BOOK REVIEWS AND ABSTRACTS

BOOK REVIEWS

PROBABILISTIC ANALYSIS OF BELIEF FUNCTIONS, by Ivan Kramosil. Kluwer Academic/Plenum Publishers, New York, 2001, xvii + 214 pages, ISBN 0-306-46702-X.

Belief functions constitute part of a mathematical structure for the representation of uncertainty that is typically referred to as evidence theory or Dempster–Shafer theory. This theory developed from work by Dempster (1967a, b, 1968) and Shafer (1976) related to the representation and manipulation of uncertainty in contexts that do not provide enough information for a complete probabilistic representation of uncertainty.

A probability space $(\mathcal{P}, \mathcal{P}, m_{\mathcal{P}})$ constitutes the formal mathematical structure used in a probabilistic representation of uncertainty, where (i) $\mathcal{P}$ is the set of everything that could occur in the particular universe under consideration, (ii) $\mathcal{P}$ is a suitably restricted set of subsets of $\mathcal{P}$ (i.e., a $\sigma$-algebra) to which probabilities are assigned and (iii) $m_{\mathcal{P}}$ is the function that assigns probabilities to elements of $\mathcal{P}$ [Feller, 1971, Sect. IV.3]. In the usual terminology of probability theory, $\mathcal{P}$ is called the sample space or universal set; elements of $\mathcal{P}$ are called elementary events; subsets of $\mathcal{P}$ contained in $\mathcal{P}$ are called events; and $m_{\mathcal{P}}$ is called a probability measure. Similarly, an evidence space $(\mathcal{E}, \mathcal{E}, m_{\mathcal{E}})$ constitutes the formal mathematical structure used in an evidence theory representation of uncertainty, where (i) $\mathcal{E}$ is the set of everything that could occur in the particular universe under consideration, (ii) $\mathcal{E}$ is a countable collection of subsets of $\mathcal{E}$ and (iii) $m_{\mathcal{E}}$ is a function defined on subsets of $\mathcal{E}$ such that

$$m_{\mathcal{E}}(\mathcal{U}) > 0 \quad \text{if} \quad \mathcal{U} \in \mathcal{E}$$

$$= 0 \quad \text{if} \quad \mathcal{U} \subseteq \mathcal{E} \quad \text{and} \quad \mathcal{U} \notin \mathcal{E}$$

and

$$\sum_{\mathcal{U} \in \mathcal{E}} m_{\mathcal{E}}(\mathcal{U}) = 1. \quad (2)$$

In the terminology of evidence theory, $\mathcal{E}$ is the sample space or universal set; the elements of $\mathcal{E}$ are elementary events; the elements of $\mathcal{E}$ are focal elements; and $m_{\mathcal{E}}(\mathcal{U})$ is the basic probability assignment (BPA) associated with a subset $\mathcal{U}$ of $\mathcal{E}$.

The sets $\mathcal{P}$ and $\mathcal{E}$ play the same role in probability theory and evidence theory. However, $\mathcal{P}$ and $m_{\mathcal{P}}$ in probability theory and $\mathcal{E}$ and $m_{\mathcal{E}}$ in evidence theory play different roles.
In probability theory, there is only one representation of uncertainty: a probability \( m_P(U) \) for each element \( U \) of \( P \). In contrast, evidence theory involves two representations for uncertainty that derive from \( E \) and \( m_E \): a belief \( \text{Bel}(\mathcal{U}) \) and a plausibility \( \text{Pl}(\mathcal{U}) \) for each subset \( \mathcal{U} \) of \( \mathcal{E} \). In particular,

\[
\text{Bel}(\mathcal{U}) = \sum_{\mathcal{V} \subset \mathcal{U}} m_E(\mathcal{V})
\]

and

\[
\text{Pl}(\mathcal{U}) = \sum_{\mathcal{V} \supset \mathcal{U} \neq \phi} m_E(\mathcal{V})
\]

for each subset \( \mathcal{U} \) of \( \mathcal{E} \). Although evidence theory representations for uncertainty usually start with BPAs and then construct beliefs and plausibilities as indicated above, it is possible to start with any of the three (i.e. BPAs, beliefs or plausibilities) and then construct the other two.

At an intuitive level, \( \text{Bel}(\mathcal{U}) \) provides a measure of the amount of credibility that must be assigned to \( \mathcal{U} \), and \( \text{Pl}(\mathcal{U}) \) provides a measure of the amount of credibility that could be assigned to \( \mathcal{U} \). In other terms, \( \text{Bel}(\mathcal{U}) \) is the greatest lower bound on the amount of credibility that must be assigned to \( \mathcal{U} \) on the basis of all available information, and \( \text{Pl}(\mathcal{U}) \) is the least upper bound on the amount of credibility that could possibly be assigned to \( \mathcal{U} \) on the basis of all available information. Under one interpretation of the development of an evidence theory representation of uncertainty, \( \text{Bel}(\mathcal{U}) \) is the smallest possible probability for \( \mathcal{U} \) that is consistent with all available information, and \( \text{Pl}(\mathcal{U}) \) is the largest possible probability for \( \mathcal{U} \) that is consistent with all available information. Under another possible interpretation, evidence theory provides an internally consistent structure for the representation of uncertainty with no relationship to probability theory. Additional information on evidence theory is available in a number of publications; for example, Wasserman (1988, 1990), Guan and Bell (1991), Halpern and Fagin (1992), Yager et al. (1994) and Klir and Wierman (1999).

As indicated by the title, the book under review takes the belief function rather than the BPA as the fundamental quantity in the development of an evidence theory representation of uncertainty. This development is based on estimating the beliefs in possible internal states of a system from information that could potentially be observed about the system and the probabilities that this observed information is consistent with possible states of the system. More details are given below.

A system SYST is assumed to be under study. This system is in one of a large number of possible states \( s \), where

\[
\mathcal{S} = \{ s : s \text{ is a possible state of SYST} \}
\]

represents the set of all possible internal states for SYST. It is desired to determine the actual internal state \( s_o \) of SYST. However, \( s_o \) cannot be directly observed; rather, all that is available is an observation \( e \) of system properties that ultimately derives from \( s_o \). For convenience,

\[
\mathcal{E} = \{ e : e \text{ is a possible observation of system properties} \}
\]

represents the set of all possible observations of system properties. The approach developed in the book is to develop beliefs for subsets of \( \mathcal{S} \) on the basis of potential values for \( e \) and additional information possessed by an analyst.
At the core of the presented development of belief functions is a probability space $(\mathcal{W}, \mathcal{W}, m_W)$ that captures all knowledge about the complete properties of the world within which the system SYST operates. Specifically,

$$\mathcal{W} = \{ w : w \text{ a possible complete set of properties defining the world within which SYST operates} \}. \quad (7)$$

The book uses slightly different notation; specifically, $(\mathcal{W}, \mathcal{W}, m_W)$ is symbolically represented by a probability space $(\Omega, \mathcal{A}, \mathcal{P})$ with $\omega$ used to represent elements of $\Omega$ (i.e. $\mathcal{W} = \Omega$, $\mathcal{W} = \mathcal{A}$, $m_W = \mathcal{P}$, $w = \omega$), and $\mathcal{P}$ and $\mathcal{A}$ are represented by $\mathcal{E}$ and $\mathcal{X}$ respectively. The following intuitive description of this probability space is provided (p. 24):

...we shall suppose that there is a universal parameter $\omega$, taking its values in a nonempty space $\Omega$ such that all the values concerning SYST and its environment, including the actual internal state $s_0 \in \mathcal{S}$ of this system and the empirical value $e \in \mathcal{E}$, are determined by the actual value $\omega \in \Omega$. This value can be understood as whole of the history of Universe since the Big Bang, or as a complete description of positions and movements of all the bodies (all the mass particles, more precisely) in the Universe. Such an interpretation agrees with the idea that having at her/his disposal such an exhaustive description of Universe, the subject would be able to predict, without any risk of failure, all the future phenomena in the Universe in all their details, and it is just the lack of such an exhaustive information which brings uncertainty into our prediction and decision-making process.

