

# Multiple Criteria Decision Making

From Early History to the 21st Century



Murat Köksalan  
Jyrki Wallenius  
Stanley Zionts

# Multiple Criteria Decision Making From Early History To The 21st Century

**Salvatore Greco, Matthias Ehrgott, José  
Rui Figueira**



## **Multiple Criteria Decision Making From Early History To The 21st Century:**

**Multiple Criteria Decision Making** M. Murat Köksalan, Jyrki Wallenius, Stanley Zionts, 2011 Ch 1 The early history of MCDM ch 2 MCDM developments in the 1970s ch 3 MCDM developments in the 1980s ch 4 MCDM developments in the 1990s and beyond ch 5 MCDM conferences ch 6 MCDM society traditions ch 7 Awards and presidents ch 8 Biographies of leading MCDM scholars ch 9 Conclusion Multiple Criteria Decision Making: From Early History To The 21st Century Murat Köksalan, Jyrki Wallenius, Stanley Zionts, 2011-06-06 Multiple Criteria Decision Making MCDM is all about making choices in the presence of multiple conflicting criteria MCDM has become one of the most important and fastest growing subfields of Operations Research Management Science As modern MCDM started to emerge about 50 years ago it is now a good time to take stock of developments This book aims to present an informal nontechnical history of MCDM supplemented with many pictures It covers the major developments in MCDM from early history until now It also covers fascinating discoveries by Nobel Laureates and other prominent scholars The book begins with the early history of MCDM which covers the roots of MCDM through the 1960s It proceeds to give a decade by decade account of major developments in the field starting from the 1970s until now Written in a simple and accessible manner this book will be of interest to students academics and professionals in the field of decision sciences Multiple Criteria Decision Making M. Murat Köksalan, Jyrki Wallenius, Stanley Zionts, 2011 Multiple Criteria Decision Making MCDM is all about making choices in the presence of multiple conflicting criteria MCDM has become one of the most important and fastest growing subfields of Operations Research Management Science As modern MCDM started to emerge about 50 years ago it is now a good time to take stock of developments This book aims to present an informal nontechnical history of MCDM supplemented with many pictures It covers the major developments in MCDM from early history until now It also covers fascinating discoveries by Nobel Laureates and other prominent scholars The book begins with the early history of MCDM which covers the roots of MCDM through the 1960s It proceeds to give a decade by decade account of major developments in the field starting from the 1970s until now Written in a simple and accessible manner this book will be of interest to students academics and professionals in the field of decision sciences *Multiple Criteria Decision Analysis* Salvatore Greco, Matthias Ehrgott, José Rui Figueira, 2016-02-18 In two volumes this new edition presents the state of the art in Multiple Criteria Decision Analysis MCDA Reflecting the explosive growth in the field seen during the last several years the editors not only present surveys of the foundations of MCDA but look as well at many new areas and new applications Individual chapter authors are among the most prestigious names in MCDA research and combined their chapters bring the field completely up to date Part I of the book considers the history and current state of MCDA with surveys that cover the early history of MCDA and an overview that discusses the pre theoretical assumptions of MCDA Part II then presents the foundations of MCDA with individual chapters that provide a very exhaustive review of preference modeling along with a chapter devoted to the axiomatic basis of

the different models that multiple criteria preferences Part III looks at outranking methods with three chapters that consider the ELECTRE methods PROMETHEE methods and a look at the rich literature of other outranking methods Part IV on Multiattribute Utility and Value Theories MAUT presents chapters on the fundamentals of this approach the very well known UTA methods the Analytic Hierarchy Process AHP and its more recent extension the Analytic Network Process ANP as well as a chapter on MACBETH Measuring Attractiveness by a Categorical Based Evaluation Technique Part V looks at Non Classical MCDA Approaches with chapters on risk and uncertainty in MCDA the decision rule approach to MCDA the fuzzy integral approach the verbal decision methods and a tentative assessment of the role of fuzzy sets in decision analysis Part VI on Multiobjective Optimization contains chapters on recent developments of vector and set optimization the state of the art in continuous multiobjective programming multiobjective combinatorial optimization fuzzy multicriteria optimization a review of the field of goal programming interactive methods for solving multiobjective optimization problems and relationships between MCDA and evolutionary multiobjective optimization EMO Part VII on Applications selects some of the most significant areas including contributions of MCDA in finance energy planning problems telecommunication network planning and design sustainable development and portfolio analysis Finally Part VIII on MCDM software presents well known MCDA software packages

