

## Book reviews

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ERICH P. KLEMENT, RADKO MESIAR, Eds.

## Logical, Algebraic, Analytic and Probabilistic Aspects of Triangular Norms

Elsevier, Amsterdam 2005.

viii + 480 pages.

ISBN 0-444-51814-2.

The referred volume was edited to document the main ideas presented at the *24th Linz Seminar on Fuzzy Set Theory* held in Linz (Austria) in February 2003. The Linz Seminars are organized regularly since 1979 to intermediate the cooperation of fuzzists mostly from Central Europe and they became inspirative events in their community.

The volume does not record the program of the Seminar in all details. It is rather a survey of selected contributions which appear to be most significant for the profile of the Seminar, and whose original text was extended into more detailed articles.

Since the Zadeh's seminal paper published in 1965, the theory of fuzzy set became the theoretical background of an enormous number of applications of mathematics in essentially new fields of human activity. The need to extend its theoretical tools and to upgrade them on a higher level of generality has motivated the search for new approaches to the processing of fuzzy concepts. The triangular norms, introduced by K. Menger in 1942, proved to be extraordinarily adequate for this purpose, as shown by B. Schweizer and A. Sklar in 1958. The topic of triangular norms was already treated also by *E. P. Klement, R. Mesiar and E. Pap* in their book *Triangular Norms* published in 2000. The development in next years has shown that  $t$ -norms and  $t$ -conorms fulfill both purposes – to be a good theoretical background for new applications and reliable starting point for further abstraction of the processing of fuzzy sets and fuzzy quantities, e. g., aggregated operators or copulas. The referred volume is edited with evident respect to this fact.

The volume contains, after a *Preface*, 16 self-contained paper which are grouped into three clusters.

The first cluster, *Introduction*, contains only two papers whose character is well described by that heading. Both of them deserve to be mentioned explicitly. *B. Schweizer* is the author of a contribution regarding the history of triangular norms and perspectives of triangle functions (let us note that the author did not personally participate in the Seminar but the introduction of his paper gives the other contributions the time-depth). The second introductory paper is a comprehensive survey of the state of art in the theory of triangular norms written by the editors and *Endre Pap*.

Remaining papers form two parts. One of them, named *Theoretical Aspects of Triangular Norms*, includes seven papers on selected aspects of the triangular norms ( $t - n.$ ) theory (namely, Semigroups and  $t - n.$ , Generators of  $t - n.$ , A survey on left-continuous  $t - n.$  and pseudo  $t - n.$ , Some aspects of functional equations,  $T - n.$  on discrete settings,  $T - n.$  and related operators in  $L^*$ -fuzzy set theory, Fitting  $t - n.$  to empirical data). None of these papers is a typical brief conference-contribution. Their extent reaches from 14 to 45 pages with typical value about 30–40, and each of them represents a self-containing chapter dealing the selected topic with respectable care.

Also the last group of papers includes seven items, oriented rather to some aspects of the theory closely connected with applications. Its title is *Applications of Triangular Norms and Related Operators* and it does not include actual “numerical” case-studies or specific fields of applications but those theoretical topics which can be immediately related to some problems of other parts of mathematics (namely:  $T - n.$  based mathematical fuzzy logics, Many-valued equalities and their representations, Varieties of algebras in fuzzy set theory,

$T - n$ . and measures of fuzzy sets, Copulas and quasi-copulas, Transitive comparison of random variables, Triangular norms in probabilistic metric spaces and fixed point theory). Even these papers (rather chapters) can be characterized by the words used for the previous group with the single difference that their typical extent is between 20–30 pages. They represent the self-containing studies of selected problems, as well.

However the edition of the volume was motivated by the content of the Linz Seminar 2003, the result reaches far beyond the typical conference transactions. The editors have composed a book which completes their own monograph on *Triangular Norms* (mentioned above) by selected chapters covering the rapid development of the last years and giving very good information about the state of art of the triangular norms theory in the recent time. This quality makes the volume very attractive for everybody who is interested in the  $t$ -norms in the models of uncertainty.

Milan Mareš

KOFI KISSI DOMPERE

## Cost–Benefit Analysis and the Theory of Fuzzy Decisions

Springer–Verlag, Heidelberg 2004.

xviii + 400 pages.

ISBN 3–540–22154–9.

The fuzzy set theory and fuzzy numbers theory is recently applied in rapidly growing area of economic and human sciences. Namely, the optimization methods and the fuzzy-based decision-making under uncertainty are in the focus of interest. In general, this development is logical and natural. The optimal decisions depend on a wide class of vague input data reaching from the expectations of the uncertain costs to the subjectively estimated benefits, and covering individual preferences and frequently not exactly known mechanism transforming the accepted decisions into real consequences. The referred book contributes to this topic by a relatively detailed analysis of the decision-making based on the vaguely formulated costs and profits. Such topic can be inspirative and fruitful, and its presentation can be supported by well elaborated theory of both – the decision-making models and fuzzy set analysis. The main task of this review is to evaluate how successfully the referred book copes with the challenge of so wide subject.

The text of the book is, after a preface, divided into six chapters. The first one, “*Decision, Cost and Benefit*” presents the introductory information on concepts and methodologies investigated in the rest of the book. This first chapter is mostly heuristic with minimum of mathematics limited rather to symbols than to some statements.

