms; expand de novo programming to changeable spaces, such as decision and objective spaces; and cover network data envelopment analysis. The second part focuses on various applications, giving readers a practical, in-depth understanding of MODM. A follow-up to the authors ' Multiple Attribute Decision Making: Methods and Applications, this book guides practitioners in using MODM methods to make effective decisions. It also extends students ' knowledge of the methods and provides researchers with the foundation to publish papers in operations research and management science journals.

Improving Homeland Security Decisions
CRC Press

During the past two decades, the consideration of mUltiple objectives in modeling and decision making has grown by leaps and bounds. The nineties in particular have seen the emphasis shift from the dominance of single-objective modeling and optimization toward an emphasis on multiple objectives. The proceedings of this Conference epitomize these evolutionary changes and contribute to the important role that the tield of multiple criteria decision making (MCDM) now plays in planning, design, operational, management, and policy decisions. Of special interest are the contributions of MCDM to manufacturing engineering. For example, it has recently been recognized that optimal, single-objective solutions have often been pursued at the expense of the much broader applicability of designs and solutions that satisfy multiple objectives. In particular, the theme (MCDM and Its Worldwide Role in Risk-Based Decision Making) of the XIVth International Conference on Multiple Criteria Decision Making (Charlottesville, Virginia, USA, June 8-12, 1998) represents the growing importance of risk-cost-benefit analysis in decision making and in engineering design and manufacturing. In such systems, minimizing the of rare and extreme events emerges as an essential objective that risk complements the minimization of the traditional expected value of risk, along with the objectives attached to cost and performance. These proceedings include forty-five papers that were presented at the Conference. A variety of techniques have been proposed for solving multiple criteria decision-making problems. The emphasis and style of the different techniques largely reflect the fields of expertise of their developers.

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

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.

Decision Making with Multiple Objectives Springer Science & Business Media

The Fifth International Conference on Multiple Criteria Decision Making, not suprisingly, had several objectives. First, it aimed at beinq a forum for exchange and intensive discussion of recent ideas on theory and practice of MCDM, following the now well-established tradition of the previous meetings in the series, organized by H. Thiriez and S. Zionts in Jouy-en-Josas (1975), S. Zionts in Buffalo (1977), G. Fandel and T. Gal in Hagen/Konigswinter (1979) and J. Morse in Newark (1980). Second, closer contacts Nere desired between participants in these meetings and other active groups in the field, prominent among which is the European Working Group on Multiple Criteria Decision Aid. Third, participation of senior or junior researchers who had recently developped important new methodolo0ies, such as the Analytical Hierarchy Process, was actively sought for. Fourth, a synthesis of the rapidly expanding field of MCDM was to be made through selective surveys by leading researchers in the various areas it comprises. Fifth, cross-fertilization and multidisciplinary research was to be encouraged through presentations on the connections between MCDM and mathematics, economics, game theory, computer science and other subjects. Sixth, much emphasis was to be given to real-world applications of MCDM, particularly large scale ones and/or pioneering work in new fields. The present volume reflects the general agreement observed among participants that these goals were largely attained.

Fuzzy-Like Multiple Objective Decision Making Springer Science & Business Media

Decision making is the process of selecting a possible course of action from all the available alternatives. In almost all such problems the multiplicity of criteria for judging the alternatives is pervasive. That

is, for many such problems, the decision maker (OM) wants to attain more than one objective or goal in selecting the course of action while satisfying the constraints dictated by environment, processes, and resources. Another characteristic of these problems is that the objectives are apparently non commensurable. Mathematically, these problems can be represented as: (1. 1) subject to: gi(~) ~ 0, ,', . . . ,. ! where ~ is an n dimensional decision variable vector. The problem consists of n decision variables, m constraints and k objectives. Any or all of the functions may be nonlinear. In literature this problem is often referred to as a vector maximum problem (VMP). Traditionally there are two approaches for solving the VMP. One of them is to optimize one of the objectives while appending the other objectives to a constraint set so that the optimal solution would satisfy these objectives at least up to a predetermined level. The problem is given as: Max f. ~) 1 (1. 2) subject to: where at is any acceptable predetermined level for objective t. The other approach is to optimize a super-objective function created by multiplying each 2 objective function with a suitable weight and then by adding them together. Multi-objective Decision Making Methods for Transportation Economic Research Institute

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 m 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 xii MULTIOBJECTIVE OPTIMIZATION applicable to multiobjective optimization and provides much needed insight into the subjective character of that problem.

