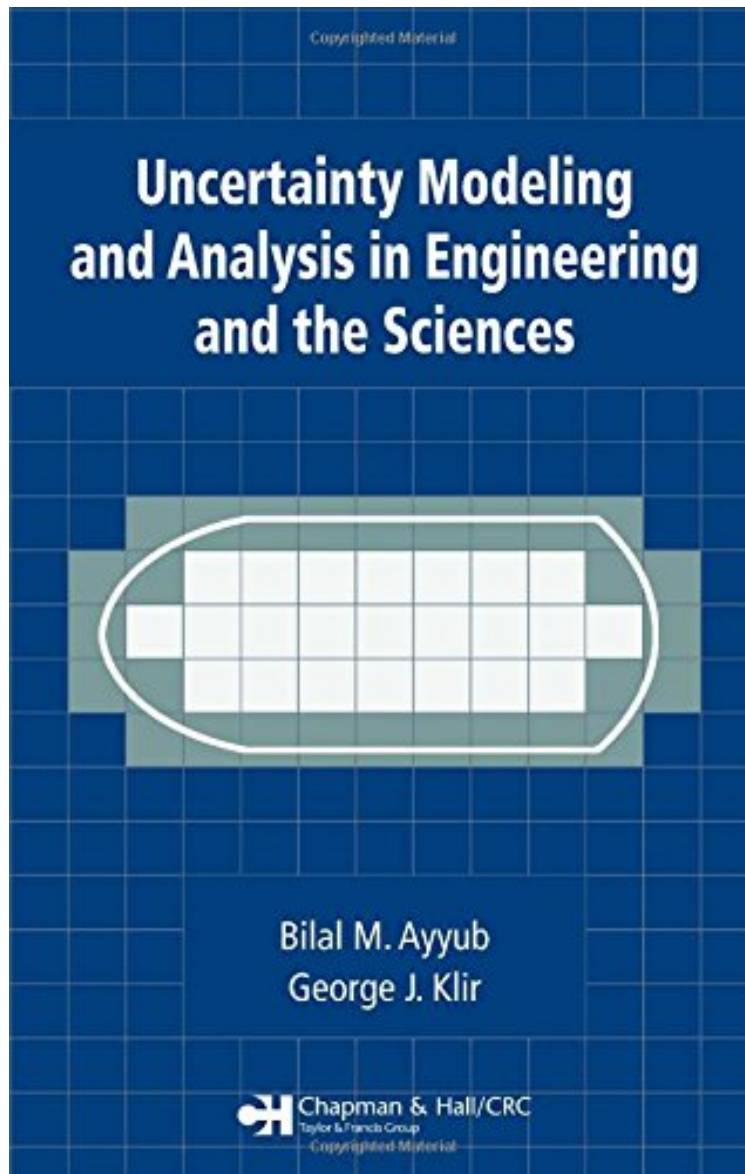


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# Uncertainty Modeling and Analysis in Engineering and the Sciences

*Bilal M. Ayyub, George J. Klir*

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**Bilal M. Ayyub, George J. Klir : Uncertainty Modeling and Analysis in Engineering and the Sciences** before purchasing it in order to gage whether or not it would be worth my time, and all praised Uncertainty Modeling and Analysis in Engineering and the Sciences:

1 of 1 people found the following review helpful. a book review for 'uncertainty modeling and analysis in engineering and sciences'By Yunchao YeThe book 'Uncertainty Modeling and Analysis in Engineering and Sciences' is a book for

analysis about knowledge of modeling and analysing uncertainty. Modern engineers often encounter situations that lack of knowledge or limited resources, in order to make decision under this sort of circumstances, one must have the ability to treat the uncertainty and expert opinions properly. This book introduces and establishes the foundation of these basic knowledge. In the first three chapters that we have already been taught, the book first set up basic knowledge by presenting concepts of 'system', 'knowledge', 'ignorance', then the fundamental of encoding data and express information by using 'classical sets', 'fuzzy sets', 'rough sets' and the basic operations of these sets, later, discuss the uncertainty and information synthesis based on a mission based system definition. In chapter IV, author provides several uncertainty measures including nonspecificity measures, entropy-like measures and fuzziness measure. In chapter V, author introduces several uncertainty-based criteria including minimum uncertainty criterion, maximum uncertainty criterion and uncertainty invariance criterion. In chapter VI, author put theory into practise discuss on a class of models in engineering and sciences of relating input variables to output variables for a system. Chapter VII discusses about expert opinion elicitation. The last chapter introduces ways for visualize uncertainty in information, in order to portray and group information effectively. After reading this book, I widen my border of view of decision making in engineering and the analysis of information from real circumstances Uncertainty can be viewed as a component of ignorance, and it has impacts on our practise and ability to make decision. Expert opinions may have nonfactual information and could be wrong, how can one draw a proper conclusion from all different expert opinions. And last but no least, the techniques for visualizing information which include degrees of certainty. All these knowledge are criterion for modern engineers in decision making. 'Uncertainty Modeling and Analysis in Engineering and Sciences' is a book about real decision making, giving the reader abundant examples and theories, to introduce and help us understand the whole theory of uncertainty.