Thus, the probability space $(\mathcal{W}, \mathcal{W}, m_W)$ can be viewed as providing a probabilistic representation of epistemic uncertainty with respect to the complete state of the world.

A mapping $X$ (i.e. a random variable, if you like that terminology) from $\mathcal{W}$ to $\mathcal{E}$ is assumed to be known. Specifically,

$$X(w) = e$$

(8)

gives the value $e$ of experimental (i.e. observational) results with respect to SYST that would be observed if $w$ did indeed correspond to the true state of the world. Further, a function $\rho$ defined on $\mathcal{S} \times \mathcal{E}$ is also assumed to be known, where

$$\rho(s, e) = \begin{cases} 1 & \text{if } s \text{ is compatible with } e \\ 0 & \text{otherwise} \end{cases} \quad (9)$$

for $(s, e) \in \mathcal{S} \times \mathcal{E}$. In the preceding, the statement that $s$ is compatible with $e$ means that, if SYST is in state $s$, then it is possible that the experimental results represented by $e$ could have been observed for SYST. Introduction of $X$ and $\rho$ makes it possible to identify all elements of $\mathcal{S}$ that are compatible with a given element of $\mathcal{W}$. Specifically,

$$\mathcal{U}_\rho[X(w)] = \{ s : s \in \mathcal{S} \text{ and } \rho(s, X(w)) = 1 \} \quad (10)$$

constitutes the set of all elements of $\mathcal{S}$ that are compatible with the element $w$ of $\mathcal{W}$.

Beliefs for subsets of $\mathcal{S}$ are now defined in terms of probabilities of subsets of $\mathcal{W}$ that yield observational results that are consistent with these subsets. Specifically, two beliefs are defined for a subset $\mathcal{A}$ of $\mathcal{S}$:

$$\text{Bel}_\rho^*(\mathcal{A}) = m_W \left( \{ w : w \in \mathcal{W} \text{ and } \phi \in \mathcal{U}_\rho[X(w)] \subset \mathcal{A} \} \right) \quad (11)$$

and

$$\text{Bel}_\rho(\mathcal{A}) = m_W \left( \{ w : w \in \mathcal{W} \text{ and } \mathcal{U}_\rho[X(w)] \subset \mathcal{A} \} \mid \{ w : w \in \mathcal{W} \text{ and } \phi \notin \mathcal{U}_\rho[X(w)] \} \right)$$

$$= \frac{m_W \left( \{ w : w \in \mathcal{W} \text{ and } \phi \notin \mathcal{U}_\rho[X(w)] \subset \mathcal{A} \} \right)}{m_W \left( \{ w : w \in \mathcal{W} \text{ and } \phi \notin \mathcal{U}_\rho[X(w)] \} \right)} \quad (12)$$

The quantities $\text{Bel}_p(\mathcal{A})$ and $\text{Bel}_m(\mathcal{A})$ are referred to as non-normalized and normalized belief, respectively, for $\mathcal{A}$. As is apparent from the preceding definitions, values for $\text{Bel}_p(\mathcal{A})$ and $\text{Bel}_m(\mathcal{A})$ derive from the probability space $(\mathcal{W}, \mathcal{W}, m_W)$ and the two mappings $X$ and $\rho$. Corresponding developments for plausibilities and BPAs are presented.

The focus of the book is a very formal development of evidence theory based on the ideas just indicated in conjunction with the definitions of $\text{Bel}_p(\mathcal{A})$ and $\text{Bel}_m(\mathcal{A})$. After presentation of introductory material (Chapter 1), the following topics are considered: preliminaries on axiomatic probability theory (Chapter 2), probability model of decision making under uncertainty (Chapter 3), basic elements of Dempster–Shafer (i.e. evidence) theory (Chapter 4), elementary properties of belief functions (Chapter 5), probabilistic analysis of Dempster combination rule (Chapter 6), non-specificity degrees of basic probability assignments (Chapter 7), belief functions induced by partial compatibility relations (Chapter 8), belief functions over infinite state spaces (Chapter 9), Boolean combinations of set-valued random variables (Chapter 10), belief functions with signed and non-standard values (Chapter 11), Jordan decomposition of signed belief functions (Chapter 12), Monte Carlo estimations for belief functions (Chapter 13), and Boolean-values and Boolean-like processed belief functions (Chapter 14).

The development of the presented topics is very mathematical and oriented towards a sophisticated reader. Much of the development depends on extensive set theoretic and measure theoretic concepts and manipulations. A reader who is not comfortable with measure theory at the level of Halmos’ classic text (1974) will have a difficult time reading and understanding this book.

The development of evidence spaces is an important topic and clearly a necessary prerequisite to the use of evidence theory in the representation of uncertainty and in the performance of decision-aiding analyses (Dubois and Prade, 1992; Sentz and Ferson, 2002; Ferson et al., 2003). The book presents an interesting approach to the development of such spaces that is based on the properties of a probability space, i.e. $(\mathcal{W}, \mathcal{W}, m_W)$, characterizing epistemic uncertainty with respect to the nature of the world that contains the system under study. As already indicated, this development is predicated on the existence of the probability space $(\mathcal{W}, \mathcal{W}, m_W)$ and the two mappings $X$ and $\rho$.

This book is very thorough in the mathematical development of the presented approach to evidence theory. The weakness in the book is that no meaningful motivation or illustration is provided for the approach. In particular, meaningful examples of $(\mathcal{W}, \mathcal{W}, m_W)$, $X$ and $\rho$ and also of the associated sets $\mathcal{F}$ and $\mathcal{B}$ are needed. Such examples should include both definitions of $(\mathcal{W}, \mathcal{W}, m_W)$, $X$ and $\rho$ and illustrations of calculations carried with these entities. Without good examples, it is very difficult for the reader to recognize what the formal mathematical structure is intended to represent and also to identify contexts in which this structure can be productively employed. Similarly, although Monte Carlo analysis is inherently a numerical procedure used to solve real problems, the chapter on Monte Carlo analysis (Chapter 13) is completely lacking in any numerical examples. It would be very beneficial if the author would prepare a presentation that made a connection between the theoretical development in this book and real problems that either motivate this development or can be effectively solved within the mathematical structure associated with this development.
The book would have benefited from more editorial care from the publisher. In particular, some of the word choices and sentence structures are strange. This is not a criticism of the author. Rather, more editorial attention in this area from the publisher would have improved the readability of the book. However, the intended content of the text is always understandable.

