

Book reviews

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Books Received

Decision Making Under Risk and Uncertainty -- New Models and Empirical Findings (*John Geweke, ed.*). (Theory and Decision Library. Series B: Mathematical and Statistical Library, Volume 22.) Kluwer Academic Publishers, Dordrecht - Boston - London 1992. ix + 262 pages; US \$ 111.00.

H. M. Srivastava and R. G. Buschman: Theory and Applications of Convolution Integral Equations. (Mathematics and Its Applications, Volume 79.) Kluwer Academic Publishers, Dordrecht - Boston - London 1992. xx + 240 pages; US \$ 96.00.

Gheorghe Micula and Paraschiva Pavel: Differential and Integral Equations through Practical Problems and Exercises. (Kluwer Texts in the Mathematical Sciences, Volume 7.) Kluwer Academic Publishers, Dordrecht - Boston - London 1992. ix + 398 pages; US \$ 139.00.

Albert N. Voronin: Mnogokriterialnyj sintez dinamičeskich sistem. (Akademija nauk Ukrainy — Institut kibernetiki im. V. M. Gluškova.) Naukova dumka, Kiev 1992. 160 pages.

V. A. Bagackij, Ju. M. Grešišev, I. V. Samus, V. A. Fabričev: Preobrazovateli formy informacii s obrabotkoj dannyh. (Akademija nauk Ukrainy — Institut kibernetiki im. V. M. Gluškova.) Naukova dumka, Kiev 1992. 264 pages.

Boris N. Pansin: Sistemy upravleniya industrialnojj informacionnojj tehnologiej. (Akademija nauk Ukrainy — Institut kibernetiki im. V. M. Gluškova.) Naukova dumka, Kiev 1992. 264 pages.

Artificial Intelligence Frontiers in Statistics -- AI and statistics III (*D. J. Hand, ed.*). Chapman and Hall, London - Glasgow - New York - Tokyo - Melbourne - Madras 1993. xvii + 510 pages; Pounds 49.95.

J. M. Maciejowski: Multivariable Feedback Design. (Electronic Systems Engineering Series.) Addison-Wesley Publishing Company, Wokingham - Reading - Menlo Park - New York 1989. xvi + 424 pages; Pounds 64.50.

Discrete Event Systems: Modeling and Control - Proceedings of a Joint Workshop held in Prague, August 1992 (*S. Balemi, P. Kozák and R. Smedinga, eds.*). (Progress in Systems and Control Theory, Volume 22.) Birkhäuser Verlag, Basel - Boston - Berlin 1993. 232 pages; SFr 88.00.

Vilém Novák: The Alternative Mathematical Model of Linguistic Semantics and Pragmatics. (International Federation for System Research - International Series on Systems Science and Engineering, Volume 8.) Plenum Press, New York - London 1992. xiii + 204 pages; \$ 65.00.

Jaromír Antoch, Dana Vorlíčková: Vybrané metody statistické analýzy dat. Academia, Praha 1992. 286 pages, 61 figures; Kčs 135,-.

Zdeněk Kotek, Vladimír Marák, Václav Hlaváč, Josef Psutka, Zdeněk Zdráhal: Metody rozpoznávání a jejich aplikace. Academia, Praha 1993. 196 pages, 68 figures; Kčs 79,-.

Tomáš Havránek: STATISTIKA pro biologické a lékařské vědy. Academia, Praha 1993. 480 pages, 142 figures.

Andrej Pázman: Nonlinear Statistical Models. (Mathematics and Its Applications, Volume 254.) Kluwer Academic Publishers, Dordrecht - Boston - London and Inter Science Press, Bratislava 1993. ix + 259 pages.

Milan Souka, Vaclav Hlavac and Roger Boyle: Image Processing, Analysis and Machine Vision. (Chapman & Hall Computing Series.) Chapman & Hall Computing, London - Glasgow - New York - Tokyo - Melbourne - Madras 1993. xix + 555 pages; Pounds 22.95.

A. BILLOT

Economic Theory of Fuzzy Equilibria. An Axiomatic Analysis

Lecture Notes in Economics and Mathematical Systems 373.

Springer-Verlag, Berlin - Heidelberg - New York - London - Paris 1992.

XII + 164 pages; ISBN 3-540-54982-X, Berlin - New York; ISBN 0-387-54982-X,
New York - Berlin.

The fuzzy set theory was developed to offer mathematical method of processing vague components of theoretical models. In this sense the notion of vagueness covers a wide range of non-stochastic uncertainties not fully corresponding to the probabilistic patterns of randomness. The enormous quantity of works devoted to fuzzy set theoretical models of various real phenomena illustrates the objective attractiveness of this alternative approach. Concerning these facts it is interesting to note that there are not so many fuzzy set theoretical monographs focused to macroeconomic problems even if the real economy is connected with numerous vague phenomena. Many input data or control coefficients can be only subjectively estimated, some of them are in their nature rather verbal with very limited possibilities of their quantification. The referred book contributed to the fuzzy macroeconomic literature in an inspirative way.

