QUARTERLY

OF

APPLIED MATHEMATICS

VOLUME LXI JUNE • 2003 NUMBER 2

Quarterly of Applied Mathematics

The *Quarterly of Applied Mathematics* prints original papers in applied mathematics which have an intimate connection with applications. It is expected that each paper will be of a high scientific standard; that the presentation will be of such character that the paper can be easily read by those to whom it would be of interest; and that the mathematical argument, judged by the standard of the field of application, will be of an advanced character.

In accordance with their general policy, the Editors welcome particularly contributions which will be of interest both to mathematicians and to scientists or engineers. Authors will receive galley proof only. The author's institution will be requested to pay a publication charge of $30 per page which, if honored, entitles the author to 100 free reprints. Detailed instructions will be sent with galley proofs.

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This journal is indexed in *Mathematical Reviews*, *Zentralblatt MATH*, *Science Citation Index*®, *Science Citation Index*™*-Expanded*, *ISI Alerting Services*℠, *CompuMath Citation Index*®, *Current Contents*®*/Engineering, Computing & Technology*. It is also indexed by *Applied Science & Technology Index* and abstracted by *Applied Science & Technology Abstracts*.
Periodicals postage paid at Providence, Rhode Island.
Publication number 808680 (ISSN 0033-569X)

SUGGESTIONS CONCERNING THE PREPARATION OF MANUSCRIPTS FOR THE QUARTERLY OF APPLIED MATHEMATICS

The editors will appreciate the authors' cooperation in taking note of the following directions for the preparation of manuscripts. These directions have been drawn up with a view toward eliminating unnecessary correspondence, avoiding the return of papers for changes, and reducing the charges made for "author's corrections."

Manuscripts: Manuscripts should be typewritten double-spaced on one side only. Marginal instructions to the typesetter should be written in pencil to distinguish them clearly from the body of the text. The author should keep a complete copy.

The papers should be submitted in final form. Only typographical errors should be corrected in proof; composition charges for any major deviations from the manuscript will be passed on to the author.

Titles: The title should be brief but express adequately the subject of the paper. The name and initials of the author should be written as he/she prefers; all titles and degrees or honors will be omitted. The name of the organization with which the author is associated should be given in a separate line following his/her name.

Mathematical Work: As far as possible, formulas should be typewritten; Greek letters and other symbols not available on the average typewriter should be inserted using either instant lettering or by careful insertion in ink. Manuscripts containing pencilled material other than marginal instructions to the typesetter will not be accepted.

The difference between capital and lower-case letters should be clearly shown; care should be taken to avoid confusion between zero (0) and the letter O, between the numeral one (1), the letter l and the prime ($'$), between alpha and a, kappa and k, mu and u, nu and v, eta and n.

The level of subscripts, exponents, subscripts to subscripts, and exponents to exponents should be clearly indicated.

Single embellishments over individual letters are allowed; the only embellishment allowed above groups of letters is the overbar.

Double embellishments are not allowed. These may be replaced by superscripts following the symbols.

Complicated exponents and subscripts should be avoided. Any complicated expression that recurs frequently should be represented by a special symbol.

For exponentials with lengthy or complicated exponents the symbol exp should be used, particularly if such exponentials appear in the body of the text. Thus,

$$\exp[(a^2 + b^2)^{1/2}] \text{ is preferable to } e^{[a^2+b^2]^{1/2}}.$$

Fractions in the body of the text and fractions occurring in the numerators or denominators of fractions should be written with the solidus. Thus,

$$\frac{\cos(x/2b)}{\cos(a/2b)} \text{ is preferable to } \frac{\cos\frac{x}{2b}}{\cos\frac{a}{2b}}.$$

In many instances the use of negative exponents permits saving of space. Thus,

$$\int u^{-1} \sin u \, du \text{ is preferable to } \int \frac{\sin u}{u} \, du.$$

Whereas the intended grouping of symbols in handwritten formulas can be made clear by slight variations in spacing, this procedure is not acceptable in typeset formulas. To avoid misunderstanding, the order of symbols should therefore be carefully considered. Thus,

$$(a + bx)\cos t \text{ is preferable to } \cos t(a + bx).$$

Figures: Figures should be drawn in black ink with clean, unbroken lines; do not use ball point pen. The paper should be of a nonabsorbant quality so that the ink does not spread and produce fuzzy lines. If the figures are intended for reduction, they should be drawn with heavy enough lines so that they do not become flimsy at the desired reduction. The notation should be of professional quality and in proportion for the expected reduction size. Figures that are unsuitable for reproduction will be returned to the author for redrawing. Legends accompanying figures should be written on a separate sheet.

Bibliography: References should be grouped together in a Bibliography at the end of the manuscript. References in text to the Bibliography should be made by numerals between square brackets.

