Chapter 2 Multi Criteria Decision Analysis For Strategic 

Multi-Criteria Decision-Making Models for Website Evaluation

Multi Criteria Decision Analysis in the Renewable Energy Industry

Multi-Criteria Decision Analysis is a method used in multiple disciplines to help decision makers make informed choices when faced with complex problems. By solving a decision-making problem, a decision maker's goal is to find the best solution among the available options. This book presents various multi-criteria analysis methods for sustainability-oriented analysis and decision-making for energy systems, under various different conditions and scenarios. It provides methodologies to solve the problem of selecting the most sustainable among the alternatives, and how multi-criteria decision analysis methods can be tailored to select the most sustainable energy systems. A systematic innovative methodological framework is presented, which enables the most appropriate energy system to be selected under different conditions including: Scientific decision support tools for sustainable energy system selection; Fuzzy, grey, and rough sets based multi-criteria decision analysis; Decision-making models under uncertainties; The combination of life cycle thinking and multi-criteria decision analysis This book is of interest to researchers, engineers, decision makers, and postgraduate students within the field of energy systems, sustainability, and multi-criteria decision analysis.

Chapter 2 Multi Criteria Decision Analysis For Strategic
This book provides a systematic way of how to make better decisions in water resources management. The applications of three weighting methods namely rating, ranking, and ratio are discussed in this book. Additionally, data mining on keywords is presented using three popular scholarly databases: Science Direct, Scopus, and SciVerse. Four abbreviated keywords (MCDM, MCDA, MCA, MADM) representing multi-criteria decision-making were used and these three databases were searched for different popular weighting methods for a period of 13 years (2000-2012). The book provides also a review of weighting methods applied in various multi-criteria decision-making (MCDM) methods and also presents survey results on priority ranking of watershed management criteria undertaken by 30 undergraduate and postgraduate students from the Faculty of Civil Engineering, Universiti Teknologi Malaysia.

**Multi-objective Optimization for Bridge Management Systems**

From selecting sites for new hospitals, schools, and factories, to managing forests and rivers, to creating and maintaining highways and bridges, public and private organizations are often called on to make decisions on geographic questions that involve a multitude of alternatives and often conflicting evaluation criteria. This book presents a formal mechanism for dealing with these situations, capturing the information in a Geographic Information System and processing it to derive optimal recommendations for confronting these complex questions.

**Advanced Studies in Multi-Criteria Decision Making**

Examines the development of methodologies for network and project level optimization of multiple, user-specified bridge management performance criteria. The report also explores the development of bridge management software modules to implement the methodologies. The report includes software modules, a user's manual, and demonstration database as part of an accompanying CD-ROM, which is available for download as an ISO image.

**Multi-Criteria Decision Analysis via Ratio and Difference Judgement**

Life Cycle Sustainability Assessment for Decision-Making: Methodologies and Case Studies gives readers a comprehensive introduction to life cycle sustainability assessment (LCSA) methodology for sustainability measurement of industrial systems, proposing an efficiency methodology for stakeholders and decision-makers. Featuring the latest methods and case studies, the book will assist researchers in environmental sciences and energy to develop the best methods for LCA, as well as aid decision-makers who are responsible for making decisions for promoting sustainable development. The past, current status and future of LCSA, Life Cycle Assessment method (LCA), Life Cycle Costing (LCC), Social Life Cycle Assessment (SLCA), the methodology of LCSA, typical LCSA case studies, limitations of LCSA, and life cycle aggregated sustainability index methods are all covered in this multidisciplinary book. Includes models for assessing sustainability in environmental, energy engineering and economic scenarios Features case studies that help define the advantages and obstacles of real world applications Presents a complete view, from theory to practice, of a life cycle approach by exploring the methods and tools of sustainability assessment, analysis and design of sustainability assessment.

**Multi-criteria Analysis in Legal Reasoning**

Multiple Criteria Decision Making (MCDM) is a subfield of Operations Research, dealing with decision making problems. A decision-making problem is characterized by the need to choose one or a few among a number of alternatives. The field of MCDM assumes special importance in this era of Big Data and Business Analytics. In this volume, the focus will be on modelling-based tools for Business Analytics (BA), with exclusive focus on the sub-field of MCDM within the domain of operations research. The book will include an introduction to Big Data and Business Analytics, and challenges and opportunities for developing MCDM models in the era of Big Data.