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*Address: Department 6849, MS 0779, Sandia National Laboratories, Albuquerque, NM 87185-0779, USA. Tel.: +1-505-284-4808. Fax: +1-505-844-2348. E-mail: jchelto@sandia.gov*

**FIVE CORE METRICS: THE INTELLIGENCE BEHIND SUCCESSFUL SOFTWARE MANAGEMENT**, by Lawrence Putnam and Ware Myers. Dorset House Publishing, New York 2003, xiv + 310 pages, ISBN 0-932633-55-2.

This is an excellent book for anyone interested in successful software project management written by two leading authorities in the field. Managing a software engineering project is a complex and difficult task. Most project failures can be traced back to inadequate management. Putnam and Myers advocate the use of five simple project metrics across all phases of a project from inception through delivery to predict, monitor and control the software project. They also recommend consistent use of these
metrics for all projects to improve an organization’s capability and process productivity over time.

A successful software project is one that is delivered on time, within budget, does what it is supposed to do and with minimal or no defects. The developer uses a set of tools, group of people, and development methodology with a certain efficiency to create the final product for the customer. Putnam and Myers identify the five core metrics as: time (duration of project), effort (people months of project), size (lines of code or function points), reliability (defects) and process productivity (efficiency) of the developing organization. None of the core metrics are linearly related to the others. The text focuses on the relationship of these five variables and how they can be used successfully to manage software projects. Originally developed by Putnam in 1977, the equation relating these variables is known as the software equation. Its constants, coefficients and exponents are mathematically derived from a database of over 6300 projects.

The book consists of 22 chapters divided into four parts. Part 1 contains four chapters, which set the stage and show the need for software metrics throughout the project for both customer and developer who desire predictability. The four chapters in Part 2 are used to define and show the relationships between the five core metrics. In addition, the software equation is given and explained in detail in this section. The authors suggest calibration of process productivity within each organization for best results. Unfortunately, most organizations do not have enough, if any, software project data from similar development projects to calibrate their process productivity. Noticeably missing from this section is adequate discussion of two common software prediction models for software sizing (Albrecht’s function points) and effort (Boehm’s constructive cost model) that would have made a more comprehensive treatment of these metrics. Putnam and Myers include an interesting discussion of reliability and how it can be controlled using the software equation by adjusting system size, schedule time, and allocation of effort. Part 3 contains seven chapters and describes how the five core metrics can be used in a practical way over phases of a software project. The authors show how, based on project needs, time and effort can be traded off. Their treatment of uncertainties in the bidding process is admirable. They show how uncertainty in software size and process productivity estimates produces a range of estimates for effort and time, and then suggest Monte Carlo simulation to arrive at a final bid price. Part 4 focuses on using the five core metrics at the organizational level. This section gives suggestions for managing a portfolio of projects, managing reusable components, and improving the software development process in an organization. The chapter on using software metrics to support negotiations is insightful and can be used by both customer and developer.

The book is a superb source of information on the use of metrics to manage software projects. With their many years of experience, knowledge and wisdom, the authors have created a very readable text that unifies software project management with five simple core metrics. I recommend this text for practitioners, researchers and students interested in software project management.

Jack Ryder
Kean University,
Union, New Jersey
THE BIG BOOK OF CONCEPTS, by Gregory L. Murphy. A Bradford Book, The MIT Press, 2002, 555 pages, ISBN 0-262-13409-8.

The notion of a concept is one which is discussed in many related but diverse fields like philosophy, psychology, logic, artificial intelligence, data analysis, etc. In all of these fields, research on concepts flourished during the past two decades or so. Perhaps the most directly related to the everyday use of concepts by humans is the investigation of concepts as done in psychology and cognitive science. The present book presents an excellent overview of various theories and aspects of concepts as being developed in the psychological investigations.

For me, a computer scientist and mathematician, who is nevertheless interested in psychological theories of concepts (mainly because of inspiration for data analysis), the book is unique in several aspects. First, the book is organized by topics and problem areas discussed in psychological literature on concepts, not by particular theories of concepts. Each topic is thoroughly explained, including examples. After this, particular theories are examined with respect to what they can and what they can not explain. This plus the lucid manner of writing make the book very informative. Second, the topic-oriented presentation is preceded by two chapters introducing and clearly explaining the main psychological theories of concepts. Third, the book contains a long list of references (26 pages), which are used in the text quite specifically. This enables the reader to go, when desired, into detail in a very comfortable way.

As to the organization, the book consists of 13 chapters, notes to chapters, references, name index and a subject index. Chapter 1 is an introduction mainly presenting the aims of the book. Chapter 2 deals with the so-called classical view of concepts and some of its revisions. Chapter 3 presents main current theories of concepts (prototype view, exemplar view, knowledge approach). Chapter 4 focuses on exemplar effects of concepts. Various aspects of concept learning are discussed in Chapter 5. Chapter 6 deals with so-called knowledge effects, e.g. the problem of background knowledge in concept learning. Chapter 7 is devoted to problems connected to taxonomies of concepts (hierarchical structure of categories, so-called basic level of categorization and its subordinated and superordinate levels). Induction and concepts are presented in Chapter 8. Chapter 9 deals with children’s concepts. A post-infant conceptual development is discussed in Chapter 10. Chapter 11 focuses on the relationship between concepts and words. The interesting issue of conceptual combination (i.e. how more complex concepts are formed out of simpler ones) is the content of Chapter 12. Chapter 13 (Anti-Summary and Conclusions) surveys some related problems which have not been discussed (therefore anti-summary) previously or have not been discussed in sufficient detail, and presents some conclusions about the topics discussed in the book.

Without hesitation, this is the best book on concepts I have ever read. This can be used as an introductory book as well as a kind of handbook which goes to sufficient depth. The greatest feature I can see is that due to the excellent way of presentation “The Big Book of Concepts” can be read by anyone interested in the fascinating realm of concepts. I believe that, in addition to psychologists, people interested in machine learning and data analysis will greatly benefit from reading the book.

Radim Belohlávek
Palacký University, Olomouc, Czech Republic
radim.belohlavek@upol.cz
INTRODUCTION TO PROBABILITY AND STATISTICS: Principles and Applications for Engineering and the Computing Sciences, Fourth Edition, by J. Susan Milton and Jesse C. Arnold, McGraw-Hill, New York, 2003, xviii +798 pages, ISBN 0-07-246836-X.

The present book is a fourth edition of a textbook in probability and statistics for students of engineering and computing sciences. The book covers a wide range of materials from probability and statistics. What makes the book distinct is that, first, except for topics which are generally covered by textbooks, it also covers topics used especially in engineering, computer engineering and computer science. Second, the book contains carefully selected exercises from engineering and computer science. These let the student directly see from the beginning why probability and statistics are important in his/her field. Moreover, the exercises show typical applications of probability and statistics in engineering and computer science.

The book consists of 16 chapters, a list of references, three appendices and an index. At the close of each chapter there is a chapter summary, a list of exercises and review exercises.