The following examples show the desired arrangements: (*for books*—S. Timoshenko, *Strength of Materials*, vol. 2, Macmillan and Co., London, 1931, p. 237; *for periodicals*—Lord Rayleigh, *On the flow of viscous liquids, especially in three dimensions*, Phil. Mag. (5) 36, 354–372 (1893)). Note that the number of the series is not separated by commas from the name of the periodical or the number of the volume.

Authors' initials should precede their names rather than follow them.

In quoted titles of books or papers, capital letters should be used only where the language requires this. Thus, *On the flow of viscous fluids* is preferable to *On the Flow of Viscous Fluids*, but the corresponding German title would have to be rendered as *Über die Strömung zäher Flüssigkeiten*.

Titles of books or papers should be quoted in the original language (with an English translation added in parentheses, if this seems desirable), but only English abbreviations should be used for bibliographical details such as ed., vol., no., chap., p.

Footnotes: As far as possible, footnotes should be avoided. Footnotes containing mathematical formulas are not acceptable.

Abbreviations: Much space can be saved by the use of standard abbreviations such as Eq., Eqs., Fig., Sec., Art., etc. These should be used, however, only if they are followed by a reference number. Thus, "Eq. (25)" is acceptable but not "the preceding Eq." Moreover, if any one of these terms occurs as the first word of a sentence, it should be spelled out.

Special abbreviations should be avoided. Thus "boundary conditions" should always be spelled out and not be abbreviated as "b.c." even if this special abbreviation is defined somewhere in the text.

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Turbulence Structure Vortex Dynamics. Edited by J. C. R. Hunt and J. C. Vassilicos, Cambridge University Press, 2001, xiii + 306 pp., $80.00

These are the proceedings of the Symposium on Vortex Dynamics and Turbulence Structure, which was part of the program on turbulence held between January and July 1999 at the Isaac Newton Institute in Cambridge. The papers in this volume address questions such as the following: What is the overall significance for turbulent flows of vortical structure? How should one study their persistence and characteristic structure; do they correspond to some kind of eigensolutions of the basic equations or of some reduced form of these equations; what are their geometrical statistics and their stability, given that they exist in a chaotic environment with many other structures surrounding them? How do they interact or not interact with each other and with surrounding turbulence, and what are their dissipative properties? Are the near-singularities of the turbulence or the conjectured finite-time singularities related to the vortical or other structures, and if so, what kind? What are the Eulerian and Lagrangian properties of such structures, and how do their conditional statistics relate to the unconditional Eulerian and Lagrangian statistics (e.g., spectra, energy cascades up- and down-scale, relative motions of particles) and the scaling properties of the entire flow? To what extent can turbulence be represented in terms of space-filling functions such as Fourier or Chebychev basis functions or is it necessary to work in terms of localized functions such as wavelets?

Quaternions and Rotation Sequences A Primer with Applications to Orbits, Aerospace, and Virtual Reality. By Jack B. Kuipers, Princeton University Press, 1999, xviii + 371 pp., $49.50

This book is an exposition of the quaternion, a 4-tuple, introduced by Hamilton in the 1800's, and its primary application in a rotation operator. It also presents the more conventional 3×3 (9 element) matrix rotation operator. The volume comprises three main parts. The opening chapters present introductory material and establish the book's terminology and notation. The next section presents the mathematical properties of quaternions, including quaternion algebra and geometry. It includes more advanced special topics in spherical geometry, along with an introduction to quaternion calculus and perturbation theory, required in situations involving dynamics and kinematics. Among state-of-the art applications is a six-degree-of-freedom, electromagnetic, position-and-orientation transducer. Finally, the author discusses the computer graphics necessary for the development of applications for virtual reality.

The Odd Quantum. By Sam Treiman, Princeton University Press, 1999, viii + 262 pp.

This book is aimed at scientists in non-quantum-mechanical disciplines as well as nonscientists, who are not put off by equations and technical particulars. Its aim is to convey something of the actual substance, methods, and oddities of quantum mechanics, yet to be not overly technical or professional. Although quantum mechanics is the main theme of the book, there are also brief reviews of classical mechanics and electromagnetism, special relativity theory, particle physics, and other topics.

Analysis for Applied Mathematics. By Ward Cheney, Springer-Verlag, 2001, viii + 444 pp., $49.95

This is volume 208 in the series Graduate Texts in Mathematics. It evolved from a course at the University of Texas at Austin for beginning graduate students in mathematics, particularly students who intended to specialize in applied mathematics. It thus deals with topics in analysis that impinge on applied mathematics. Chapter headings: 1. Normed linear spaces; 2. Hilbert spaces; 3. Calculus in Banach spaces; 4. Basic approximate methods of analysis; 5. Distributions; 6. The Fourier transform; 7. Additional topics; 8. Measure and integration.