Multicriteria Decision Making Springer Science & Business Media

This book introduces students on Multiple Criteria Decision Aiding and Making courses to practical, real-world cases. Each case study introduces a problem or situation together with a method, and a description and explanation of a computer application. In this sense each chapter is based on four pillars: the problem, the model building, the methods and their

implementation. The book presents and elaborates a rich and comprehensive set of practical problems comprising multiple criteria, including numerous approaches for their solution, for decision support or decision aid. It complements traditional textbooks and lecture material by employing case studies to promote a deeper understanding of the investigated concepts and help students apply these methods to other areas.

Multiple Criteria Decision Making and Aiding Springer Science & Business Media

This book proposes a set of models to describe fuzzy multi-objective decision making (MODM), fuzzy multi-criteria decision making (MCDM), fuzzy group decision making (GDM) and fuzzy multi-objective group decision-making problems, respectively. It also gives a set of related methods (including algorithms) to solve these problems. One distinguishing feature of this book is that it provides two decision support systems software for readers to apply these proposed methods. A set of real-world applications and some new directions in this area are then described to further instruct readers how to use these methods and software in their practice. Contents: Decision Making, Decision Support Systems, and Fuzzy Sets:Decision MakingMulti-Objective and Multi-Attribute Decision MakingGroup Decision MakingDecision Support SystemsFuzzy Sets and SystemsFuzzy Multi-Objective Decision Making:Fuzzy MODM ModelsFuzzy MODM MethodsFuzzy Multi-Objective DSSFuzzy Group Decision Making:Fuzzy MCDMFuzzy Group Decision MakingA Web-Based Fuzzy Group DSSFuzzy Multi-Objective Group Decision Making:Multi-Objective Group DSSFuzzy Multi-Objective Group DSSApplications:Environmental Economic Load DispatchTeam Situation AwarenessReverse Logistics Management Readership: Final year undergraduates, graduate and postgraduate students in business management, computer science, fuzzy logic, artificial intelligence and related areas. Keywords:Multi-Objective Decision Making;Group Decision Making;Multi-Criteria Decision Making;Decision Support Systems;Fuzzy SetKey Features:Describes a complete set of models, methods and algorithms with fuzzy set techniques not only for solving fuzzy MODM, fuzzy MCDM and fuzzy GDM problems, but also for solving general MODM, MCDM and GDM problemsFeatures two decision support systems (DSSs) for a fuzzy multi-objective DSS and a fuzzy group DSS on how to apply, design and implement such kinds of DSSs in practiceHighlights various applications of proposed decision-making methods and DSS software including power markets, team situation awareness, and logistics management, from the practical point of viewReveals new directions of DSSs — online customer DSSs and perceptive DSSs

Fuzzy Multiple Objective Decision Making Springer Science & Business Media

This book describes how a confused decision maker, who wishes to make a reasonable and responsible choice among alternatives, can systematically probe their thoughts and feelings in order to make the critically important trade-offs between incommensurable objectives.

Multi-Objective Programming and Goal Programming Cambridge University Press

What are the random-like phenomena that can be found everywhere in real-life world? When carrying out a random sampling survey on the traffic situation, we often obtain some descriptive results such as approximately expedite, a little crowded and so on, therefore,

the average level should be regarded as the random fuzzy phenomenon, which is one of the random-like phenomena. Decision makers usually need to make the decision for these problems with random-like phenomena. Which model should be constructed for them? How should we handle these models to find the optimal strategy? How can we apply these models to solve real-life problems with random-like phenomena? In order to answer these questions, this book provides an up-to-date methodology system 5MRP for random-like multiple objective decision making, which includes problem system with random-like phenomena, model system with random-like coefficients, research system with random-like uncertain methods. Some practical applications are also provided to illustrate the effectiveness of the proposed methodology system. Researchers, practitioners and students in systems science, economics, mathematics, information, engineering and MS/OR will get a lot of useful references from this research monograph.

Fuzzy Multiple Objective Decision Making CRC Press

At a practical level, mathematical programming under multiple objectives has emerged as a powerful tool to assist in the process of searching for decisions which best satisfy a multitude of conflicting objectives, and there are a number of distinct methodologies for multicriteria decision-making problems that exist. These methodologies can be categorized in a variety of ways, such as form of model (e.g. linear, non-linear, stochastic), characteristics of the decision space (e.g. finite or infinite), or solution process (e.g. prior specification of preferences or interactive). Scientists from a variety of disciplines (mathematics, economics and psychology) have contributed to the development of the field of Multicriteria Decision Making (MCDM) (or Multicriteria Decision Analysis (MCDA), Multiattribute Decision Making (MADM), Multiobjective Decision Making (MODM), etc.) over the past 30 years, helping to establish MCDM as an important part of management science. MCDM has become a central component of studies in management science, economics and industrial engineering in many universities worldwide. Multicriteria Decision Making: Advances in MCDM Models, Algorithms, Theory and Applications aims to bring together `state-of-the-art' reviews and the most recent advances by leading experts on the fundamental theories, methodologies and applications of MCDM. This is aimed at graduate students and researchers in mathematics, economics, management and engineering, as well as at practicing management scientists who wish to better understand the principles of this new and fast developing field.