Strategic Approach in Multi-Criteria Decision Making Nolberto Munier, Eloy Hontoria, Fernando Jiménez-Sáez, 2019-01-29 This book examines multiple criteria decision making MCDM and presents the Sequential Interactive Modelling for Urban Systems SIMUS as a method to be used for strategic decision making It emphasizes the necessity to take into account aspects related to real world scenarios and incorporating possible real life aspects for modelling The book also highlights the use of sensitivity analysis and presents a method for using criteria marginal values instead of weights which permits the drawing of curves that depicts the variations of the objective function due to variations of these marginal values In this way it also gives quantitative values of the objective function allowing stakeholders to perform a comprehensive risk analysis for a solution when it is affected by exogenous variables Strategic Approach in Multi Criteria Decision Making A Practical Guide for Complex Scenarios is divided into three parts Part 1 is devoted to exploring the history and development of the discipline and the way it is currently used It highlights drawbacks and problems that scholars have identified in different MCDM methods and techniques Part 2 addresses best practices to assure quality MCDM process Part 3 introduces the concept of Linear Programming and the proposed SIMUS method as techniques to deal with MCDM It also includes case studies in order to help document and illustrate difficult concepts especially related to demands from a scenario and also in their modelling The decision making process can be a complex task especially with multi criteria problems With large amounts of information it can be an extremely difficult to make a rational decision due to the number of intervening variables their interrelationships potential solutions that might exist diverse objectives envisioned for a project etc The SIMUS method has been designed to offer a strategy to help organize classify and evaluate this information

effectively     Multiple Criteria Decision Making by Multiobjective Optimization Ignacy Kaliszewski, Janusz Miroforidis, Dmitry Podkopaev, 2016-08-02 This textbook approaches optimization from a multi aspect multi criteria perspective By using a Multiple Criteria Decision Making MCDM approach it avoids the limits and oversimplifications that can come with optimization models with one criterion The book is presented in a concise form addressing how to solve decision problems in sequences of intelligence modelling choice and review phases often iterated to identify the most preferred decision variant The approach taken is human centric with the user taking the final decision is a sole and sovereign actor in the decision making process To ensure generality no assumption about the Decision Maker preferences or behavior is made The presentation of these concepts is illustrated by numerous examples figures and problems to be solved with the help of downloadable spreadsheets This electronic companion contains models of problems to be solved built in Excel spreadsheet files Optimization models are too often oversimplifications of decision problems met in practice For instance modeling company performance by an optimization model in which the criterion function is short term profit to be maximized does not fully reflect the essence of business management The company s managing staff is accountable not only for operational decisions but also for actions which shall result in the company ability to generate a decent profit in the future This calls for management decisions and actions which ensure short term profitability but also maintaining long term relations with clients introducing innovative products financing long term investments etc Each of those additional though indispensable actions and their effects can be modeled separately case by case by an optimization model with a criterion function adequately selected However in each case the same set of constraints represents the range of company admissible actions The aim and the scope of this textbook is to present methodologies and methods enabling modeling of such actions jointly     New Concepts and Trends of Hybrid Multiple Criteria Decision Making Gwo-Hshiung Tzeng, Kao-Yi Shen, 2017-08-15 When people or computers need to make a decision typically multiple conflicting criteria need to be evaluated for example when we buy a car we need to consider safety cost and comfort Multiple criteria decision making MCDM has been researched for decades Now as the rising trend of big data analytics in supporting decision making MCDM can be more powerful when combined with state of the art analytics and machine learning In this book the authors introduce a new framework of MCDM which can lead to more accurate decision making Several real world cases will be included to illustrate the new hybrid approaches     **Multiple criteria decision making** Jyrki Wallenius, 1986     *Multi-Criteria Decision Analysis to Support Healthcare Decisions* Kevin Marsh, Mireille Goetghebeur, Praveen Thokala, Rob Baltussen, 2017-04-18 Representing the first collection on the topic this book builds from foundations to case studies to future prospects providing the reader with a rich and comprehensive understanding of the use of multi criteria decision analysis MCDA in healthcare The first section of the collection presents the foundations of MCDA as it is applied to healthcare decisions providing guidance on the ethical and theoretical underpinnings of MCDA and how to select MCDA methods