Randomization in Clinical Trials—Theory and Practice. By William F. Rosenberger and John M. Lachin, Wiley, 2002, xvii + 259 pp., $74.95

This is a volume in the Wiley Series in Probability and Statistics. It combines the applied aspects of randomization in clinical trials with a probabilistic treatment of properties of randomization. The book takes a non-Bayesian and nonparametric approach to inference, focusing mainly on the linear rank test under a randomization model, with added discussion on likelihood-based inference as it relates to sufficiency and ancillarity. Chapters 1–12 represent the primary focus of the book, while chapters 13–15 present theoretical developments of interest to those conducting theoretical research in randomization. Chapter headings: 1. Randomization and the clinical trial; 2. Issues in the design of clinical trials; 3. Randomization for balancing treatment assignments; 4. Balancing on known covariates; 5. The effects of unobserved covariates; 6. Selection bias; 7. Randomization as a basis for inference; 8. Inference for stratified, blocked, and covariate-adjusted analyses; 9. Randomization in practice; 10. Response-adaptive randomization; 11. Inference for response-adaptive randomization; 12. Response adaptive randomization in practice; 13. Some useful results in large sample theory; 14. Large sample inference for complete and restricted randomization; 15. Large sample inference for response-adaptive randomization.

Computational Cell Biology. Edited by Christopher P. Fall, Eric S. Marland, John M. Wagner, and John Tyson, Springer, 2002, xx + 468 pp., $59.95

This is volume 20 in the series Interdisciplinary Applied Mathematics. It is an introduction to dynamical modeling in cell biology, emphasizing computational approaches based on realistic molecular mechanisms. It was conceived and begun by Joel Keizer, who founded and directed the Institute of Theoretical Dynamics at the University of California, Davis, and was expanded and finished by his students and colleagues after his death in 1999. The first six chapters are the core of the book, covering the basic elements of compartmental modeling, and the remaining chapters cover more specialized topics. An appendix presents some of the mathematical and computational concepts used in the book in more detail, and another appendix contains an introduction to the XPPAUT ODE package, developed by Bard Ermentrout, but the text is independent of any particular software. There are illustrative exercises included with each chapter. The chapter headings, with authors, are as follows: I. Introductory Course: 1. Dynamic phenomena in cells (C. P. Fall and J. E. Keizer); 2. Voltage gated ionic currents (same); 3. Transporters and pumps (E. S. Marland and J. E. Keizer); 4. Fast and slow time scales (J. P. Keener and J. E. Keizer); 5. Whole-cell models (A. S. Sherman, Yue-Xian Li, and J. E. Keizer); 6. Intercellular communication (John Rinzel); II. Advanced Material: 7. Spatial modeling (James P. Keener); 8. Modeling intracellular calcium waves and sparks (G. D. Smith, J. E. Pearson, and J. E. Keizer); 9. Biochemical oscillations (John J. Tyson); 10. Cell cycle controls (J. J. Tyson and Béla Novák); 11. Modeling the stochastic gating of ion channels (Gregory D. Smith); 12. Molecular motors: theory (A. Mogilner, T. C. Elston, Hongyun Wang, and G. Oster); 13. Molecular motors: examples (same). Appendix A: Qualitative analysis of differential equations; Appendix B: Solving and analyzing dynamical systems using XPPAUT.

Regression Models for Time Series Analysis. By Benjamin Kedem and Konstantinos Fokianos, Wiley, 2002, xiv + 337 pp., $84.95

This is a volume in the Wiley Series in Probability and Statistics. It introduces the reader to relatively newer and somewhat more diverse regression models and methods for time series analysis than most standard texts. In particular, in the first four chapters, the General Linear Models (GLM) methodology, introduced by Nelder and Wedderburn in 1972 and originally intended for independent data, is extended systematically to time series, where the primary and covariate data are both random and stochastically dependent. The three notions which make this possible are: the notion of an increasing sequence of histories relative to an observer, the notion of partial likelihood introduced by Cox in 1975 and further elaborated by Wong in 1986, and the notion of a martingale with respect to a sequence of histories. The GLM approach to time series is introduced in chapter 1. Chapters 2, 3, and 4 specialize to regression models for binary, categorical, and count time series, respectively. Chapter 5 is an introduction to various regression models developed during the past thirty years or so, particularly to those for integer valued time series including hidden Markov models. Chapter 6 summarizes classical and more recent results concerning state space models. Chapter 7 presents a Bayesian approach to prediction and interpolation in spatial data adapted to time series that may be short and/or observed irregularly, including a description of software for its implementation. There is a bibliography with 451 items.

Statistical Methods in Diagnostic Medicine. By Xia-Hua Zhou, Nancy A. Obuchowski, and Donna K. McClish, Wiley, 2002, xiv + 437 pp., $94.95

This is a volume in the Wiley Series in Probability and Statistics. It is its purpose to provide a comprehensive account of statistical methods for design and analysis of diagnostic studies, including sample-size calculations, estimation of the accuracy of a diagnostic test, comparison of accuracies of competing diagnostic tests, and regression analysis of diagnostic accuracy data. Additionally, some recently developed methods for the analysis of clustered diagnostic accuracy data and methods for meta-analysis are discussed. There are 12 chapters, divided into two parts: Part I. Basic Concepts and Methods (Chapters 2–7); Part II. Advanced Methods (Chapters 8–12). Chapter headings: 1. Introduction; 2. Measures of diagnostic accuracy; 3. The design of diagnostic accuracy studies; 4. Estimation and hypothesis testing in single samples; 5. Comparing the accuracy of two diagnostic tests; 6. Sample size calculations; 7. Issues in meta-analysis for diagnostic tests; 8. Regression analysis for independent Receiver Operating Characteristic (ROC) data; 9. Analysis of correlated ROC data; 10. Methods for correcting verification bias; 11. Methods for correcting imperfect standard bias; 12. Statistical methods for meta-analysis.