Chapters 1 and 2 contain basics on counting principles (permutations, combinations) and probability (axioms, interpretations, fundamental notions like conditional probability, independence, Bayes’ theorem). Chapters 3 and 4 deal with basic discrete and continuous probability distributions and their characteristics and relationships. Joint distributions, independence, covariance, correlation, regression and related topics are discussed in Chapter 5. Chapter 6 introduces fundamental notions of descriptive statistics like random sampling, sample statistics, histograms, boxplots, etc. Chapters 8 and 9 deal with estimations of a mean, a variance, a proportion (of members of a population with a given property) and a difference of two proportions. Comparison of means of two populations and variances of two populations is the subject of Chapter 10. Chapter 11 presents basics of simple linear regression and correlation (linear regression model, least-squares estimation of parameters, properties of least-squares, confidence interval, residual analysis, correlation). Chapter 12 is devoted to multiple linear regression with focus on the polynomial model (the single predictor variable can appear in power greater than 1) and the multiple linear regression model (linear model with more than one predictor). The methodology of analysis of variance (ANOVA) and basics of the design of experiments (randomized complete block design, Latin squares) are presented in Chapter 13. Factorial experiments, i.e. experiments with two or more factors affecting the measured response, are treated in Chapter 14. Chapter 15 deals with an important topic, namely basics of statistics of categorical data (i.e. data with outputs taking finitely many values-category labels). Chapter 16, the last chapter, introduces statistical quality control, an area which is becoming a standard part of engineering education.

The book can be useful for undergraduate as well as graduate courses. I very much appreciate lots of examples taken directly from engineering practice. Also, the text contains several comments on development of statistical techniques as they occurred in practice. To sum up, this is a very good textbook presenting a broad material suitably focused on the intended readers.

RADIM BÉLOHLÁVEK
Palacký University, Olomouc, Czech Republic
radim.belohlavek@upol.cz
ANALYZING CATEGORICAL DATA, by Jeffrey S. Simonoff. Springer, New York, 2003, xvi + 496 pages, ISBN 0-387-00749-0.

Categorical data, i.e. data with finitely many values representing categories, are abundant in everyday practice. They arise in many fields like sociology, biology, management, economics, marketing, etc. The present book focuses on statistical methods of analysis of categorical data. A great emphasis is on applications of the methods to real problems; several examples from recent papers are presented in a great detail. The intended audience consists of students of statistics, econometrics and management, and data analysts coping with categorical data.

Classical statistical methods were designed for continuous data, i.e. data describing variables whose values are real numbers. These methods are often not sufficient since the data gathered in practice also describe categorical variables. Examples are nominal variables like yes/no answer, type of a product and ordinal variables like the number of days per week with special characteristics, the degree of quality of a product (bad, poor, good, very good), etc. Standard statistical methods are not appropriate for these data and one has to come up with new methods designed with the focus on the categorical character of the data in mind. These methods have been developing for the past two decades or so and the book presents an overview of selected aspects.

The text consists of ten chapters, each with information about background material and a list of exercises, an appendix on matrix algebra, a list of references and an extensive list (27 pages) of references. Chapter 1 is introductory. After that, the book is basically divided into three parts. The first part consists of Chapters 2 and 3, which contain basic information on Gaussian-based statistical methods for continuous data. The second part consists of Chapters 4–8 and deals with count data and its modelling. Chapter 4 introduces the reader to the basic approaches to categorical data analysis, like the Poisson, binomial, multinomial, negative binomial and beta-binomial distributions of categorical data, testing the goodness of fit, overdispersion and underdispersion. Chapter 5 introduces the regression modelling of count data, the generalized linear model, Poisson regression and some of the related aspects. Analysis of two-dimensional contingency tables of categorical data is the content of Chapter 6. Tables with an additional structure (ordering on the variable values, square tables) are treated in Chapter 7. Chapter 8 discusses the topics of Chapters 6 and 7 for multidimensional contingency tables. The third part consists of Chapters 9 and 10. Chapter 9 deals with regression models for binary data—a special but very important form of categorical data, especially with logistic regression. Chapter 10 extends these models to data with more levels.

The book focuses mainly on practical aspects of categorical data analysis, paying only the necessary portion of attention to formal mathematical properties. As such, it is of great help to data analysts, practitioners and researchers who deal with categorical data and need to get a necessary insight into the methods of analysis as well as practical guidelines for solving problems. The book or some of its selected parts can also be used in the course of data analysis for students having some previous experience with statistical data analysis.

RADIM BĚLOHLÁVEK
Palacký University, Olomouc, Czech Republic
radim.belohlavek@upol.cz
When I first started reading this book, I was somewhat irritated by the word and sentence structuring, especially in the introduction. It read as if it was a translation from another language and it was difficult to absorb the content without several readings. However, the more I read, the more interesting the approach and topic seemed, and I found the text to be ultimately quite useful and interesting.

The focus of the book is how parallel computing, particularly for scientific computing, can be done on a heterogeneous environment consisting of computers, not necessarily homogenous, connected by standard interconnection technologies. The author discusses the underlying hardware and related performance issues, but focuses to a great extent on the programming models. The author, in particular, covers a particular programming language, mpC, an extension of the C programming language, designed by the author for parallel computing on heterogeneous networks.

In the first part of the book the author gives a quick overview of the evolution of parallel computing, starting with vector and superscalar processors, then shared memory and distributed memory multiprocessors and finally general networks of computers. I found the coverage somewhat superficial and would have appreciated some more depth and detail in this part. A particularly interesting thread, however, is the discussion of the software and languages that have been implemented in order to make use of the available hardware. The author discusses array libraries such as BLAS for vector and matrix operations, parallel languages such as Fortran 90, Fortran 95 and C[], and the widely used MPI model based on message passing for distributed memory environments. In particular, the discussion of the MPI library and the MPI example programs were extremely illustrative. In fact, the ongoing presentations of sample program code throughout the book were extremely useful and clarifying even where the other written information was sometimes too dense or incomplete.

In the second part of book, the author focuses on the mpC programming model. This part is quite well done and gives a good basic understanding of the advantages and techniques of programming in mpC, particularly through a series of programming examples that describe different features and capabilities of the language. As the author stresses many times, the goal of parallel programming, as compared with distributed programming, is to speed up the solution of a single problem. For solving problems using mpC, the author expertly takes the reader through how parallel processes, communicating via message passing, are described and coded and how a variety of logical networks are defined for computation. Software constructs to support coordination and synchronization, such as barriers, are illustrated through the examples. This section is not for the faint-hearted as it is necessary to dig into the actual code to get sufficient information to be useful, although thankfully it does not get to the point of being a language manual. The differences and advantages of mpC over MPI are also covered.

The last part of the book covers a well thought out set of scientific applications (linear algebra, the N-body problem, some business applications, etc.) and describes how mpC can be used to solve these problems.

This book is certainly not a general survey of parallel/distributed computing over heterogeneous networks. It is also not designed to be a textbook. It is primarily an overview of mpC with enough background given to allow the reader to appreciate the design and
development of this language, and with enough examples and details given to encourage one to try the language to solve real problems. In this the book succeeds, particularly for those scientists who need to solve large scale problems using parallel computing methods and are willing to experiment with evolutionary approaches.

SUDHIR AGGARWAL
Department of Computer Science
Florida State University
Tallahassee, FL

ALGORITHMS FOR UNCERTAINTY AND DEFEASIBLE REASONING, edited by Jürg Kohlas and Serafín Moral. Kluwer Academic Publishers, Dordrecht, Boston and London, 2000, 517 pages, ISBN 0-7923-6672-7.

This book is Volume 5 in Handbook of Defeasible Reasoning and Uncertainty Management Systems, edited by Dov M. Gabbay and Philippe Smets. The previous four volumes were reviewed in 31(1), 2001 (pp.99–101) of this journal.