**Big Data Analytics Using Multiple Criteria Decision-Making Models**

Applications of Multi-Criteria Decision-Making Theories in Healthcare and Biomedical Engineering contains several practical applications on how decision-making theory could be used in solving problems relating to the selection of best alternatives. The book focuses on assisting decision-makers (government, organizations, companies, general public, etc.) in making the best and most appropriate decision when confronted with multiple alternatives. The purpose of the analytical MCDM techniques is to support decision makers under uncertainty and conflicting criteria while making logical decisions. The knowledge of the alternatives of the real-life problems, properties of their parameters, and the priority given to the parameters have a great effect on consequences in decision-making. In this book, the application of MCDM has been provided for the real-life problems in health and biomedical engineering issues. Provides a comprehensive analysis and application of multi-criteria decision-making methods Presents detailed information about MCDM and their usage Covers state-of-the-art MCDM methods and offers applications of MCDM for health and biomedical engineering purposes

**Multi-Criteria Decision Making in Maritime Studies and Logistics**

With contributions from some of the top academics and scientists in the field, Advanced Studies in Multi-Criteria Decision Making presents an updated view of the landscape of Decision Sciences, current research topics, the interaction with other sciences and fields, as well as the prospects and challenges at an international level. Trainers, researchers, and scientists are recognized in science and technology, this book would be of interest to decision-makers, managers, and researchers from academia, and industrial/services companies that would like a fresh insight into MCDM. Features International collaboration on several scientific fields. General reader approach, including applied researchers from the social, business, enterprise services Suitable for academics and professionals Presents a broad coverage of MCDM tools either in industry or in services companies and systems Provides a fresh overview on MCDM studies promoted by prestigious R&D institutions.

**Evaluation and Decision Models with Multiple Criteria**

This latest Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) will again form the standard reference for all those concerned with climate change and its consequences, including students, researchers and policy makers in environmental science, meteorology, climatology, biology, ecology, atmospheric chemistry and environmental policy.

**Using Multi-Criteria Decision Analysis in Natural Resource Management**

This book covers various multiple-criteria decision making (MCDM) methods for modeling and optimization of advanced manufacturing processes (AMPs). Processes such as non-conventional machining, rapid prototyping, environmentally conscious machining and hybrid machining are finally put together in a single book. It highlights the research advances and discusses the published literature of the last 15 years in the field. Case studies of real life manufacturing situations are also discussed.

**Application of Multi-Criteria Decision Analysis in Environmental and Civil Engineering**

This book covers the domain of multi-criteria decision making, a topic which has gained significant attention of researchers and practitioners spanning a variety of disciplines for enhancing their decision making in real life situations. The topics in this book include sustainability, decision making for sustainable development, risk assessment, and decision making in the new building and analysis stage. The chapters cover a variety of techniques and their applications for interesting problems. This book will be of interest to readers in diverse disciplines such as engineering, business, management, humanities, psychology and law. 

**Feasibility Model of Solar Energy Plants by ANN and MCDM Techniques**

While there are many different models for performing system analysis, the multi-criteria decision making method has proven to be one of the most efficient. By analysis of an individual, it can be enhanced and will benefit future organizations and companies in novel ways. Multi-Criteria Decision Making for the Management of Complex Systems provides a comprehensive examination of the latest strategies and methods involved in decision theory. Featuring extensive coverage on relevant topics such as nested scalar convolutions, Pareto optimality, nonlinear schemes, and operator performance, this publication is ideally designed for engineers, students, professionals, academics, and researchers seeking innovative perspectives on the supervision of advanced decision making theories in system analysis.

**GIS and Multicriteria Decision Analysis**
Decision Making is a book where each chapter has been contributed to by a different author(s). The book synthesizes the analytical principles with business practice of Decision Making. Throughout the book, principles of engineering/technology and the organizational, administrative, and planning abilities of decision making. It is complementary to other sub-disciplines such as economics, finance, marketing, decision and risk analysis, etc. The chapters introduce and demonstrate decision making in practical case studies. It demonstrates key results for each sector with diverse real-world case studies that can be comprehended by relevant and practical building from simple theory to complex and dynamic decisions with multiple data points, including big data, etc. Computational techniques, dynamic analysis, probabilistic methods, and mathematical optimization techniques are expertly blended to support analysis of multi-criteria decision-making problems with defined constraints and requirements.