Categorical Data Analysis. By Alan Agresti, Wiley, 2002, xv + 710 pp., $89.95

This is the second edition of a volume in the Wiley Series in Probability and Statistics, first published in 1990. Each chapter has been extensively rewritten for this edition. The book gives an overview of methods for analyzing categorical data, both older, now standard methods, and methods developed in recent years. It gives special emphasis to generalized linear modeling techniques, which extend linear model methods for continuous variables, and their extensions for multivariate responses. Chapters 1–7 could form the essence of a course on the subject. Chapters 1–3 cover distributions for categorical responses and traditional methods for two-way contingency tables. Chapters 4–7 introduce logistic regression and related logit models for binary and multicategory response variables. Chapters 8 and 9 cover loglinear models for contingency tables. A major area of new research in the past decade has concerned the development of methods for repeated measurement and other forms of clustered categorical data. Chapters 10–13 present these methods, including marginal models and generalized linear mixed models with random effects. Chapters 14 and 15 present theoretical foundations as well as alternatives to the maximum likelihood paradigm adopted in this text. Chapter 16 is a historical overview of the subject. Chapter headings: 1. Introduction: distributions and inference for categorical data; 2. Describing contingency tables; 3. Inference for contingency tables; 4. Introduction to generalized linear models; 5. Logistic regression; 6. Building and applying logistic regression models; 7. Logit models for multinomial responses; 8. Loglinear models for contingency tables; 9. Building and extending loglinear/logit models; 10. Models for matched pairs; 11. Analyzing repeated categorical response data; 12. Random effects; generalized linear mixed models for categorical responses; 13. Other mixture models for categorical data; 14. Asymptotic theory for parametric models; 15. Alternative estimation theory for parametric models; 16. Historical tour of categorical data analysis. There is a bibliography of about 900 items.

Time Series—Applications to Finance. By Ngai Hang Chan, Wiley-Interscience, 2002, xiii + 203 pp.

This is a volume in the Wiley Series in Probability and Statistics. It was originally designed for a six-week, three-hour course in the Masters of Science in Computational Finance program at Carnegie Mellon University. It emphasizes the following features: the first seven chapters cover the standard topics in time series, but at a much higher and more succinct level than in the usual introductory courses; many recent developments in nonstandard time series techniques, such as the univariate and multivariate generalized autoregressive conditional heteroskedastic (GARCH) model, state space modelling, cointegrations, and common trends, are all discussed and illustrated with real finance examples in the last six chapters; to the extent possible, almost all examples are illustrated through Splus programs, with detailed analyses and explanations of the Splus commands. Chapter headings: 1. Introduction; 2. Probability models; 3. Autoregressive moving average models; 4. Estimation in the time domain; 5. Examples in Splus; 6. Forecasting; 7. Spectral analysis; 8. Nonstationarity; 9. Heteroskedasticity; 10. Multivariate time series; 11. State space models; 12. Multivariate GARCH; 13. Cointegrations and common trends.

The Statistical Analysis of Failure Time Data. By John D. Kalbfleisch and Ross L. Prentice, Wiley-Interscience, 2002, xiii + 439 pp., $84.95

This volume in the Wiley Series in Probability and Statistics is the second edition of the well-known standard text first published in 1980. The authors have attempted to preserve the features of a fairly elementary and classical likelihood-based presentation of failure time models and methods while integrating the counting process notation and related martingale theory. This is done by using classical notation and descriptions throughout the first four chapters while introducing the reader to key estimating functions and estimators in a notation involving counting processes and stochastic integration (see chapter headings below). A new chapter 5 provides a more systematic introduction to counting processes and martingale convergence results and describes how they can be applied to yield asymptotic results for many of the statistical methods discussed in the first four chapters. Chapter 6 is devoted to general concepts of likelihood and partial likelihood construction, especially in relation to time-dependent and evolving covariate histories. Chapter 7 (like the previous edition's chapter 6) treats the semi-parametric log-linear or accelerated failure time model. Like the previous chapter 7, chapters 8 through 10 are devoted to aspects of multivariate failure time data analysis, including competing, multistate failure time and recurrent event modeling and estimation, and correlated failure time methods. Chapter 11 is devoted to more specialized topics, such as risk set sampling, missing and mismeasured covariate data, sequential testing and estimation, and Bayesian methods, mostly in the context of the Cox model. There is a bibliography of about 500 items. Chapter headings: 1. Introduction; 2. Failure time models; 3. Inference in parametric models and related topics; 4. Relative risk (Cox) regression models; 5. Counting processes and asymptotic theory; 6. Likelihood construction and further results; 7. Rank regression and the accelerated failure time model; 8. Competing risks and multistate models; 9. Modeling and analysis of recurrent event data; 10. Analysis of correlated failure time data; 11. Additional failure time data topics. There are two appendices, one with some data sets, and one with supporting material: a review of the EM algorithm and remarks on failure time software, including references to SAS, S-Plus, BMDP, and SPSS literature.