As the title of this volume suggests, the focus is on algorithmic aspects of the various uncertainty calculi that are at this time sufficiently developed from the theoretical point of view. Some fairly general algorithms, utilizing common structure of uncertainty theories, as well as algorithms pertaining to individual uncertainty theories are covered. The latter include algorithms for three methodological areas based on probability theory (probabilistic argumentation systems, probabilistic networks and probabilistic satisfiability) and three other areas: possibilistic logic, imprecise probabilities and Dempster–Shafer theory.

The importance of multiple theories of uncertainty is increasingly recognized. Their practical applicability is contingent on the availability of efficient algorithms for dealing with methodological issues within individual uncertainty calculi. I consider this book an important resource of algorithms for dealing with uncertainty, perhaps the best one currently available on the market.

GEORGE J. KLIR
Binghamton University – SUNY

MODELING AND SIMULATION: Theory and Practice, edited by George A. Bekey and Boris Y. Kogan. (A Memorial Volume for Professor Walter J. Karplus.), Kluwer Academic Publishers, Boston and Dordrecht, 2003, xiii + 292 pages, ISBN 1-4020-7062-4.

This book is dedicated by its editors to the memory of Prof. Walter Karplus, a pioneer in the area of systems modelling and simulation, who died in November 2001 at the age of 74. It is divided into three parts.

Part I of the book is devoted to Walter Karplus’ biography. It contains an overview of his main scientific contributions, lists of his publications and doctoral dissertations that he supervised, and a very interesting set of short reminiscences by his colleagues, former students and friends.
Part II contains a reprint of a classical paper by Karplus, entitled “The Spectrum of Mathematical Modeling and Systems Simulation,” and six other papers devoted to various methodological issues regarding systems modelling and simulation:

- “Models of Reality: Some reflections on the Art and Science of Simulation” by George Bekey.
- “Structure Characterization of Ill-Defined Systems” by G.C. Vansteenkiste and J.A. Spriet.
- “Inverse Problems” by Rao Vemuri.
- “Model Interoperability in the Discrete Event Paradigm: Representation of Continuous Models” by Fernando Barros and Bernard Zeigler.
- “A Simulation-Model Compiler for All Seasons” by Granino Korn.
- “Simulation Languages and Applications” by Ralph Huntsinger.

Part III contains six papers that deal with various applications of simulation. Included are applications in biology and medicine, virtual reality, visualization and intelligent human–computer interfaces.

I had the privilege to be a colleague of Walter Karplus at UCLA in 1966–68. I remember him as a great scholar and a good human being. As an older colleague, he inspired me a great deal. I wholeheartedly welcome this book and recommend it to readers of this journal.

GEORGE J. KLIR
Binghamton University – SUNY

GENETIC ALGORITHMS—PRINCIPLES AND PERSPECTIVES: A Guide to GA Theory, by Colin R. Reeves and Jonathan E. Rowe. Kluwer Academic Publishers, Boston, Dordrecht and London, 2003, xi +332 pages, ISBN 1-4020-7240-6.

Since the pioneering work by Holland (1975), the remarkable capability of genetic algorithms for solving very hard optimization problems has increasingly been recognized. Interest in genetic algorithms has been growing quite rapidly since the late 1980s, stimulated possibly by the publication of the well-known classic text by Goldberg (1989). It is fair to say that current literature on genetic algorithms is abundant. However, most of the publications deal with methodological variations, computer implementations and applications of genetic algorithms in various areas. Publications dealing with theoretical issues of genetic algorithms are rather scarce. With the exception of the book by Vose (1999), which is written neither as a text nor as a comprehensive survey, these publications are by and large scattered in conference proceedings. The motivation for writing Genetic Algorithms—Principles and Perspectives is well described by the authors in their Preface to this book:

There really is no book-length treatment of the subject of GA theory, so we have written this book in the conviction that the time is ripe for an attempt to survey and synthesize existing theoretical work, with the intent of preparing the way for further theoretical advances. Actually, a synthesis is not here yet—the field is still a little too fragmented, which is why we have described this book as a set of perspectives. But there are encouraging signs that the different perspectives are beginning to integrate, and we hope that this book will promote the process.

In my opinion, the authors have fully achieved what they intended to achieve. The book is a comprehensive and pedagogically sound survey of existing theoretical works regarding
genetic algorithms. It is written as a text for graduate or upper-division undergraduate courses. No previous knowledge of genetic algorithms is needed, but some basic knowledge of linear algebra and stochastic processes is desirable. Each chapter has valuable Bibliographical Notes (referring to 350 entries in the Bibliography) and a set of Exercises. In summary, this is an excellent book. Since genetic algorithms have already been established in systems science as a powerful methodological tool for dealing with many hard optimization problems, which are so typical in systems science, this book is, in my opinion, highly relevant to readers of this journal.

References
Goldberg, D.E. (1989) Genetic Algorithms in Search, Optimization & Machine Learning (Addison-Wesley, Reading, Mass).
Holland, J. (1975) Adaptation in Natural and Artificial Systems (University of Michigan Press, Ann Arbor).
Vose, M.D. (1999) Simple Genetic Algorithms: Foundations and Theory (MIT Press, Cambridge, Mass).

GEORGE J. KLIR
Binghamton University – SUNY

IDENTIFICATION OF NONLINEAR PHYSIOLOGICAL SYSTEMS, by David T. Westwick and Robert E. Kearney, IEEE Press, Wiley Interscience, New York, 2003, 261 pages, ISBN 0-471-27456-9.

Modern biology presents many examples of highly efficient engineering solutions. These solutions are genetically optimized for specific environments, quite different from those of the engineering world, but this difference narrows with every new advancement in robotics, electronics and computing technology. Future progress in engineering inevitably implies the utilization of principles of operation of complex biological and physiological systems. This reality is well understood by engineers adding biological disciplines to the traditional engineering background, and biologists utilizing mathematical methods commonly used by engineers. The new book, “Identification of Nonlinear Physiological Systems” by David T. Westwick and Robert E. Kearney, addresses increasing interest of modern physiologists in quantifying their research on the basis of mathematical techniques developed for engineering applications. In many ways, this book stimulates fruitful collaboration between biologists and engineers.

The book has eight chapters and a complete list of bibliography. Each chapter features notes and references, problems and computer assignments.

Chapter 1 of the book provides a non-engineering reader with a background in signals and systems presenting major concepts of deterministic and stochastic signals and their characteristics; static and dynamic, deterministic and stochastic, linear and nonlinear systems and their properties; the concepts of mathematical modelling and system identification.

Chapter 2 is a review of mathematical and numerical techniques commonly used for signal characterization and mathematical description of dynamic systems utilizing experimental data. It discusses correlation functions, spectral analysis, parameter estimation, power series and polynomials.
Chapter 3 presents various forms of mathematical description of linear systems, including time-domain, frequency-domain, discrete-time domain and state-space models. A case study, a discrete-time state-variable human ankle compliance model is presented.

Chapter 4 features a wide array of nonlinear modelling techniques, their applications and relevant mathematical methods facilitating the utilization of these techniques. It includes topics such as Volterra series, Wiener series, multiple-input and multiple-output systems, similarity transformation, series and parallel cascade models.

