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Fundamentals of Uncertainty Calculi
With Applications to Fuzzy Inference

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xi + 346 pages.
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The referred book deals in a representative way with general mathematical methods emulating human reasoning as effective tools for implementation of intelligent systems. Even if the main attention is paid to fuzzy logic and fuzzy set theoretical approaches to the problem, also other relevant concepts are mentioned. The authors consider the decision-making under uncertainty for a crucial attribute of human (and also artificial) intelligence and its managing by mathematical models for an essential step to managing intelligent systems. The main source of uncertainty in real situations is the natural language used in practical specification of the decision-making situations. The principal aim of the book is to provide a rigorous background for uncertainty calculi with special stress to fuzziness.

The book is divided into ten chapters. After brief *Introduction* (Chapter 1) which presents a heuristical background of the book, the remaining chapters can be clustered into two groups. The first one (Chapters 2 – 6) is focused on the theoretical analysis and presentation of the considered models, and the second group (Chapters 7 – 10) is devoted to application of the general theory.

Chapter 2, *Modelling Uncertainty* offers a brief survey of various ways to mathematical treatment of the uncertainty, including probability, uncertainty in quantum mechanics, entropy, belief structures, non-additive set functions as models of uncertainty, and also the elements of fuzziness. The next chapter, *Capacities and the Choquet Functionals*, brings abstract models of capacities including capacities in topological spaces, relation between capacities and belief functions, Choquet functional, capacities in Bayesian statistics, and also a formulation of the general decision-making problem. Chapter 4, *Information Measures* presents the concept of information, its general measures and their compositions and also connection between information measures and capacities. The following two chapters are devoted to fuzziness. First, in *Calculus of Fuzzy Concepts*, the fuzzy sets are presented including calculus of fuzzy quantities, reasoning with fuzzy concepts (using also *t*-norms), robustness of fuzzy logic, fuzzy inference and other concepts. Then, in *Fuzzy Measures and Integrals*, the concepts and properties of fuzzy measures, Choquet integral and other related topics are explained.

The applications oriented chapters deal with analysis and solutions of *Decision Making* (Chapter 7), *Subjective Multicriteria Evaluation* (Chapter 8), *Pattern Recognition and Computer Vision* (Chapter 9), and *Identification and Interpretation of Fuzzy Measures* (Chapter 10). In these chapters the general uncertainty calculi is effectively used to the solution of applied (but also generally formulated) specific problems. The book is completed by *Bibliography* (283 items) and *Index*.

The topic of uncertainty and vagueness processing is managed at a very good level. Even if the main parts of the book deal with fuzziness, a proportional attention is focused on the relations to other mathematical models of uncertainty, and these relations are discussed and interpreted. The mathematical presentation of the models and results uses abstract theoretical tools, the whole conception of the book is very modern and formally precise.

The referred book represents a very good survey of the vagueness processing in intelligent systems and its relations to other similar branches of artificial intelligence and

information science. It can be recommended to everyone who wishes to study these problems in their completeness with respect to their wider consequences.

Milan Mareš