Applied Latent Class Analysis. Edited by Jaques A. Hagenaars and Allan L. McCutcheon, Cambridge University Press, 2002, xxii + 454 pp., $85.00

Latent class analysis is frequently used when the researcher has a set of categorically scored observed measures that are highly interrelated. The latent class model—which is often characterized as the categorical data analog to factor analysis—is most appropriately used when the observed indicator variables are associated because of some underlying unobserved factor rather than being causally related. In addition to the preface by the editors, sketching the history of the subject, and providing a detailed summary and analysis of the contents of the book, the book's fifteen chapters are divided into four parts. The first part, I. Introduction, consists of two papers introducing the subject: 1. Latent class analysis—the empirical study of latent types, latent variables, and latent structures, by Leo A. Goodman, and 2. Basic concepts and procedures in single- and multiple-group latent class analysis, by Allan L. McCutcheon. The other parts are: II. Classification and measurement (5 papers); III. Causal analysis and dynamic models (4 papers); IV. Unobserved heterogeneity and nonresponse. There are three appendices on notational conventions, further readings, and selected software (including reference to the book's webpage), respectively.

Statistical Models and Methods for Lifetime Data. By Jerald F. Lawless, Wiley, 2002, xx + 630 pp., $94.95

This is a volume in the Wiley Series in Probability and Statistics. It is the second edition of the standard text first published in 1982 and has been rewritten to reflect new developments in methodology, theory, and computing. The subject is again covered without concentrating exclusively on any specific field of application, though most examples are drawn from engineering and the biomedical sciences. There is a strong emphasis on parametric models, but non- and semiparametric methods are also given detailed treatments. Likelihood-based inference procedures are emphasized and serve to unify the methodology; implementation using both special lifetime data software and general optimization software is discussed. Among changes from the first edition, there are expanded discussions of observation schemes and censoring and of multiple failure modes. Several new topics have been introduced, including counting process martingale tools, resampling and simulation methodology, estimating function methods, treatments of interval censored and truncated data, and discussions of multivariate lifetimes and event history models. Chapter 1 contains introductory material on lifetime distributions and surveys important models. Chapter 2 deals with observation schemes for lifetime data and the formation of likelihoods functions. Chapter 3 discusses graphical methods and nonparametric estimation of distribution characteristics based on different types of lifetime data. Chapter 4 introduces inference procedures for parametric models, including exponential, gamma, inverse Gaussian, and mixture models. Chapter 5 provides corresponding procedures for log-location-scale models and extensions to them; the Weibull, log-normal, and log-logistic models are treated in detail. Chapter 6 discusses regression models, exploratory and diagnostic methods, and develops inference procedures for parametric models. Chapter 7 deals with semiparametric methodology for proportional or multiplicative hazards models. Chapter 8 presents rank-based and semiparametric procedures based on location-scale models. Chapter 9 gives a thorough treatment of multiple failure modes, or competing risks. Chapter 10 discusses goodness-of-fit tests and describes procedures for specific models in the book. Finally, Chapter 11 introduces several important topics that go beyond univariate survival analysis: multivariate lifetime models, sequences of lifetimes, event history processes, and joint models for lifetimes and coprocesses. It is shown how the methods of previous chapters can be applied to many problems in these areas. Each chapter concludes with bibliographic and computational notes, and the bibliography contains about 800 items.

Models for Investors in Real World Markets. By James R. Thompson, Edward E. Williams, and M. Chapman Findlay III, Wiley, 2003, xxi + 372 pp., $84.95

