BOOK REVIEWS

FUZZY MODELING FOR CONTROL by Robert Babuška. Kluwer, Boston/Dordrecht/London, 1998, XVIII + 260 pages, ISBN 0-7923-8154-8.

FUZZY CONTROL OF INDUSTRIAL SYSTEMS: Theory and Applications by Ian S. Shaw. Kluwer, Boston/Dordrecht/London, 1998, XVIII + 192 pages, ISBN 0-7923-8249-8.

TRAFFIC CONTROL AND TRANSPORT PLANNING: Fuzzy Sets and Neural Networks Approach by Dušan Teodorovic and Katarina Vukadinovic. Kluwer, Boston/Dordrecht/London, 1998, XVIII + 387 pages, ISBN 0-7923-8380-X.

The utility of fuzzy set theory and fuzzy logic to deal with surprisingly broad spectrum of problems in engineering, business, science, and other areas of human affairs has been demonstrated since the late 1980s. At this time, the most developed applications of fuzzy set theory and fuzzy logic are in engineering, and the most visible of them is fuzzy control.

During the last decade or so, Kluwer published extensively in the area of fuzzy set theory and fuzzy logic, covering both theory and applications. The three books chosen here, all published by Kluwer, are respectable recent contributions to the rapidly growing literature on fuzzy control. They are ordered according to their degree of generality.

Fuzzy Modeling for Control is the most general of the three books. Its focus is on developing a comprehensive methodology by which fuzzy rule-based models can be automatically generated from data. The methodology employs techniques of fuzzy clustering to partition given data into subsets that are characterized by locally linear behaviors,
from which the overall fuzzy model is constructed. Although fuzzy models are considered in the book primarily for their use in nonlinear control, they have a broader utility (e.g., as powerful predictive models in science). Two approaches to control design are developed in the book and illustrated by several applications: internal model control with an inverted fuzzy model and a predictive control based on a fuzzy model. Throughout the book, attention is paid to the proper balance between accuracy and transparency of the constructed models. This feature distinguishes the book from other books on fuzzy control. It is based on an attitude expressed well in Preface by the author:

Recently, a great deal of research activity has focused on the development of methods to build or update fuzzy models from numerical data. Most approaches are based on neuro-fuzzy systems, which exploit the functional similarity between fuzzy reasoning systems and neural networks. This "marriage" of fuzzy systems and neural networks enables a more effective use of optimization techniques for building fuzzy systems, especially with regards to their approximation accuracy. However, the aspects related to the transparency and interpretation tend to receive considerably less attention. Consequently, most neuro-fuzzy models can be regarded as black-box models which provide little insight to help understand the underlying process.

The approach adopted in this book aims at the development of transparent rule-based fuzzy models which can accurately predict the quantities of interest, and at the same time provide insight into the system that generated the data.

*Fuzzy Control of Industrial Systems* is intended to serve as an introductory textbook on fuzzy control for undergraduate students as well as for practitioners in control engineering to upgrade their knowledge. In general, it is written in a textbook style except that it does not contain exercises. Some knowledge of classical control is assumed, but relevant fundamentals of fuzzy set theory are introduced. The book has a practical orientation and provides the reader with a good overview of successful applications of fuzzy controllers. It should be of interest to anyone who is familiar with classical control and wants to learn in an efficient way about the nature, capabilities, and design of fuzzy controllers.

As the name indicates, *Traffic Control and Transport Planning* is the most specialized of the three books. It is a book of considerable significance since it is the first one fully devoted to the use of fuzzy set theory and fuzzy logic in transportation. Except for about 70 pages introduction to basic concepts of fuzzy set theory, the book describes (on more than 300 pages) a fascinating menu of applications of fuzzy
set theory and neuro-fuzzy techniques in transportation. It is an important resource for anyone interested in transportation.

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ABSTRACTS

FUZZY LOGIC IN DATA MODELING: Semantics, Constraints, and Database Design by Guoquing Chen. Kluwer, Boston/Dordrecht/London, 1998, X + 224 pages. ISBN 0-7923-8253-6.

The book addresses fundamental and important issues of fuzzy data modeling, such as fuzzy data representation, fuzzy integrity constraints, fuzzy conceptual modeling, and fuzzy database design. The purpose of introducing fuzzy logic in data modeling is to enhance the classical models such that uncertain and imprecise information can be represented and manipulated. Fuzzy data representation reflects how, where and to what extent fuzziness is incorporated into classical models. Fuzzy integrity constraints are a sort of fuzziness-involved business rules and semantic restrictions that need to be specified and enforced. Fuzzy conceptual modeling describes and treats high-level data concepts and related semantics in a fuzzy context, allowing the model to tolerate impression at different degrees. Fuzzy databases design provides guidelines for how relation schemes of fuzzy database should be formed, and develops remedies to possible problems of data redundancy and update anomalies. The book is intended to be used as a text for a graduate level course on fuzzy database, or as a reference for researchers and practitioners in industry.

FUZZY ALGORITHMS FOR CONTROL edited by H.B. Verbruggen, H.-J. Zimmermann and R. Babuška. Kluwer, Boston/Dordrecht/London, 1999, XIII + 352 pages. ISBN 0-7923-8461-X.

The book gives an overview of the research results of a number of European research groups that are active and play a leading role in the
field of fuzzy modeling and control. It contains 12 Chapters divided into three parts.

Chapters in the first part address the position of fuzzy systems in control engineering and in the AI community. State-of-the-art surveys on fuzzy modeling and control are presented along with a critical assessment on the role of these methodologies in control engineering.

The second part is concerned with several analysis and design issues in fuzzy control systems. The analytical issues addressed include the algebraic representation of fuzzy models of different types, their approximation properties, and stability analysis of fuzzy control systems. Several design aspects are addressed, including performance specification for control systems in a fuzzy decision-making framework and complexity reduction in multivariable fuzzy systems.

In the third part of the book, a number of applications of fuzzy control are presented. It is shown that fuzzy control in combination with other techniques such as fuzzy data analysis is an effective approach to the control systems. One has to cope with problems such as process nonlinearity, time-varying characteristics or incomplete process knowledge. Examples of real-world industrial applications presented in this book are a blast-furnace, a lime kiln and a solar-plant. Other examples of challenging problems in which fuzzy logic plays an important role and which are included in this book are mobile robotics and aircraft control.

The aim of the book is to address both theoretical and practical subjects in a balanced way. Hence, it should be useful for readers from the academic world and also from industry who want to apply fuzzy control in practice.

FOUNDATIONS OF DATABASES AND KNOWLEDGE SYSTEMS by Gred Wagner. Kluwer, Boston/Dordrecht/London, 1998, XXIV + 296 pages. ISBN 0-7923-8212-9.

The book covers both basic and advanced topics. It may be used as the textbook of a course offering a broad introduction to databases and knowledge bases, or it may be used as an additional textbook in a course on databases or Artificial Intelligence. Professionals and
researches interested in learning about new developments will benefit from the encyclopedic character of the book providing organized access to many advanced concepts in the theory of databases and knowledge bases.