Chapter 5 addresses various aspects of identification of linear systems. It presents the concept of model validation using the coefficient of determination. It describes the Least-Squares estimation of regression coefficients, use of correlation analysis and frequency-domain techniques. It suggests nonlinear optimization techniques as a versatile approach to estimation of model parameters.

Chapter 6 deals with correlation-based identification techniques. Chapter 7 presents various least-squares methods with relevant mathematical techniques, many practical considerations and computer applications and a case study. Finally, Chapter 8 addresses various nonlinear optimization methods facilitating iterative approaches to model building and parameter estimation.

The book will enable a biologist reader to develop a good background in system identification techniques and relevant mathematics. It is well written; its offers well thought through computer exercises and assignments and is a good candidate for a textbook for senior undergraduate and graduate students in the non-engineering fields of study. It provides a comprehensive bibliography that will be invaluable for further learning and independent research.

Speaking of the book’s shortcomings, we recommend that its next edition should address such important issues as statistical significance of correlation, confidence analysis of parameters of regression models and model-based predictions. It would be advisable to introduce the use of numerical simulation tools (Simulink, VisSim), and put more emphasis on the MATLAB tools.

VICTOR A. SKORMIN
Binghamton University – SUNY
E-mail: vskormin@binghamton.edu

CELLULAR NEURAL NETWORKS: Dynamics and Modelling, by Angela Slavova. Kluwer Academic, Dordrecht, The Netherlands, 2003, x +220 pages, ISBN 1-4020-1192-X.

With an increasing interest in the field of neural networks, both theory and its applications to fields such as engineering, mathematics, economics, ecology, etc., new theoretical developments are evolving. This new book, entitled “Cellular Neural Networks: Dynamics and Modelling” by Angela Slavova, presents the latest theoretical results for studying cellular neural networks (CNNs). The main emphasis in this book is to give an introduction to the mathematical modelling and analysis of CNN from the viewpoint of dynamical systems. This book presents an introduction to several well-known mathematical models of
CNNs, and gives some new developments in the theoretical study of the dynamics of the related mathematical CNN models.

The book has four chapters and three appendices plus a complete list of bibliography.

Chapter 1 offers the basic theory about CNNs. A survey of the basic theory of CNN architectures and dynamics and results on CNNs stability is provided.

Then, Chapter 2 explores the dynamics and stability of nonlinear and delay CNNs. Some new results of the author concerning the dynamics of nonlinear CNNs are reported.

Chapter 3 studies phenomena of the hysteresis, bifurcation and chaos arising in CNNs. In this chapter, the author analyses how the approximation techniques are used for studying the stability, chaotic phenomenon, and hysteresis and bifurcation characteristics. This chapter also includes the author’s contribution in this important field. Some new methods for studying hysteresis, bifurcation and chaos arising in CNNs are also presented.

Finally, in Chapter 4 the author presents the methods of using CNNs for modelling some famous nonlinear partial differential equations arising in biology, genetics, neurophysiology, physics, ecology, etc., which are the new trends in the field of CNNs applications.

Appendices A, B and C provide some mathematical foundations for this book. In Appendix A, the degree of a map in is defined and some useful properties are derived. Hysteresis operators and their mathematical models are described in Appendix B. Appendix C discusses the describing function method and its application for the stability analysis of CNNs.

In this book the author has provided a concise comprehensive reference of fundamental theory (the basic architectures and dynamics of linear, nonlinear and delay CNNs) and advanced research and applications (hysteresis, bifurcation and chaos in CNNs, and approximation of nonlinear partial differential equations using CNNs) for multi-discipline learners and researchers.

Readers in different scientific disciplines, such as engineering, dynamic systems, applied mathematics, mathematical modelling, information processing, biology and neurophysiology, will find this book to have comprehensive and useful discussions on the subject of CNNs as well as a rigorous mathematical analysis of CNNs.

This book, which contains a good mathematical description and an extensive list of bibliography, will be a suitable textbook for senior undergraduate and graduate students in the field of applied mathematics, information science and engineering.

MADAN M. GUPTA
University of Saskatchewan, Canada
E-mail: madan.gupta@sask.usask.ca

and

ZENG-GUANG HOU
Chinese Academy of Sciences, China
E-mail: hou@compsys.ia.ac.cn
INTELLIGENT CONTROL ROBOTIC SYSTEMS, by Dusko Katic and Miomir Vukobratovic, Kluwer Academic Publishers, Dordrecht, Boston and London, 2003, xix + 294 pages, ISBN 1-4020-1630-1.

This book deals with robotic systems in the spirit of the broader area that is lately known under the name “intelligent systems”. In general, intelligent systems are defined in this context as human-made systems that are capable of achieving highly complex tasks in a human-like, intelligent way. The qualifier “human-like” in this definition is important, since it distinguishes the area of intelligent systems from the current mainstream in the broader area of artificial intelligence. An important distinction between these two areas is the acceptance and utilization of the various tools of soft computing within the area of intelligence systems, and their virtual rejection within the mainstream of artificial intelligence.

The basic thesis of soft computing is that precision and certainty carry cost and that intelligent systems should exploit, whenever possible, the tolerance for imprecision to achieve tractability, robustness and low cost in performing very complex and often imprecisely formulated tasks. Components of soft computing include fuzzy set theory and fuzzy logic, artificial neural networks, various types of evolutionary algorithms, rough set theory, and probabilistic reasoning with precise as well as imprecise probabilities of various types. These components are combined in soft computing as needed, and some new capabilities are gained by each combination.

It seems that robotics is an ideal engineering area for using soft computing and the ideas emerging from research on intelligent systems. Unfortunately, robotics is still dominated by the mainstream, artificial intelligence, at least to the best of my knowledge. This means that soft computing is virtually ignored in the area of robotics. It is thus encouraging to see a new book whose primary focus is on the use of soft computing in robotics. I am aware of only one other book on robotics that has a similar orientation (Intelligent Robotic Systems’ Design, Planning and Control by Witold Jacak, Kluwer, 1999).

The reviewed book focuses on the various issues of control in robotics. These issues are consistently dealt with via tools of soft computing and it is well argued by the authors why this is their choice. Individual components of soft computing (fuzzy logic, neural networks and genetic algorithms) as well as their combinations are introduced efficiently and their applications in robotics are amply illustrated. This makes the book self-contained for researchers and practitioners in robotics. However, the way in which the applications are covered makes the book self-contained for the soft computing community as well. The book is thus an excellent resource for teams containing members of both communities. The book is mathematically rigorous and well written from the pedagogic point of view. It is certainly attractive as a text for graduate or upper-division undergraduate courses in robotics, but it is also very suitable for self-study.

GEORGE J. KLIR
Binghamton University–SUNY
SPEECH CODING ALGORITHMS: Foundation and Evolution of Standardized Coders, by Wai C. Chu. John Wiley, Hoboken, NJ, 2003, 558 pages, ISBN 0471373125.

As its title indicates, the book under review is a comprehensive survey of various speech coding algorithms and standards. It contains 19 chapters, six appendices, a bibliography of about 200 references and an index. At the end of each chapter, there is a section of summary and references, where the author presents an overview of the chapter and historical developments of algorithms or standards discussed in the chapter, as well as a set of exercises, which is very valuable when using the book as a textbook or a training material. Some high-level computer pseudo-code is included after discussing the algorithms so that a software engineer is able to implement the algorithms in whatever computer language he/she prefers and to experiment with the algorithms.