This is a volume in the Wiley Series in Probability and Statistics. The philosophy underlying it is that the writers during the 1930s–1960s period (from Ben Graham to J. M. Keynes) were trying to confront real problems and had good ideas, but lacked modern analytical tools, large databases, and the vast computational power currently available. The aim of the authors is to address these problems using modern tools. In chapter 1 (Introduction and the institutional environment), they outline some of the basic institutional factors associated with the way stock markets operate and raise questions as to whether these markets are efficient. In chapter 2 (Some conventional building blocks), the reader is introduced to the basic concepts of utility theory. Chapter 3 (Diversification and portfolio selection) illustrates why diversification is an important fundamental requirement of rational investment choice. The materials in chapters 4 (Capital market equilibrium theories) and 5 (Equilibrium implying efficiency: the neoclassical fantasy) provide a summary of the current theory as generally accepted in financial economics along with an extensive critique of that theory. Chapter 6 (More realistic paradigms for investment) examines the basic valuation equations derived by J. B. Williams seventy years ago. Chapters 7 (Security analysis) and 8 (Empirical financial forecasting) provide a detailed procedure for analyzing securities. Chapter 9 (Stock price growth as noisy compound interest) examines the importance of compound interest and observes that growth is merely noisy compound interest. Chapter 10 (Investing in real world markets: returns and risk profiles) continues the authors' conceptualisation of risk profiling and applies the idea to bundles of securities (i.e., portfolios). The options market is introduced and analyzed in chapter 11 (Common stock options) as a way of considering the notion of risk. Chapter 12 (Summary: some unsettled–unsettling–questions, and conclusions) offers a short summary of the book and draws the authors' conclusions. An appendix provides a brief introduction to probability and statistics, including the Wiener process, and parametric and resampling simulation.

Elements of Applied Stochastic Processes. By U. Narayan Bhat and Gregory K. Miller, Wiley, 2002, xi + 461 pp., $94.95

This is a volume in the Wiley Series in Probability and Statistics. This is the third edition of a book first published in 1972, with the second edition in 1984. In this edition, the authors no longer saw a need for separate chapters for each application, but the applied problems have been given as illustrations in two separate chapters, and some have been absorbed in the theoretical chapters. An unusual and attractive feature of the book is its inclusion of inference procedures for Markov and stationary processes. Chapter headings: 1. Stochastic processes: description and definitions; 2. Markov chains; 3. Irreducible Markov chains with ergodic states; 4. Branching processes and other special topics; 5. Statistical inference for Markov chains; 6. Applied Markov chains; 7. Simple Markov processes; 8. Statistical inference for simple Markov processes; 9. Applied Markov processes; 10. Renewal processes; 11. Stationary processes and time series analysis; 12. Simulation and Markov chain Monte Carlo.

Cross-Cultural Survey Methods. Edited by Janet A. Harkness, Fons J. R. Van de Vijver, and Peter Ph. Mohler, Wiley, 2003, x + 419 pp., $89.95

This is a volume in the Wiley Series in Survey Methodology. It contains the proceedings of the Third ZUMA Symposium on Cross-Cultural Survey Methods (ZUMA = Zentrum für Umfragen, Methoden und Analysen) held in Mannheim, Germany. There are 21 chapters divided into five parts: I. Introduction; II. Design and implementation; III. Error and comparative surveys; IV. Analysis of comparative data; V. Documentation and secondary analysis.

Case Studies in Reliability and Maintenance. Edited by Wallace R. Blischke and D. N. Prabhakar Murthy, Wiley, 2003, xxiii + 661 pp., $99.95

This is a volume in the Wiley Series in Probability and Statistics. The 27 chapters of the handbook are divided into an Introduction and Overview, and six parts: I. Cases with emphasis on product design; II. Cases with emphasis on development and testing; III. Cases with emphasis on defect prediction and failure analysis; IV. Cases with emphasis on maintenance and maintainability; V. Cases with emphasis on operations optimization and reengineering; VI. Cases with emphasis on product warranty.

Subjective and Objective Bayesian Statistics—Principles, Models and Applications. By S. James Press, Wiley, 2003, xxx + 558 pp., $89.95

This is a volume in the Wiley Series in Probability and Statistics. It is the second edition of a book first published in 1989, but really a new book, not merely the first edition with a few changes inserted. It is a completely restructured book with major new chapters and material: there are 16 chapters instead of eight, and seven appendices instead of four. One direction of growth of Bayesian statistics is a new method, now called Markov chain Monte Carlo, for applying and implementing Bayesian procedures numerically. Another important direction of growth arises from the recognition of the distinction between subjective and objective prior information, explored in detail in the new edition. Other new aspects include the incorporation of uncertainty regarding which model to choose in a Bayesian analysis of data by using Bayesian model averaging, Bayesian modeling in a hierarchical way to represent nested degrees of uncertainty about a problem, and exploratory factor analysis. Also new in this edition is an extensive listing, by field, of some of the applications that have been made of the Bayesian approach. The sixteen chapters are divided into four parts. Part I: Foundations and principles. 1. Background; 2. A Bayesian perspective on probability; 3. The likelihood function; 4. Bayes' theorem; 5. Prior distributions. Part II: Numerical implementation of the Bayesian Paradigm. 6. Markov chain Monte Carlo methods (by Siddhatha Chib); 7. Large sample posterior distributions and approximations. Part III: Bayesian Statistical Inference and Decision Making. 8. Bayesian estimation; 9. Bayesian hypothesis testing; 10. Predictivism; 11. Bayesian decision making. Part IV: Models and Applications. 12. Bayesian inference in the general linear model; 13. Model averaging; 14. Hierarchical Bayesian modeling; 15. Bayesian factor analysis; 16. Bayesian inference in classification and discrimination. Appendices: 1. Thomas Bayes, by Hilary Seal; 2. Thomas Bayes: a bibliography, by George A. Barnard; 3. Communication of Bayes' essay to the Philosophical Transactions of the Royal Society of London, by Richard Price; 4. An essay towards solving a problem in the doctrine of chances, by the Reverend Thomas Bayes; 5. Applications of Bayesian statistical science; 6. Selecting the Bayesian Hall of Fame; 7. Solutions to selected exercises. There is a bibliography with approximately 450 entries.