appropriate to different decision settings Section two comprises a collection of case studies spanning the decision continuum including portfolio development benefit risk assessment health technology assessment priority setting resource optimisation clinical practice and shared decision making Section three explores future directions in the application of MCDA to healthcare and identifies opportunities for further research to support these

### **Energy Systems Evaluation (Volume 1)**

Jingzheng Ren,2021-06-01 This book presents various methods for sustainability assessment of energy systems under various different conditions and scenarios It answers the questions of how to measure the sustainability of energy systems by adopting appropriate metrics and methods This book provides readers with a comprehensive view of the frontiers of sustainability assessment methods for energy system analysis It presents various methodologies allowing readers to understand the complete metrics for sustainability assessment life cycle thinking for sustainability assessment of energy systems and the advanced sustainability assessment methods for energy systems This book is of interest to researchers engineers decision makers and postgraduate students within the field of energy systems sustainability and decision analysis

*Evaluation of Health Services* Sandeep Reddy,Aida Isabel Tavares,2020-03-11 As the costs and resources of delivering health services have increased over the years the importance of evaluating health services and interventions has become essential An evaluation provides a systematic process of assessing the efficacy and efficiency of health services including an assessment of their impact on beneficiaries whether it be individuals or communities Evaluation in the health sector includes the evaluation of burden disease where human and economic costs resulting from poor health are measured In this book various evaluation studies are detailed providing an excellent resource for both evaluation practitioners and academics alike The geographical range and variety of case studies showcase how evaluation has become integral for health service planning and assessment and to assist public health policy makers decide how to use limited resources to minimize burden and inequity This book will act as a ready resource for both workers experienced in health service evaluation and those intending to learn about burden of disease of evaluation

### **Multicriteria Decision Aid and Artificial Intelligence**

Michael Doumpos,Evangelos Grigoroudis,2013-02-01 Presents recent advances in both models and systems for intelligent decision making Organisations often face complex decisions requiring the assessment of large amounts of data In recent years Multicriteria Decision Aid MCDA and Artificial Intelligence AI techniques have been applied with considerable success to support decision making in a wide range of complex real world problems The integration of MCDA and AI provides new capabilities relating to the structuring of complex decision problems in static and distributed environments These include the handling of massive data sets the modelling of ill structured information the construction of advanced decision models and the development of efficient computational optimization algorithms for problem solving This book covers a rich set of topics including intelligent decision support technologies data mining models for decision making evidential reasoning evolutionary multiobjective optimization fuzzy modelling as well as applications in management and engineering Multicriteria Decision Aid

and Artificial Intelligence Covers all of the recent advances in intelligent decision making Includes a presentation of hybrid models and algorithms for preference modelling and optimisation problems Provides illustrations of new intelligent technologies and architectures for decision making in static and distributed environments Explores the general topics on preference modelling and learning along with the coverage of the main techniques and methodologies and applications Is written by experts in the field This book provides an excellent reference tool for the increasing number of researchers and practitioners interested in the integration of MCDA and AI for the development of effective hybrid decision support methodologies and systems Academics and post graduate students in the fields of operational research artificial intelligence and management science or decision analysis will also find this book beneficial New Approaches to CSR, Sustainability and Accountability, Volume VI Kıymet Tunca Çalıyurt, 2025-07-02 This book continues the discussion from the first five volumes on the challenges that organizations face in order to implement sustainability ethics and effective corporate governance all of which are important elements of standing out from other companies Examining the background of the New European Consensus on development with the new guiding motto Our World Our Dignity Our Future the authors explore how this new legislation on sustainability issues around the world is forcing companies to deal directly with sustainability issues