Although self-contained, the book is highly mathematical. Readers need to have a solid background in areas such as advanced calculus, Fourier transforms, signal processing, linear algebra, etc. However, the author’s simple and clear writing style definitely helps the reader to understand the rather complex and abstract material.

The book is highly focused on the subject of speech signal processing. In my opinion, it is the best textbook on this subject that is currently available on the market. It is suitable for upper-level undergraduate as well as graduate students in electrical engineering. Perhaps one of the most valuable contributions of the book is in Appendix C, where the author expresses his view on research directions in speech coding. Graduate students may be able to find here some research ideas for their thesis projects.

One deficiency of the book I am able to find is that Chinese characters in the front matter are inverted intentionally or unintentionally. Overall, the book is done well. It should be on the desk of everyone who is interested in the theory and applications of speech coding algorithms.

In order to get a better idea of the specific topics that are covered in the book, the following is its Table of Contents:

1. Introduction.
2. Signal Processing Techniques.
3. Stochastic Processes and Models.
4. Linear Prediction.
5. Scalar Quantization.
6. Pulse Code Modulation and its Variants.
7. Vector Quantization.
8. Scalar Quantization of Linear Prediction Coefficient.
9. Linear Prediction Coding.
10. Regular-Pulse Excitation Coders.
11. Code-Excited Linear Prediction.
12. The Federal Standard Version of CELP.
13. Vector Sum Excited Linear Prediction.
14. Low-Delay CELP.
15. Vector Quantization of Linear Prediction Coefficient.
16. Algebraic CELP.
17. Mixed Excitation Linear Prediction.
18. Source-Controlled Variable Bit-Rate CELP.
19. Speech Quality Assessment.

Appendix A: Minimum-Phase Property of the Forward Prediction-Error Filter.
Appendix B: Some Properties of Line Spectral Frequency.
Appendix C: Research Directions in Speech Coding.
Appendix D: Linear Combiner for Pattern Classification.
Appendix E: CELP: Optimal Long-Term Predictor to Minimize the Weighted Difference.
Appendix F: Review of Linear Algebra: Orthogonality, Basis, Linear Independence, and the Gram–Schmidt Algorithm.

Bibliography.

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YIN PAN
Department of Information Technology, Rochester Institute of Technology

ABSTRACTS

FOUNDATIONS OF QUANTUM MECHANICS: An Empiricist Approach, by William M. De Muynck. Kluwer Academic Publishers, Dordrecht, Boston, and London, 2002, XXIV + 680 pages, ISBN 1-4020-0932-1.

Old and new problems of the foundations of quantum mechanics are viewed from the new perspective provided by a generalization of the mathematical formalism encompassing positive operator-valued measures. One objective is to demonstrate the crucial role the generalized formalism plays in fundamental issues as well as in practical applications, and to contribute to the development of the operational approach. A second objective is the development of an empiricist interpretation of this approach, duly taking into account the role played by the measuring instrument in quantum mechanical measurement. Copenhagen and anti-Copenhagen interpretations are critically assessed, and found to be wanting, due to insufficiently taking into account the measurement interaction. The Einstein–Podolsky–Rosen problem and the problem of the Bell inequalities are discussed, starting from this new perspective. An explanation of violation of the Bell inequalities is developed providing an alternative to the usual explanation on the basis of non-locality. This treatise is based on lecture notes of an advanced course on the foundations of quantum mechanics.
TOPOLOGICAL AND ALGEBRAIC STRUCTURES IN FUZZY SETS: A Handbook of Recent Developments in the Mathematics of Fuzzy Sets, edited by Stephen Ernest Rodabaugh and Eric Peter Klement. Kluwer Academic Publishers, Dordrecht, Boston, and London, 2003, XI + 467 pages, ISBN 1-4020-1515-1.

Topological and Algebraic Structures in Fuzzy Sets has these unique features:

- strategically located at the juncture of fuzzy sets, topology, algebra, lattices, foundations of mathematics;
- major studies in uniformities and convergence structures, fundamental examples in lattice-valued topology, modifications and extensions of sobriety, categorical aspects of lattice-valued subjects, logic and foundations of mathematics, t-norms and associated algebraic and ordered structures;
- internationally recognized authorities clarify deep mathematical aspects of fuzzy sets, particularly those topological or algebraic in nature;
- comprehensive bibliographies and tutorial nature of longer chapters take readers to the frontier of each topic;
- extensively referenced introduction unifies volume and guides readers to chapters closest to their interest;
- annotated open questions direct future research in the mathematics of fuzzy sets;
- suitable as a text for advanced graduate students.

THE TURING TEST: The Elusive Standard of Artificial Intelligence, edited by James H. Moor. Kluwer Academic Publishers, Dordrecht, Boston, and London, 2003, 273 pages, ISBN 1-4020-1204-7.

The Turing Test gives the most comprehensive, in-depth and contemporary assessment of this classic topic in artificial intelligence. This is the first book to elaborate in such a detail the numerous conflicting points of view on many aspects of this multifaceted controversial subject. It offers new insights into Turing’s own interpretation and traces the history of the debate about the merits of the Turing test in more detail than anywhere else. Turing’s famous predictions (1950) are assessed 50 years after they were made. The book also gives competing views about how the Turing test should be interpreted, and applications are suggested and alternatives to the Turing test are examined in detail.

HANDBOOK OF HUMAN SYSTEMS INTEGRATION, edited by Harold R. Booher. Wiley-Interscience, Hoboken, NJ, 2003, XXVI + 964 pages, ISBN 0-471-02053-2.

Human Systems Integration (HIS) is very attractive as a new integrating discipline designed to help to move business and engineering cultures toward a more people-technology orientation. Over the past decade, the United States and foreign governments have developed a wide range of tools, techniques and technologies aimed at integrating human factors into engineering systems in order to achieve important cost and performance benefits that otherwise would not have been accomplished. In order for this new discipline to be effective, however, a cultural change is needed that must start with organizational leadership.
Handbook of Human Systems Integration outlines the principles and methods that can be used to help integrate people, technology and organizations with a common objective towards designing, developing and operating systems effectively and efficiently. Handbook of Human Systems Integration is broad in scope, covering both public and commercial processes as they interface with systems engineering processes.

This book will be of special interest to HIS practitioners, systems engineers and managers, as well as government and industry decision-makers who must weigh the recommendations of all multidisciplines contributing to systems performance, safety and costs in order to make sound systems acquisition decisions.

E VOLUTION OF BI OLOGICAL SYSTEMS IN RANDOM MEDIA: Limit Theorems and Stability, by Anatoly Swishchuk and Jianhong Wu. Kluwer Academic Publishers, Dordrecht and Boston, 2003, XX +216 pages, ISBN 1-4020-1554-2.

This is a new book in biomathematics, which includes new models of stochastic nonlinear biological systems and new results for these systems. These systems are based on the new results for nonlinear difference and differential equations in random media. This book contains:

(1) new stochastic nonlinear models of biological systems, such as biological systems in random media: epidemic, genetic selection, demography, branching, logistic growth and predator-prey models;
(2) new result of scalar and vector difference equations in random media with applications to the stochastic biological system in (1);
(3) new results for stochastic nonlinear biological systems, such as averaging, merging, diffusion approximation, normal deviations and stability;
(4) new approach to the study of stochastic biological systems in random media such as random evolution approach.