Statistical Analysis with Missing Data. By Roderick J. A. Little and Donald B. Rubin, Wiley, 2002, xv + 381 pp., $94.95

This is the second edition of a volume in the Wiley Series in Probability and Statistics. When the first edition was written in the mid-1980s, a weakness in the literature was that missing-data methods were mainly confined to the derivation of point estimates of parameters and approximate standard errors, with interval estimation and testing based on large-sample theory. Since that time, Bayesian methods for simulating posterior distributions have received extensive development, and these developments are reflected in this edition. The closely related technique of multiple imputation also receives greater emphasis than in the first edition. Part II includes extensions of the EM algorithm, not available at the time of the first edition, and more Bayesian theory and computation. Applications of the likelihood approach have been assembled in a new Part III. The 15 chapters are now divided into three parts: Part I. Overview and Basic Approaches. 1. Introduction; 2. Missing data in experiments; 3. Complete-case and available-case analysis, including weighted methods; 4. Single imputation methods; 5. Estimation of imputation uncertainty. Part II. Likelihood-based Approaches to the Analysis of Missing Data. 6. Theory of inference based on the likelihood function; 7. Factored likelihood methods, ignoring the missing-data mechanism; 8. Maximum likelihood for general patterns of missing data: introduction and theory with ignorable responses; 9. Large-sample inference based on maximum likelihood estimates; 10. Bayes and multiple imputation. Part III. Likelihood-based Approaches to the Analysis of Incomplete Data: Some Examples. 11. Multivariate normal examples, ignoring the missing-data mechanism; 12. Robust estimation; 13. Models for partially classified contingency tables, ignoring the missing-data mechanism; 14. Mixed normal and non-normal data with missing values, ignoring the missing-data mechanism; 15. Nonignorable missing-data models. There is a bibliography of about 330 items.

Theory and Applications of Long-Range Dependence. Edited by Paul Doukhan, George Oppenheim, and Murad S. Taqqu, Birkhäuser, 2003, x + 719 pp., $89.95

Long-range dependence concerns time-series models for phenomena in which correlations decay like a power law, thus much more slowly than in ARMA models. The subject started with Kolmogorov's work on the fractional Brownian motion model in the 1940s, with Mandelbrot using it and its increments in the 1960s to generate long-range dependence and pointing out its relevance to applications. The theoretical developments of long-range dependence have continued since then in the work of Yaglom, Rosenblatt, Major, Dobrushin, Taqqu, Surgailis, Giriatis, Robinson, and many others. The present volume contains 28 surveys of the field, treating and merging both theory and applications, giving a global picture of the field. The papers are grouped into four parts: I. Probabilistic Aspects; II. Statistical Aspects; III. Applications to Telecommunications, Economics, Hydrology, and Turbulence; IV. Practical Methodologies.

The Evolution Problem in General Relativity. By Sergiu Klainerman and Francesco Nicolo, Birkhäuser, 2003, xii + 383 pp., $74.95

The main goal of this work is to revisit the proof of the global stability of Minkowski space by D. Christodoulou and S. Klainerman (1993). It provides a new self-contained proof of the main part of that result, which concerns the full solution of the radiation problem in vacuum, for arbitrary asymptotically flat initial data sets. This can also be interpreted as a proof of the global stability of the external region of Schwarzschild spacetime.

Annual Review of Genomics and Human Genetics, Volume 3, 2002. Edited by Eric Lander, David Page, and Richard Lifton. Annual Reviews, 2002, viii + 459 pp.

This volume contains an introductory paper "A Personal History of the Mouse Genome" by Mary F. Lyon and fifteen surveys of recent work in the field. Among the titles are: Human migrations and population structure: what we know and why it matters; Structuring the universe of proteins; Molecular mechanisms for genomic disorders: Databases and tools for browsing genomes; Genetic "code": representations and dynamical models of genetic components and networks; Patenting genes and genetic research tools: good or bad for innovation? Deciphering the genetic basis of Alzheimer's disease; Developmental genomic approaches in model organisms.