0 of 0 people found the following review helpful. A well written book

By samess

In a world that is becoming increasingly complex and sophisticated in technology for the delivery of goods and services, an understanding of the complexity and uncertainties in the systems and technologies that sustain these goods and services is becoming increasingly important in a wide range of disciplines: in engineering, science, technology, business, politics, healthcare delivery etc. The logical treatment of uncertainty in analysis, design and decision making is the focus of this book. The book is written to assist analyst and designers in understanding the fundamentals of knowledge and ignorance, how to model and analyze uncertainty, and how to select appropriate analytical tools for a particular problem. The authors adopt a more generalized approach to uncertainty analysis that includes both probabilistic and nonprobabilistic methods. The book begins with this quote from Stephen Hawking: "The greatest enemy of knowledge is not ignorance; it is the illusion of knowledge". This quote was deliberately chosen by the authors to set the tone for the discussion on the close connection between uncertainty, information, ignorance and knowledge. The authors look at the meaning, nature, and hierarchy of knowledge and ignorance from a philosophical perspective; where the close connection between uncertainty and information as a pair, and ignorance and knowledge as another pair are carefully examined. The subject of Systems Framework is well treated, with emphasis on taxonomy of systems, complexity of systems, and systems knowledge. In order to quantify and analyze uncertainty, the data that contains or expresses the uncertainty in a system should be organized in a structured manner so that it can lend itself to mathematical or logical representation and analysis. This leads the authors to explore methods of encoding data. The concept of Identification and Classification of Theories is used as a basis for defining a universal set based on closed-world and open-world assumptions, from which elements of the universal set (precise or imprecise), and sets (also precise or imprecise) are developed. The fundamentals of classical set theory, probability theory, fuzzy sets, generalized measures, rough sets, and gray systems are presented as a formalized way of encoding data. Numerical examples are used to explain the basic mathematical operations of fuzzy sets and rough sets. However, not much attention is paid to gray sets. In order to make appropriate decisions about a system, engineers and scientists need to synthesis data and information. This leads the authors to the subject of uncertainty and information synthesis. Here, measure theory and monotone measures, including possibility theory and the Dempster-Shafer theory of evidence are explained. They then compare and contrast these theories with some variations of probability theory, such as Bayesian probabilities, and interval probabilities. Simple numerical problems are used to demonstrate how these methods can be used to aggregate expert opinion. The concept of aggregating expert opinion is further examined with demonstrative examples by utilizing minimum and maximum uncertainty criterion, and uncertainty invariance criterion. The book also presents methods for propagating uncertainty in input-output systems. The processes of eliciting expert opinions also receive a fair amount of coverage in the book. The authors demonstrate the applications of expert opinion elicitation with practical examples. Techniques for visualizing uncertainty in information are also presented. Uncertainty Modeling and Analysis in Engineering and the Sciences presents a holistic view of understanding uncertainty in systems that are of relevance to engineers and scientists in practice, in a more generalized approach, and is a useful book that provides a fundamental understanding to analyzing uncertainty in engineering and scientific systems. The authors demonstrate a deep understanding of the subject matter and draw on real word examples to explain the concepts presented in the book.

0 of 0 people found the following review helpful. Very thorough textbook with unique approach

By Greg

This textbook is intended to help prepare scientists to deal with incomplete and uncertain information while solving complex problems. In general, the first two chapters deal with

introductory information and set the framework for the rest of the textbook by defining the terminology and mathematical operations that will be utilized in subsequent chapters. The later chapters deal with identifying and quantifying uncertainty, dealing with uncertainty, modeling uncertainty, and tracking uncertainty propagation through a complex problem. The style of the textbook is fairly standard, with each chapter containing sections with theory, supported by numerous examples showing how the theory is applied. In some cases, however, the examples are rather simplistic - not always giving the reader a full understanding of the complexities of some problems that they may encounter in real life. The use of figures and tables in the text is very useful. At some points, the text itself can be somewhat unclear, however, the sections using figures and tables to support the text, are much easier to understand. A major criticism would be the lack of examples, or the simplicity of many of the current examples. Otherwise, this textbook is very effective in conveying a subject matter that may not be inherently understandable to many students.

Engineers and scientists often need to solve complex problems with incomplete information resources, necessitating a proper treatment of uncertainty and a reliance on expert opinions. *Uncertainty Modeling and Analysis in Engineering and the Sciences* prepares current and future analysts and practitioners to understand the fundamentals of knowledge and ignorance, how to model and analyze uncertainty, and how to select appropriate analytical tools for particular problems. This volume covers primary components of ignorance and their impact on practice and decision making. It provides an overview of the current state of uncertainty modeling and analysis, and reviews emerging theories while emphasizing practical applications in science and engineering. The book introduces fundamental concepts of classical, fuzzy, and rough sets, probability, Bayesian methods, interval analysis, fuzzy arithmetic, interval probabilities, evidence theory, open-world models, sequences, and possibility theory. The authors present these methods to meet the needs of practitioners in many fields, emphasizing the practical use, limitations, advantages, and disadvantages of the methods.