**Quantitative Methods in Transportation** Dušan Teodorović, Miloš Nikolić, 2020-08-20 Quantitative Methods in Transportation provides the most useful simple and advanced quantitative techniques for solving real life transportation engineering problems It aims to help transportation engineers and analysts to predict travel and freight demand plan new transportation networks and develop various traffic control strategies that are safer more cost effective and greener Transportation networks can be exceptionally large and this makes many transportation problems combinatorial and the challenges are compounded by the stochastic and independent nature of trip planners decision making Methods outlined in this book range from linear programming multi attribute decision making data envelopment analysis probability theory and simulation to computer techniques such as genetic algorithms simulated annealing tabu search ant colony optimization and bee colony optimization The book is supported with problems and has a solutions manual to aid course instructors

**Multicriteria and Multiobjective Models for Risk, Reliability and Maintenance Decision Analysis** Adiel Teixeira de Almeida, Cristiano Alexandre Virgínio Cavalcante, Marcelo Hazin Alencar, Rodrigo José Pires Ferreira, Adiel Teixeira de Almeida-Filho, Thalles Vitelli Garcez, 2015-07-01 This book integrates multiple criteria concepts and methods for problems within the Risk Reliability and Maintenance RRM context The concepts and foundations related to RRM are considered for this integration with multicriteria approaches In the book a general framework for building decision models is presented and this is illustrated in various chapters by discussing many different decision models related to the RRM context The scope of the book is related to ways of how to integrate Applied Probability and Decision Making In Applied Probability this mainly includes decision analysis and reliability theory amongst other topics closely related to risk analysis and maintenance In

Decision Making it includes a broad range of topics in MCDM Multi Criteria Decision Making and MCDA Multi Criteria Decision Aiding also known as Multi Criteria Decision Analysis In addition to decision analysis some of the topics related to Mathematical Programming area are briefly considered such as multiobjective optimization since methods related to these topics have been applied to the context of RRM The book addresses an innovative treatment for the decision making in RRM thereby improving the integration of fundamental concepts from the areas of both RRM and decision making This is accomplished by presenting an overview of the literature on decision making in RRM Some pitfalls of decision models when applying them to RRM in practice are discussed and guidance on overcoming these drawbacks is offered The procedure enables multicriteria models to be built for the RRM context including guidance on choosing an appropriate multicriteria method for a particular problem faced in the RRM context The book also includes many research advances in these topics Most of the multicriteria decision models that are described are specific applications that have been influenced by this research and the advances in this field Multicriteria and Multiobjective Models for Risk Reliability and Maintenance Decision Analysis is implicitly structured in three parts with 12 chapters The first part deals with MCDM A concepts methods and decision processes The second part presents the main concepts and foundations of RRM Finally the third part deals with specific decision problems in the RRM context approached with MCDM A models

**Standard Transport Appraisal Methods**, 2020-11-04 Standard Transport Appraisal Methods Volume 6 in the Advances in Transport Policy and Planning series assesses both successful and unsuccessful practices and policies from around the world Chapters in this new release include Transport models Cost Benefit Analysis Value of Travel Time Savings and reliability Value of Statistical Life Wider economic benefits Multi criteria analysis Best Worst Method Participatory Value Evaluation Ex post evaluation Sustainability assessment Evaluating Transport Equity Environmental Impact Assessment Decision Support Systems Deliberative appraisal methods Critique on appraisal methods Appraisal methods in developing countries Research agenda for appraisal methods and much more Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Advances in Transport Policy and Planning series