Multiple Criteria Decision Making by Multiobjective Optimization CRC Press

Under intense scrutiny for the last few decades, Multiple Objective Decision Making (MODM) has been useful for dealing with the multiple-criteria decisions and planning problems associated with many important applications in fields including management science, engineering design, and transportation. Rough set theory has also proved to be an effective mathematical tool to counter the vague description of objects in fields such as artificial intelligence, expert systems, civil engineering, medical data analysis, data mining, pattern recognition, and decision theory. Rough Multiple Objective Decision Making is perhaps the first book to combine state-of-the-art application of rough set theory, rough approximation techniques, and MODM. It illustrates traditional techniques—and some that employ simulation-based intelligent algorithms—to solve a wide range of realistic problems. Application of rough theory can remedy two types of uncertainty (randomness

and fuzziness) which present significant drawbacks to existing decision-making methods, so the authors illustrate the use of rough sets to approximate the feasible set, and they explore use of rough intervals to demonstrate relative coefficients and parameters involved in bi-level MODM. The book reviews relevant literature and introduces models for both random and fuzzy rough MODM, applying proposed models and algorithms to problem solutions. Given the broad range of uses for decision making, the authors offer background and guidance for rough approximation to real-world problems, with case studies that focus on engineering applications, including construction site layout planning, water resource allocation, and resource-constrained project scheduling. The text presents a general framework of rough MODM, including basic theory, models, and algorithms, as well as a proposed methodological system and discussion of future research.

Multi-objective Group Decision Making Springer Science & Business Media

Many real-world decision problems have multiple objectives. For example, when choosing a medical treatment plan, we want to maximize the efficacy of the treatment, but also minimize the side effects. These objectives typically conflict, e.g., we can often increase the efficacy of the treatment, but at the cost of more severe side effects. In this book, we outline how to deal with multiple objectives in decision-theoretic planning and reinforcement learning algorithms. To illustrate this, we employ the popular problem classes of multi-objective Markov decision processes (MOMDPs) and multi-objective coordination graphs (MO-CoGs). First, we discuss different use cases for multi-objective decision making, and why they often necessitate explicitly multi-objective algorithms. We advocate a utility-based approach to multi-objective decision making, i.e., that what constitutes an optimal solution to a multi-objective decision problem should be derived from the available information about user utility. We show how different assumptions about user utility and what types of policies are allowed lead to different solution concepts, which we outline in a taxonomy of multi-objective decision problems. Second, we show how to create new methods for multi-objective decision making using existing single-objective methods as a basis. Focusing on planning, we describe two ways to creating multi-objective algorithms: in the inner loop approach, the inner workings of a single-objective method are adapted to work with multi-objective solution concepts; in the outer loop approach, a wrapper is created around a single-objective method that solves the multi-objective problem as a series of single-objective problems. After discussing the creation of such methods for the planning setting, we discuss how these approaches apply to the learning setting. Next, we discuss three promising application domains for multi-objective decision making algorithms: energy, health, and infrastructure and transportation. Finally, we conclude by outlining important open problems and promising future directions.

Interactive Multiobjective Decision Making Under Uncertainty Bentham Science Publishers

Multi-objective programming (MOP) can simultaneously optimize multi-objectives in mathematical programming models, but the optimization of multi-objectives triggers the issue of Pareto solutions and complicates the derived answers. To address these problems, researchers often incorporate the concepts of fuzzy sets and evolutionary algorithms into MOP models. Focusing on the methodologies and applications of this field, Fuzzy Multiple Objective Decision Making presents mathematical tools for complex decision making. The first part of the book introduces the most popular methods used to calculate the solution of MOP in the field of multiple objective decision making (MODM). The authors describe multi-objective evolutionary algorithms; expand de novo programming to changeable spaces, such as decision and objective spaces; and cover network data envelopment analysis. The second part focuses on various applications, giving readers a practical, in-depth understanding

of MODM. A follow-up to the authors' Multiple Attribute Decision Making: Methods and Applications, this book guides practitioners in using MODM methods to make effective decisions. It also extends students' knowledge of the methods and provides researchers with the foundation to publish papers in operations research and management science journals.