Intended level of readership: researchers in biomathematics, stochastic (random) dynamical systems, applied mathematics; practitioners in epidemiology, medicine, genetics, demography and fishery.

S TRUCTURAL RELIABILISM: Inductive Logic as a Theory of Justification, by Pawel Kawalec. Kluwer Academic Publishers, Dordrecht, Boston and London, 2003, xv +190 pages, ISBN 1-4020-1013-3.

This monograph is a novel defense of the program of inductive logic, developed initially by Rudolf Carnap in the 1950s and Jaakko Hintikka in the 1960s. It revives inductive logic by bringing out the underlying epistemology. The main strength of the work is its link between inductive logic and contemporary discussions of epistemology. Through this perspective the author succeeds to shed new light on the significance of inductive logic. The resulting structural reliabilist theory propounds the view that justification supervenes on syntactic and semantic properties of sentences of justification-bearers. The claim is made that this sets up a genuine alternative to the prevailing theories of justification. Kawalec substantiates this claim by confronting reliabilism with a number of epistemological problems.
Therefore, the book is interesting for philosophers of science dealing with problems of induction, but it will also appeal to readers working in the theory of knowledge. Kawalec writes in a clear manner, makes his theses and arguments explicit, and gives ample bibliographical references. The book will be a valuable companion to graduate and postgraduate courses on inductive logic.

**EVOLUTIONARY ALGORITHMS FOR SOLVING MULTIOBJECTIVE PROBLEMS**, by Carlos A. Coello Coello, David A. van Veldhuizen, and Gary B. Lamont. Kluwer Academic /Plenum Publishers, New York, 2002, xxxiii + 576 pages, ISBN 0-306-46762-3.

This book is a complete, self-contained reference providing necessary elements in the analysis, design, implementation and validation of multiobjective evolutionary algorithms. It distils the discipline’s state-of-the-art findings in a single text, with suggestions of new research areas. As such, it is an important reference for researchers as well as practitioners in any area that is concerned with multiobjective optimization.

**PROBABILISTIC LOGIC IN A COHERENT SETTING**, by Giulianella Coletti and Romano Scozzafava. Kluwer Academic Publishers, Dordrecht, Boston and London, 2002, 289 pages, ISBN 1-4020-0917-8.

The approach to probability theory followed in this book (which differs radically from the usual one, based on a measure-theoretic framework) privileges probability as a linear operator rather than a measure, and is based on the concept of *coherence*, that can be framed inside the most general view of conditional probability. It is a “flexible” and unifying tool apt to handle, e.g. *partial probability assessments* (not requiring that the set of all possible “outcomes” be endowed with a previously given algebraic structure, such as a Boolean algebra) and *conditional independence* in a way that avoids all the inconsistencies related to logical dependence (so that a theory referring to graphical models, more general than those usually considered in Bayesian networks, could be derived). Moreover, it is also possible to encompass other approaches to uncertain reasoning, such as fuzziness, possibility functions and default reasoning. The book is self-contained, provided that the reader is familiar with the elementary aspects of propositional calculus, linear algebra and analysis.

**RISK ANALYSIS IN ENGINEERING AND ECONOMICS**, by Bilal. M. Ayyub. Chapman and Hall/ CRC, Boca Raton, FL, 2003, 571 pages, ISBN 1-58488-395-2.

This book introduces the fundamental concepts, techniques and applications of the subject in a style tailored to meet the needs of students and practitioners of engineering, science, economics and finance. Drawing on his extensive experience in uncertainty and risk modelling and analysis, the author leads readers from the fundamental concepts through the theory, applications, and data needs, sources and collections. He emphasizes the practical use of the methods presented and carefully examines the limitations, advantages and disadvantages of each. Case studies that incorporate the techniques discussed offer a practical perspective that helps readers identify and solve problems encountered in practice.
ARTIFICIAL INTELLIGENCE AND SECURITY IN COMPUTING SYSTEMS, edited by Jerzy Soldek and Leszek Drobiszewicz. Kluwer Academic Publishers, Boston Dordrecht and London, 2003, xi + 302 pages, ISBN 1-4020-7396-8.

The book consists of selected papers from the 2002 Conference of Advanced Computer Systems. It covers three areas: (1) methods of artificial intelligence, where the main focus is on methods of soft computing, using fuzzy logic, rough set theory, neural networks and genetic algorithms, as well as their various combinations; (2) multiagent systems, covering both basic research and applications in transportation and information systems; and (3) computer security and safety, where the focus is on new cryptographic algorithms and risk management methods.

COMPUTATIONAL INTELLIGENT SYSTEMS FOR APPLIED RESEARCH: Proceedings of the Fifth International FLINS Conference, edited by Da Ruan, Pierre D’hondt, and Etienne E. Kerre. World Scientific, Singapore, 2002, xii + 591 pages, ISBN 981-238-066-3.

FLINS is an acronym for Fuzzy Logic and Intelligent Technologies in Nuclear Science. FLINS 2002 is the fifth in a series of FLINS conferences and covers state-of-the-art research and development in computational intelligence for applied research in general and for nuclear science and engineering, in particular. This book outlines the trends in computational intelligence in control, decision-making and nuclear engineering, and presents the latest developments of computational intelligent systems in applied research and nuclear applications.

THE CONNECTIVITY HYPOTHESIS: Foundations of an Integral Science of Quantum, Cosmos, Life, and Consciousness, by Ervin Laszlo, State University of New York Press, Albany, New York, 2003, viii + 147 pages, ISBN 0-7914-5786-9.

Ervin Laszlo, widely regarded as the founder of systems philosophy and general evolutionary theory, introduces the foundations of a genuine unified theory of the world in this pioneering treatise on the new sciences. In contrast to other unified theories that centre mainly on physics, Laszlo’s embraces quantum, cosmos, life, as well as consciousness. He delineates the principles of a new physics of universal connectivity and puts forward the corresponding metaphysics, discussing the implications for such philosophical issues as the nature of matter and mind, freedom and morality, and design versus evolution. This landmark book lays the groundwork for the non-materialist, non-reductionist yet rigorous paradigm that is likely to signal the next revolution in science: the “paradigm of universal connectivity.”

QUANTUM MECHANICS AND ITS EMERGENT MACROPHYSICS, By Geoffrey Sewell. Princeton University Press, Princeton, NJ, 2002, xi + 292 pages, ISBN 0-691-05832-6.

The quantum theory of macroscopic systems is a vast, ever-developing area of science that serves to relate the properties of complex physical objects to those of their constituent
particles. Its essential challenge is the finding of the conceptual structures needed for the description of the various states of organization of many-particle quantum systems. Sewell provides a new approach to the subject, based on a “macrostatistical mechanics,” which sharply contrasts with the standard microscopic treatments of many-body problems. He begins by presenting the operator algebraic framework for the theory. He then undertakes a macrostatistical treatment of both equilibrium and non-equilibrium thermodynamics. This yields a major new characterization of a complete set of thermodynamic variables and a nonlinear generalization of the Onsager theory. The remainder of the book focuses on ordered and chaotic structures that arise in some key areas of condensed matter physics. The book is written for scientists and mathematicians who are interested in quantum theory, statistical physics, thermodynamics and general questions of order and chaos.