Fuzzy Multi-Criteria Decision Making

This book integrates multiple criteria concepts and methods for problems within the Risk, Reliability and Maintenance (RRM) context. The concepts and foundations related to MCDM models are presented in the first part, building multicriteria decision theory. In the book, a general framework for this integration is proposed 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 management. 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 areas 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 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 MCDMA 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 MCDMA models.

Strategic Approach in Multi-Criteria Decision Making

This book offers a comprehensive guide to the use of neoteric soft techniques in multiple criteria decision making problems. It shows how neoteric soft techniques, which have been proposed as an extension of fuzzy and grey systems, can be used to deal with certain types of non-classical problems. This is based on a detailed treatment of fuzzy and grey systems, which can be used to deal with real world problems. The book is organized into three parts. The first part provides an introduction to fuzzy and grey systems. The second part describes the main characteristics of fuzzy and grey systems. The third part provides an overview of the main applications of fuzzy and grey systems. The book is aimed at researchers, engineers, managers, and graduate students.

Multi-Criteria Decision-Making Techniques in Waste Management

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 urban systems management. It emphasizes the need for methods related to real world situations and the importance to take into account the multiplicity of criteria and the complexity of the decision making process. 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 task for decision makers to evaluate all the potential solutions and make a decision. However, with the use of multicriteria approaches, it is possible to tackle these problems and make decisions that are not only objective but also subjective. The SIMUS method has been designed to offer a strategy to help organize, classify, and evaluate information effectively.

Multi-criteria Decision Analysis for Supporting the Selection of Engineering Materials in Product Design

This book covers a large variety of multi-criteria decision making applications (MCDAs), presenting them in a coherent framework provided by the methodology chapters and the comments accompanying each case study. The chapters describing MCDAs invite the reader to experiment with MCDMA methods and perhaps develop new variants using data from these case studies or other cases they encounter, equipping them with a broader perception of real-world problems and how to overcome them with the help of MCDAs.

Explainable Neural Networks Based on Fuzzy Logic and Multi-criteria Decision Tools

Decision makers in the Renewable Energy sector face an increasingly complex social, economic, technological, and environmental scenario in their decision process. Different groups of decision-makers become involved in the process, each group bringing along different criteria therefore, policy formulation for fossil fuel substitution by Renewable Energies must be addressed in a multi-criteria context. Multi Criteria Analysis in the Renewable Energy Industry is a direct response to the increasing interest in the Renewable Energy industry which can be seen as an important remedy to many environmental problems that the world faces today. The multiplicity of criteria and the increasingly complex social, economic, technological, and environmental scenario makes multi-criteria analysis a valuable tool in the decision-making process for fossil fuel substitution. The detailed chapters explore the use of the Multi-criteria decision-making methods and how they provide valuable assistance in reaching equitable and acceptable solutions in the selection of renewable energy projects. Common multi-criteria decision-making methods include ELECTRE, TOBIT, TOPSIS, VIKOR, and others. Concepts are explored in detail with a focus on the application of each method. The book concludes with a summary of each chapter at the end of each chapter. As such, Multi Criteria Analysis in the Renewable Energy Industry is an ideal resource for those groups of individuals, institutions and professionals who are concerned with the selection of renewable energy technologies. The book is illustrated with many figures, tables, and other visual aids which help to explain the concepts. It is complementary to other sub-disciplines such as economics, finance, decision and risk analysis, etc. The book is written from a practical perspective, making it accessible to a wide range of readers.

Multi-criteria Decision Making Methods

Providing useful insights on the use of Multi-Criteria Decision Analysis (MCDA) in natural resource management, this book examines a number of empirical applications for several countries and a variety of natural resources. This book gives in-depth analysis of the potential problems in applying MCDA techniques, including difficulties eliciting required information, lack of suitable measures for environmental variables and the need to develop innovative methods to simplify the use of MCDA.