Multiple Objective Decision Making — Methods and Applications Springer Science & Business Media

This work examines all the fuzzy multicriteria methods recently developed, such as fuzzy AHP, fuzzy TOPSIS, interactive fuzzy multiobjective stochastic linear programming, fuzzy multiobjective dynamic programming, grey fuzzy multiobjective optimization, fuzzy multiobjective geometric programming, and more. Each of the 22 chapters includes practical applications along with new developments/results. This book may be used as a textbook in graduate operations research, industrial engineering, and economics courses. It will also be an excellent resource, providing new suggestions and directions for further research, for computer programmers, mathematicians, and scientists in a variety of disciplines where multicriteria decision making is needed.

Fuzzy-Like Multiple Objective Multistage Decision Making Springer Science & Business Media

He consider a cone dominance problem: given a "preference" cone lP and a set n X ~ R of available, or feasible, alternatives, the problem is to identify the non dominated elements of X. The nonzero elements of lP are assumed to model the do- nance structure of the problem so that y s X dominates x s X if Y = x + P for some nonzero p S lP. Consequently, x S X is nondominated if, and only if, ({x} + lP) n X = {x} (1.1) He will also refer to nondominated points as efficient points (in X with respect to lP) and we will let EF(XJP) denote the set of such efficient points. This cone dominance problem draws its roots from two separate, but related, ori gins. The first of these is multi-attribute decision making in which the elements of the set X are endowed with various attributes, each to be maximized or minimized.

Fuzzy Multiple Objective Decision Making Morgan & Claypool Publishers

Recently, many books on multiobjective programming have been published. However, only a few books have been published, in which multiobjective programming under the randomness and the fuzziness are investigated. On the other hand, several books on multilevel programming have been published, in which multiple decision makers are involved in hierarchical decision situations. In this book, we introduce the latest advances in the field of multiobjective programming and multilevel programming under uncertainty. The reader can immediately use proposed methods to solve multiobjective programming and multilevel programming, which are based on linear programming or convex programming technique. Organization of each capter is summarized as follows. In Chapter 2, multiobjective programming problems with random variables are formulated, and the corresponding interactive algorithms are developed to obtain a satisfactory solution, in which the fuzziness of human's subjective judgment for permission levels are considered. In Chapter 3, multiobjective programming problems with fuzzy random variables are formulated, and the corresponding interactive algorithms are developed to obtain a satisfactory solution, in which not only the uncertainty of fuzzy random variables but also the fuzziness of human's subjective judgment

for permission levels are considered. In Chapter 4, multiobjective multilevel programming is discussed, and the interactive algorithms are developed to obtain a satisfactory solution, in which the hierarchical decision structure of multiple decision makers is reflected. In Chapter 5, two kinds of farm planning problems are solved by applying the proposed method, in which cost coefficients of crops are expressed by random variables.

Multi-Objective Decision Making Springer

This volume is devoted to models and methods in multiple objectives decision making. The importance of the multiple dimensions of decision making was first recognised during the 1960s and since then progress has been made in that theoretical or application oriented contributions may now be categorized under two main headings:- Multiattribute Decision Making (MADM) which concerns the sorting, the ranking or the evaluation of objects of choice according to several criteria and Multiobjective Decision Making (MODM) which deals with the vector optimization in mathematical programming. The above are also presented in the context of various applications, namely banking, environment, health, manpower, media, portfolio and traffic control, resulting in a book for a wide variety of readers.

Research and Practice in Multiple Criteria Decision Making Springer

Multiple criteria decision making is a major and rapidly growing field of research. Methods resulting from this field of research are used in this book to develop a Multiobjective Decision Support Systems (MODSS) for environmental management. The primary focus of the book is therefore on the issues and practicalities that arise when these methods are applied to support decisions on environmental problems. Most methods included in this book are derived from the literature on multicriteria decision making, decision anlysis and operations research. Concepts developed in management science are used to describe environmental decision processes and to define the functions of decision support. The author's work on MODSS has resulted in the development of a decision support package, called DEFINITE (DEcisions on a FINITE set of alternatives). A demonstration version of this programme is included with the book. This Demo Disk can be run on a MS-DOS compatible personal computer (version 2.0 or higher) having a 3,5 inch, 720 Kb disk drive and 640 Kb available RAM.