Due to the Acknowledgement the book is partially based on the author's Ph. D. dissertation. From this point of view the scale of subjects dealt in it is surprisingly wide. It covers, at least briefly, such subjects like individual and group preference systems, strategic and coalition games, general equilibrium in Walrasian sense and the analysis of underemployment equilibrium. Such variety of subjects cannot be treated in all details and practical as well as theoretical subspects. In this book the author prefers the theoretical features of the relevant concepts, their axiomatics and logical structure. In spite of the theoretical orientation the formal apparatus of the explanation used in the book it is acceptably simple and well readable.

The text of the book is divided (besides brief General Introduction, General Conclusion, Annexes subjected to a few more theoretical formal aspects of the presented subjects, and representative Bibliography) into five main chapters.

The first one is devoted to the one-criterion fuzzy decision making. The basic concepts like fuzzy relations, fuzzy preference orderings, fuzzy utility functions are described and their properties and mutual relations are analyzed.

The extension of the previous concepts to the multi-criteria decision making is treated in the second chapter. Special attention is paid to the Arow's axiomatics including the well known aggregation paradox. The main section of this chapter is focused to the fuzzy concept of coalition and group decision making.

The third chapter, which is the most extensive one, is oriented to the fuzzy game as specific component of fuzzy economic models and strategic decision making. The game theoretical equilibria in a wide sense represent a basic pattern for more complex macroeconomic equilibria concepts. The third chapter of the referred book contains three sections concentrated to non-cooperative game equilibrium (the Nash solution and its relation to fixed points), so called prudent equilibria (lexicographic and discontinuous preferences in non-cooperative games), and to cooperative fuzzy games.

The general economy equilibria of the Walrasian type are studied in the fourth chapter. The relation between wage, price and production in fuzzy economy models and the related equilibria concepts are described and discussed.

The fifth, and shortest, chapter deals with the unemployment equilibrium as a specific type of macroeconomic phenomena.

The book is written in a lucid well readable style. Not only the used formalism is relatively simple and compact, as mentioned above, but the whole text is well arranged, divided into short sections and subsections which enable the reader to follow the logical structure of the presented concepts. Considering the complexity and extent of the explained subjects this segmentation of the text appears very useful.

It is assumed that the reader of the book is familiar with both, the elements of fuzzy set theory and the very elements of the deterministic models of game theory and economic equilibria. Other, more advanced, concepts and especially the conjunction of fuzziness and economic theories, are explained and discussed on an appropriate level.

The referred book is a good presentation of the main introductory steps into the mathematical modelling of vague economic structures and their equilibria.

Milan Mareš

HANS J. ZIMMERMAN

Fuzzy Sets, Decision Making and Expert Systems

International Series in Management Science / Operations Research.

Kluwer Academic Publishers, Boston – Dordrecht – Lancaster 1991.

335 + ix pages, bibliography, index, 110 figures. ISBN 0-89838-149-5.

The new printing of this classical book is worth mentioning in spite of the fact that the first edition appeared in 1987 already. It is still actual for anybody who is interested in a wide spectrum of fuzzy approaches to the optimal decision making problems.

The book is divided into seven chapters completed by preface, references (unfortunately not completed by new publications) and index. The first chapter, *Introduction*, contains a brief explanation of the basic concepts of decision making, optimization, and fundamentals of the fuzzy set theory.

The monocriterial decision making models are described in the next chapter, *Individual Decision Making in Fuzzy Environments* dealing with symmetric and nonsymmetric models of decision making and with fuzzy utilities.

The next chapter, *Multi-Person Decision Making in Fuzzy Environments* is focused to the multicriteria decision making situations like fuzzy games, fuzzy team theory, and fuzzy group decision making.

The heading of the fourth chapter, *Fuzzy Mathematical Programming*, sufficiently determines its orientation to fuzzy linear, nonlinear and multi-stage programming.

The multi-criteria modifications of those problems are dealt in the following chapter, *Multi-Criteria Decision Making in Ill-Structured Situations*, with paragraphs subjected to fuzzy multi-criteria programming and outranking, and multi-attribute decision making.

The conceptual background of fuzzy optimization and decision making, like axiomatic, pragmatic and empirical justification, as well as measurement of membership functions or selecting relevant operators is presented in the chapter titled *Operators and Membership Functions in Decision Models*.

The last chapter, *Decision Support Systems*, is oriented to applied methods and results and to the discussion of their properties. Such topics like the comparison of knowledge-based and data-based systems, fuzzy logic including fuzzy reasoning and processing linguistic variables, interactive fuzzy decision support systems and fuzzification of expert systems are presented and explained.

