Book Review of

Fuzzy Sets, Fuzzy Logic, Applications

by George Bojadziev and Maria Bojadziev

World Scientific, Singapore, 1995, 283 pages

This book aims to be a simple introduction to fuzzy logic. Its originality lies in the attempt to introduce fuzzy sets from the particular case of intervals and fuzzy numbers rather than the usual approach based on set theory. So the first hundred pages deal with interval and fuzzy arithmetics, basically the four elementary operations. Chapters 5 and 6 deal with classical set theory and fuzzy set theory, respectively. Chapter 7 hints on the calculus of fuzzy relations. Chapter 8 stresses the logical under-pinnings of fuzzy set theory, so as to give a concrete meaning to the name "fuzzy logic" in Chapter 9. Chapter 10 illustrates fuzzy arithmetics on the merging of expert opinions and budgeting problems. Chapter 11 is an elementary introduction to fuzzy control.

The main feature of this book is its concern in being very simple. It restricts to very basic definitions, provides a lot of examples, a lot of figures, a lot of small exercises, and a small set of historic notes attached to each chapter. The book is in the tradiction of Kaufmann's early treatise, and of Gupta and Kaufmann book on fuzzy arithmetics, to which it borrows significantly.

This book is so simple that it should not really be recommended to graduate students. Indeed the concern for simplicity leads the authors into debatable choices of topics, and unfortunate oversights. For instance restricting interval arithmetics to the four operations may lead readers to take fuzzy arithmetic for granted when computing polynomial functions, while it is well-known by specialists that, in general, if a quantity appears several times in a mathematical expression, the imprecision of this quantity will sometimes be counted several times if elementary operations on intervals are applied. The evaluation of distances between fuzzy numbers is too briefly addressed and the problem of ranking fuzzy numbers totally omitted (while it may be useful for the budgeting example of Chapter 10).

The chapter on fuzzy sets suggests only two of the three elementary fuzzy intersections (resp.: unions), and it is not clear why the linear connectives do not appear. Similarly, the extension principle is stated for functions of a single argument, and is never related to the (lengthy) part on fuzzy arithmetic. Possibility theory is not even mentioned in the book (while it also justifies fuzzy arithmetic, and would be useful in the budgeting example again).

The coverage of the chapter on fuzzy relations is not extensive either: nothing about fuzzy similarity and orderings introduced by Zadeh in 1971, while the 1971 paper by Zadeh is cited as founding fuzzy relation calculus. On the other hand the min-max composition of fuzzy relation is offered as an alternative to the max-min one, but it is not really explained why it makes sense. The material on multiple-valued logics is also very poor and gives the misleading impression that the 3-valued truth-tables on pages 171-172 are unique. Moreover the text on multiple-valued logic falls in the classical trap of misinterpreting the third truth-value (1/2) as expressing uncertainty about truth (instead of half-true). The analysis of the generalized modus ponens made in Chapter 9 can be judged rather shallow since only a comparison is made between Lukasiewicz implication and Mamdani's min-based implication under a combination-projection principle based on the minimum triangular norm. While this comparison may be enough to give the reader a feeling of what is fuzzy set-based reasoning, it is rather dangerous to draw general conclusions on the behavior of these particular implications. Extensive works by, for instance, Trillas and colleagues, among others, have been done on the analysis of fuzzy implications and are not cited in the book.

Despite these reservations, this is a reasonable introductory book for undergraduate beginners who will have opportunity to approach fuzzy set theory via elementary calculations, before getting deeper in the subject matter in more extensive and detailed treatises such as Klir and Yuan's (1995).

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Reference

G.J. Klir and Bo Yuan "Fuzzy Sets and Fuzzy Logic – Theory and Applications", Prentice Hall, Upper Saddle River, New Jersey, 1995.