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**Baczyński, Michał; Jayaram, Balasubramaniam****Fuzzy implications.** (English)

Studies in Fuzziness and Soft Computing 231. Berlin: Springer. xviii, 310 p. EUR 129.95/net; SFR 216.00; \$ 169.00; £ 98.00 (2008).

The most elaborated constituent of the structure of truth values in fuzzy logic are “fuzzy conjunctions” which are interpreted in  $[0, 1]$  by triangular norms. Based on them, distinct rich algebraic structures have been proposed to serve as structures of the truth values. The book of Michał Baczyński and Balasubramaniam Jayaram is, by the best knowledge of the reviewer, the very first book in this area which adopts a bit different approach based on the investigation of “fuzzy implications”.

The book starts with a brief but fully sufficient chapter devoted to the state of art in fuzzy implications. Then it continues with Part I consisting of four chapters dealing with the analytical part of investigations of the fuzzy implications. Introduction to all basic families of fuzzy implications, such as (S,N)-Implications, S-Implications, R-Implications and QL-Implications is provided together with all main as well as the latest results. Self contained chapters are devoted also to fuzzy implications based on uninorms and fuzzy implications constructed by generator functions. Chapter 4 provides readers with an exhaustive study of intersections between families of fuzzy implications.

Part II of the book, consisting of two chapters, concerns the algebraic study of fuzzy implications. The first chapter in this book provides readers with an interesting walk through the lattice of fuzzy implications, its sublattices, convex classes as well as conjugacy classes and semigroups of fuzzy implications. Chapter 7 investigates fuzzy implications and their role in some functional equations. From the point of view of possible applications and usage, this is perhaps the most useful theoretical chapter of the book. It provides readers with a study of contrapositive symmetrization, distributivity T-conditionality and other functional properties of fuzzy implications such as the law of importation. These equations are studied using distinct families of fuzzy implications introduced in the previous chapters.

Finally, Part III, consisting of the only one chapter, deals with application impact of the theoretical results, e.g. Chapter 7 and its conclusions are used here. The last part focuses on applications related to the approximate reasoning as perhaps the most important area of fuzzy logic applications at all. It introduces fundamental elements of fuzzy rule modeling and fuzzy inference schemes and recall main problems to be studied such as interpolativity, generalized modus ponens properties or computational efficiency of inference schemes. Due to the importation law studied in the previous chapter, the authors are able to introduce a hierarchical version of the CRI scheme which dramatically lowers computational efforts without any impact on the deduced output of a fuzzy inference mechanism. Many other approaches are recalled or introduced including a lossless rule reduction algorithm.

The book is well written and full of novel results and/or using references to the latest publications. Such a book introducing not only theoretical but also applicational aspects

of fuzzy implications, which are unfortunately very often neglected by a certain subpart of the community of practitioners, was highly desirable among the fuzzy community.

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fuzzy sets; residuated lattice; triangular norm; computational rule of inference;  
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