Statistical Mechanics. By Franz Schwabl. Springer, 2002, xvi + 573 pp., $69.95

This is a translation, by William Brewer, of the original German edition, published in 2000. Its goal is to give a deductive presentation of the statistical mechanics of equilibrium systems based on a single hypothesis—the form of the microcanonical density matrix—as well as to treat the most important aspects of non-equilibrium phenomena. Also, it attempts to demonstrate the breadth and variety of the applications of statistical mechanics. Modern areas, such as renormalization group theory, percolation, stochastic equations of motion and their applications in critical dynamics, are treated. Chapter headings: 1. Basic principles; 2. Equilibrium ensembles; 3. Thermodynamics; 4. Ideal Quantum gases; 5. Real gases, liquids, and solutions; 6. Magnetism; 7. Phase transitions, renormalization group theory, and percolation; 8. Brownian motion, equations of motion and the Fokker-Planck equations; 9. The Boltzmann equation; 10. Irreversibility and the approach to equilibrium. There are nine appendices covering physical and mathematical background material.

Modeling and Inverse Problems in Image Analysis. By Bernard Chalmond. Springer, 2003, xxii + 309 pp., $69.95

This is volume 155 in the series Applied Mathematical Sciences. It is concerned with two types of models: bayesian models, derived from probability theory, and energy-based models, derived from physics and mechanics. It compares their hypotheses, discusses their merits, and suggests possible fields of application, and is divided into three parts. The first deals with the processing of spline functions, interpolation, classification, and auto-associative models, including the Bayesian interpretation of splines. The second part is concerned with inverse problems considered as Markovian energy optimization. The third part is devoted to detailed analyses of some specific imaging problems. Table of contents: 1. Introduction; Part I. Spline Models: 2. Nonparametric spline models; 3. Parametric spline models; 4. Auto-associative models; Part II. Markov Models: 5. Fundamental aspects; 6. Bayesian estimation; 7. Simulation and optimization; 8. Parameter estimation; Part III. Modeling in Action: 9. Model building; 10. Degradation in imaging; 11. Detection of filamentary entities; 12. Reconstruction and projections; 13. Matching. There is a bibliography of 189 items.

Numerical Analysis in Modern Scientific Computing. By Peter Deuflhard and Andreas Hohmann, Springer, 2003, xviii + 337 pp., $49.95

This is the second edition of volume 43 in the series Texts in Applied Mathematics. The book has been generally revised for this edition; the essential new item is a section on stochastic eigenvalue problems. It is an introductory textbook addressed to students in the mathematical sciences and engineering, and to practitioners who wish to get acquainted with modern concepts of numerical analysis and scientific computing. Chapter headings: 1. Linear systems; 2. Error analysis; 3. Linear least-squares problems; 4. Nonlinear systems and least-squares problems; 5. Linear eigenvalue problems; 6. Three-term recurrence relations; 7. Interpolation and approximation; 8. Large symmetric systems of equations and eigenvalue problems; 9. Definite integrals.

High-Order Methods for Incompressible Fluid Flow. By M. O. Deville, P. F. Fisher, and E. H. Mund, Cambridge University Press, 2002, xxvii + 499 pp., $80.00

This is volume 9 in the series Cambridge Monographs on Applied and Computational Mathematics. It is intended to be an advanced textbook on higher-order methods applied to incompressible fluid flow problems. It is not aimed at mathematical proofs of convergence, but rather at practical applications and results achievable with large-scale computing capabilities. The goal is to show the reals of feasibility of high-order methods: accuracy versus efficiency, tractable problems, nonlinearities, complex geometrical configurations, and the influence of computer architectures. The focus is on high-order methods in physical space, namely, collocation and spectral elements. Chapter headings: 1. Fluid mechanics and computation: an introduction; 2. Approximation methods for elliptic problems; 3. Parabolic and hyperbolic problems; 4. Multidimensional problems; 5. Steady Stokes and Navier-Stokes equations; 6. Unsteady Stokes and Navier-Stokes equations; 7. Domain decomposition; 8. Vector and parallel implementations. Appendices: A. Preliminary mathematical concepts; B. Orthogonal polynomials and discrete transforms. There is a bibliography of 424 items.

Boundary Element Programming in Mechanics. By Xiao-Wei Gao and Trevor G. Davies, Cambridge University Press, 2002, xvi + 254 pp., $75.00

The essence of this book is the three-dimensional nonlinear computer code for boundary element analysis of solid continua provided on the CD-Rom accompanying it. The software described in the book offers a powerful alternative to existing methods (e.g., finite elements), especially for three-dimensional applications. The chapters describing the code and background are divided into two parts. Part I. Linear problems: 1. Introduction; 2. Theory of elasticity; 3. Boundary integral equations for elasticity; 4. Numerical implementations; 5. The elastic program code; 6. Linear applications; Part II. Nonlinear problems: 7. Rate-independent plasticity theory; 8. Boundary integral equations in elasto-plasticity; 9. Numerical implementation; 10. The elasto-plastic program code; 11. Nonlinear applications; 12. Epilogue. There are eight appendices: A. Derivation of kernel functions; B. Shape functions; C. Degenerate elements: singular mapping; D. Elasto-plastic flow theory; E. Domain integral formulations; F. Solution of the nonlinear system equations; G. Elements of elasto-plasticity; H. Description of input data.