Sustainable Modeling for Urban Systems: A Multi-Criteria Perspective

This book presents an introduction to MCDA followed by more detailed chapters about each of the leading methods used in this field. Comparison of methods and software is also featured to enable readers to choose the most appropriate method needed in their research. Worked examples as well as the software featured in the book are available on an accompanying website.

Climate Change 2014 - Impacts, Adaptation and Vulnerability: Global and Sectoral Aspects

In this book we introduce a new procedure called α-Discounting Method for Multi-Criteria Decision Making (α-D MCDM), which is an alternative and extension of
This book describes a wide range of real-case applications of Multi-Criteria Decision Making (MCDM) in maritime related subjects including shipping, port, maritime logistics, cruise ports, waterfront developments, and shipping finance, etc. In such areas, researchers, students and industrialists, in general, felt struggling to find a step-by-step guide on how to apply MCDM to formulate effective solutions to solving real problems in practice. This book focuses on the in-depth analysis and applications of the most well-known MCDM methodologies in the aforementioned areas. It brings together an eclectic collection of twelve chapters which seek to respond to these challenges. The book begins with an introduction and is followed by an overview of major MCDM techniques. The next chapter examines the theory of analytic hierarchy process (AHP) in detail and investigates a fuzzy AHP (FAHP) approach and its capability and rationale in dealing with decision problems of ambiguous information. Chapter 4 proposes a generic methodology to identify the key factors influencing green shipping and to establish an evaluation system for the assessment of shipping greenness. In Chapter 5, the authors describe a new function of fuzzy evidential reasoning (FER) to improve the vessel selection process in multiple criteria with insufficient and ambiguous information are evaluated and synthesized. Chapter 6 presents a novel methodology by using an Artificial Potential Field (APF) model and the ER approach to estimate the collision probabilities of monitoring targets for coastal radar surveillance. Chapter 7 develops the inland port performance assessment model (IPPM) using a hybrid of AHP, ER and a utility function. The next chapter showcases a challenging approach to address the risk and uncertainty in LNG transfer operations, by utilizing a Stochastic Utility Additives (UTA) method with the help of the philosophy of aggregation-disaggregation coupled with a robustness control procedure. Chapter 9 uses Entropy and Grey Relation Analysis (GRA) to analyze the relative weights of financial ratios through the case studies of the four major shipping companies in Korea and Taiwan: Evergreen, Yang Ming, Hanjin and Hyundai Merchant Marine. Chapter 10 systematically applies modern heuristics to solving MCDM problems in the fields of operation optimisation in container terminals. Arguing that bunkering port selection is typically a multi-criteria group decision problem, and in many practical situations, decision makers cannot form proper judgments using incomplete and uncertain information in an environment with exact and crisp values, in Chapter 11, the authors propose a hybrid Fuzzy-Delphi-TOPSIS based methodology with a sensitivity analysis. Finally, Chapter 12 deals with a new conceptual port performance indicators (PPIs) interdependency model using a hybrid approach of a fuzzy logic based evidential reasoning (FER) and a decision making trial and evaluation laboratory (DEMATEL).
Multi-criteria Decision Analysis for Supporting the Selection of Engineering Materials in Product Design, Second Edition, provides readers with tactics they can use to optimally select materials to satisfy complex design problems when they are faced with the vast range of materials available. Current approaches to materials selection range from the use of intuition and experience, to more formalized computer-based methods, such as electronic databases with search engines to facilitate the materials selection process. Recently, multi-criteria decision-making (MCDM) methods have been applied to materials selection, demonstrating significant capability for tackling complex design problems. This book describes the rapidly growing field of MCDM and its application to materials selection. It aids readers in producing successful designs by improving the decision-making process. This new edition updates and expands previous key topics, including new chapters on materials selection in the context of design problem-solving and multiple objective decision-making, also presenting a significant amount of additional case studies that will aid in the learning process. Describes the advantages of Quality Function Deployment (QFD) in the materials selection process through different case studies Presents a methodology for multi-objective material design optimization that employs Design of Experiments coupled with Finite Element Analysis Supplements existing quantitative methods of materials selection by allowing simultaneous consideration of design attributes, component configurations, and types of material Provides a case study for simultaneous materials selection and geometrical optimization processes