The book summarizes the essential fuzzy theoretical tools and knowledge connected with a wide scale of optimization and decision making problems or contributing to managing such problems in an adequate way. In this sense it is extremely useful for anybody who wants to be familiar with modern methods of applied mathematics based on the fuzzy set theory.

The book is written in a lucid well readable style fully respecting the mathematical exactness as well as good acceptability for mathematically educated specialists from other branches. The ordering of subjects is logical and well structured if the wide extent and variety of the presented subjects is considered.

Milan Mares

SHU-JEN CHEN, CHING-LAI HWANG, FRANK P. HWANG

Fuzzy Multiple Attribute Decision Making. Methods and Applications

Lecture Notes in Economics and Mathematical Systems 375.

Springer-Verlag, Berlin – Heidelberg – New York 1992.

XII + 536 pages. ISBN 3-540-54998-6, Berlin – New York; ISBN 0-387-54998-6, New York – Berlin.

The referred publication represents a detailed manual for good orientation in practical fuzzy multicriteria decision making procedures. The variety of real decision-making problems connected with the vagueness in input data and preference orderings offers a wide range of the application possibilities. Considering the fact that even the deterministic multicriteria decision making theory has developed lots of practical approaches to the solution of its problems, it is quite understandable that the fuzzification of the model offers very rich amount of solution methods and algorithms. Many of them are presented and discussed in this book.

The text is divided into six main chapters, each of them being further partitioned in numerous sections and subsections. After a heuristic Introduction the next chapter presents the basic concepts of multiple attribute decision making, classification of its method and description of 14 of them. The approaches to the multicriteria decision making presented in this part are deterministic not using the fuzzy set theory models.

Those models are presented in the following, also quite brief, chapter. An overview of the fuzzy set and fuzzy numbers theory covers the definition of fuzzy set and set theoretical operation and the elements of arithmetics of fuzzy numbers. A short subsection is devoted also to the concept of *L*-fuzzy sets.

Following two sections represent the main part of the book – three quarters of its extent. One of them concerns the fuzzy ranking methods of different type, based on the degrees of optimality, Hamming distance and eight other types of ranking up to the linguistic approach. The second one of the main chapters deals with the fuzzified forms of particular multicriteria decision making methods. Its eight principal sections are focused to the fuzzy versions of additive weight methods, analytic hierarchical process methods, conjunctive/disjunctive methods, heuristic approach, outranking methods, maximin methods, and methods based on linguistic approach.

The last chapter presents brief remarks and critical comments on mutual connections between fuzziness and multiobjective decision making as well as on some new or marginal approaches and consequences of the presented theory. The book is concluded by a representative and enormously rich (443 items) list of references.

The main advantage of the referred book is in its systematic approach to the versatile topic of the multicriteria decision making in fuzzy environment. All approaches and methods are classified in a synoptical survey with well recognizable inner structure. This schemes enable the reader to keep oriented in the complex topic which is treated in this work. The explanation of all parts is lucid, well readable and the general rules and algorithms are illustrated by many numerical examples.

The referred book can be very useful for everybody who is interested in practical applications of fuzzy multicriteria decision making methods in various branches demanding their specific adequate approaches to the optimality problem.

Milan Mareš

S. BALEMI, P. KOZÁK, R. SMEDINGA, Eds.

Discrete Event Systems: Modeling and Control.

Proceedings of a Joint Workshop held in Prague, August 1992.

Progress in Systems and Control Theory, Volume 13.

Birkhäuser Verlag, Basel – Boston – Berlin 1993.

vii + 232 pages.

The book under review reflects an increasing activity in the field of discrete event systems theory. The book contains 16 papers selected from 39 ones presented at the Joint Workshop on Discrete Systems (WODES'92) held in Prague. In addition of those, two invited survey lectures from five presented ones are published. While the first lecture, given by Prof. K. Inan, has been devoted to supervisory control and formal methods for distributed systems, the area of synchronized continuous flow systems has been covered by Prof. G. J. Olsder in the second lecture.

The material of the book is divided into three chapters. In the first one, different aspects of logical models of discrete event systems are discussed. They include the concept of an augmented language of a specified language, an input/output interpretation of supervisory control theory, and using of trace theory. Further, a minimally restrictive policy for deadlock avoidance, similarity of events, control by means of the Boolean differential calculus, and a unifying framework for control problem formulation and solution are studied as well. The second chapter deals with optimization and it is particularly concerned with a generalized asymptoticity in max algebra, tracking of timing perturbations in discrete event dynamic systems modelled by timed Petri nets, and some extensions to the theory of optimal control. The third chapter contains six of nine papers presented during a special session entitled "The Workshop exercise". In these papers, different solutions to the "cat and mouse" control problem are given to stimulate a comparison among different approaches to discrete event systems. The book is concluded with a selected bibliography of journal papers and books closely related to the modelling and control of discrete event systems.

The published lectures and papers are of high scientific level and the book should be recommended to the specialists interested in both control theory and computer science.

Jiří Pík