The second chapter “*The Theory of Computable Cost-Benefit Identification Matrices*” introduces the logical structure and significant properties of the concept of identification matrices representing the basic formal tool for the analysis of cost-benefit decision-making. Chapter 3, “*Theory of Social Cost and Costing*” presents the fuzzy-decision theory of social cost in the relation to the theory of computable cost-benefit identification matrices. The next Chapter 4 “*The Theory of Social Benefits and Benefit Accounting*” deals with the second component of the cost-benefit model and its fuzzification, namely the fuzzy decision theory of social benefits and benefit accounting. The cost and benefit accounting is presented as soft computing with subjectivity and vagueness included in the computation.

These three chapters are characterized by heuristic discussions combined with isolated mathematical symbols, a few tables, some identification matrices and several graphical

schemes of the interrelations among the investigated phenomena. Only Chapter 4 includes formal definitions – there are 17 of them – and several statements.

Chapter 5, “*Essential Mathematics for Fuzzy Decision Processes*” aims to summarize the essential mathematics for the fuzzy decision investigation. It is presented in almost sixty definitions combined with some mostly simple statements (most of them are “observations” and “statements” without proofs) and numerous examples with illustrative figures. Finally, Chapter 6, “*The Basic Theory of Fuzzy Decisions*” is devoted to the fundamentals of the fuzzy decision-making being in the background of the main Chapter 3.

It is typical for the referred book that the main theoretical (i. e., mathematical) parts useful for the understanding of the conceptual analysis of the input concepts of cost, benefit and decision are organized after their presentation. The main stress is putted on the fluent and illustrative explanation with necessary symbols and formulas, supported by many examples, figures and numerical data. The unavoidable mathematics includes much more definitions than effective mathematical theorems with not-trivial proofs.

It is to be mentioned that the volume is completed by a well prepared index and very rich list of references (1 277 items) organized into nine groups due to their main subjects.

The previous characteristics means that the referred book will not fully satisfy (at least by my opinion) a theoretically oriented mathematician but it can be very attractive for an economist or sociologist which is able to percept the not very complicated mathematical terminology and formulas, who is used to read graphical representation of relations existing in the cost-benefit decision situations in economics, welfare models and related fields.

*Milan Mareš*

DAMIEN CHALLET, MATTEO MARSILI, YI-CHENG ZHANG

## **Minority Games: interacting agents in financial markets**

Oxford University Press, Oxford 2004.

xvi + 344 pages.

ISBN 0-19-856640-9.

The theory of games offers several classical examples illustrating the main sorts of problems generated by a crash of interests of several independent subjects. It regards, e. g., the prisoners’ dilemma, Blotto game, pursuit or duel game, and some others. The minority games belong to them. They represent situations in which many players dispose with two alternatives to choose one of them. Those who form the minority group are the winners. Such games are played every day on the financial market with alternatives “buy” and “sell”. The authors of the book mention also the applicability of these games (and perhaps other economic models) in physical context but they do not develop this idea. It is obvious that such games have good sense namely if the number of players is large, and that they can hardly be cooperative. Nevertheless, one of the four main chapters deals with the cooperative principle given by the existence and flow of information.

The referred book is devoted to the description and analysis of the model of minority games and their applicability in economic situations. It summarizes the results achieved in this field during its relatively short existence, and shows its perspectives and promising priorities in its further development.

The volume is organized in rather hybrid style. After prefaces it is divided into two different parts completed by appendices. The first part is oriented to the theoretical framework of the minority games. It is formed by five chapters. The "Introduction" includes brief and consequently heuristic presentation of the background of the topic, and "Early Works" summarizes the historical roots of the problem. Also this chapter is almost exclusively a verbal presentation of the model. The next chapter, "Understanding the Minority Game Dynamics" is mostly devoted to the methods of computer simulation of minority game and to the experience following from it. This topic is treated as a path to the understanding the analytical solution. The fourth chapter "Minority Games and Market Models" deals with the relationship between the general model of minority game and market models including both directions of dependence between game and market, and some related notes. Also this chapter contains mostly the heuristic explanation completed by several formulas and diagrams. Finally, the last chapter of the first part, "Quest for Better Cooperation", is devoted to the eventual possibilities of cooperative approach to the minority games and their reflections in financial markets, which means a potential extension of the model.

The second part of the volume includes the reprints of 27 papers related to the topics dealt in the previous chapters. Some of them are written by the authors of the volume. They include and explain the formal tools and results being more or less heuristically presented in the first part.

These two parts are completed by two appendices. One of them offers only the exact citations of the papers forming the second part. The second Appendix, "Source Code" is added to the volume to explain how to carry out numerical simulations, and to give commented source code in the C programming language. The book contains also a representative "Bibliography" (143 items), and the "Index".

The organization of the book is rational, and it makes the volume attractive especially for those readers who do not insist in the detailed knowledge of the mathematical background of the model and, instead of it, prefer good and easily understandable explanation of the methodological approach to the model. Surely, some mathematical tools cannot be avoided but they are of the type which would not disturb any reader educated in modern economic literature. Moreover, each of the explanatory chapters is as independent of the others as possible. It enables their separate reading (or re-reading) without significant loss of understanding.

As follows from the above paragraphs, the book is oriented on (and useful for) the readers who are interested in a specific game-theoretical model related to a significant field of the analysis of financial markets and their behaviour.

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