**Multi-Objective and Multi-Attribute Optimisation for Sustainable Development Decision Aiding** Samarjit Kar, Edmundas Kazimieras Zavadskas, Jurgita Antuchevičienė, 2019-09-20 Optimization is considered as a decision making process for getting the most out of available resources for the best attainable results Many real world problems are multi objective or multi attribute problems that naturally involve several competing objectives that need to be optimized simultaneously while respecting some constraints or involving selection among feasible discrete alternatives In this Reprint of the Special Issue 19 research papers co authored by 88 researchers from 14 different countries explore aspects of multi objective or multi attribute modeling and optimization in crisp or uncertain environments by suggesting multiple attribute decision making MADM and multi objective decision making MODM approaches The papers elaborate upon the approaches of state of the art case studies in selected areas of



applications related to sustainable development decision aiding in engineering and management including construction transportation infrastructure development production and organization management      **Advanced Concepts, Methodologies and Technologies for Transportation and Logistics** Jacek Żak,Yuval Hadas,Riccardo Rossi,2017-07-03 This book is a collection of original papers produced by the members of the Euro Working Group on Transportation EWGT in the last several years 2015 2017 The respective chapters present the results of various research projects carried out by the members of the EWGT and extended versions of presentations given at the last several meetings of the EWGT The book offers a representative sampling of the EWGT s research activities and covers the state of the art in quantitative oriented transportation logistics research It highlights a range of advanced concepts methodologies and technologies divided into four major thematic streams Multiple Criteria Analysis in Transportation and Logistics Urban Transportation and City Logistics Road Safety and Artificial Intelligence and Soft Computing in Transportation and Logistics The book is intended for academics researchers analysts business consultants and graduate students who are interested in advanced techniques of mathematical modeling and computational procedures applied in transportation and logistics      Linear and Multiobjective Programming with Fuzzy Stochastic Extensions Masatoshi Sakawa,Hitoshi Yano,Ichiro Nishizaki,2013-11-29 Although several books or monographs on multiobjective optimization under uncertainty have been published there seems to be no book which starts with an introductory chapter of linear programming and is designed to incorporate both fuzziness and randomness into multiobjective programming in a unified way In this book five major topics linear programming multiobjective programming fuzzy programming stochastic programming and fuzzy stochastic programming are presented in a comprehensive manner Especially the last four topics together comprise the main characteristics of this book and special stress is placed on interactive decision making aspects of multiobjective programming for human centered systems in most realistic situations under fuzziness and or randomness Organization of each chapter is briefly summarized as follows Chapter 2 is a concise and condensed description of the theory of linear programming and its algorithms Chapter 3 discusses fundamental notions and methods of multiobjective linear programming and concludes with interactive multiobjective linear programming In Chapter 4 starting with clear explanations of fuzzy linear programming and fuzzy multiobjective linear programming interactive fuzzy multiobjective linear programming is presented Chapter 5 gives detailed explanations of fundamental notions and methods of stochastic programming including two stage programming and chance constrained programming Chapter 6 develops several interactive fuzzy programming approaches to multiobjective stochastic programming problems Applications to purchase and transportation planning for food retailing are considered in Chapter 7 The book is self contained because of the three appendices and answers to problems Appendix A contains a brief summary of the topics from linear algebra Pertinent results from nonlinear programming are summarized in Appendix B Appendix C is a clear explanation of the Excel Solver one of the easiest ways to solve optimization problems through the use of simple

examples of linear and nonlinear programming      *Theory and Practice in Policy Analysis* M. Granger Morgan, 2017-10-12

Many books instruct readers on how to use the tools of policy analysis. This book is different. Its primary focus is on helping readers to look critically at the strengths, limitations, and the underlying assumptions analysts make when they use standard tools or problem framings. Using examples, many of which involve issues in science and technology, the book exposes readers to some of the critical issues of taste, professional responsibility, ethics, and values that are associated with policy analysis and research. Topics covered include policy problems formulated in terms of utility maximization such as benefit-cost decision and multi-attribute analysis; issues in the valuation of intangibles; uncertainty in policy analysis; selected topics in risk analysis and communication; limitations and alternatives to the paradigm of utility maximization; issues in behavioral decision theory; issues related to organizations and multiple agents; and selected topics in policy advice and policy analysis for government.

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