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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 which 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 Stromung zaher 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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Robust Regression and Outlier Detection. By Peter J. Rousseeuw and Annick M. Leroy. John Wiley & Sons, New York, 1987. pp. xiv+329. $36.95.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. The authors emphasize methods with high breakdown point, which are able to cope with a large fraction of outliers. The "high breakdown" objective could be considered a kind of third generation robustness theory, coming after minimax variance (Huber) and influence function (Hampel). The emphasis is on the methods the authors have worked on themselves, although many other estimators are discussed. They advocate the least median of squares method because it appeals to the intuition and is easy to use. The primary aim of their work is to make robust regression available for everyday statistical practice. The book has been written from an applied perspective, and the technical material is concentrated in a few sections, which may be skipped without any loss of understanding. Chapter headings: 1. Introduction. 2. Simple regression. 3. Multiple regression. 4. The special case of one-dimensional location. 5. Algorithms. 6. Outlier diagrams. 7. Related statistical techniques.

Field Arithmetic. By Michael D. Fried and Moshe Jarden. Springer-Verlag, New York, 1986. pp. xvi+458.

This is volume eleven of the 3rd "Folge" of the series "Ergebnisse der Mathematik und ihrer Grenzgebiete". Its topic is the use of algebraic tools—coming mainly from algebraic geometry, number theory, and the theory of profinite groups—in the study of the elementary properties of classes of fields, and related algorithm problems. Chapter headings: 1. Infinite Galois theory of profinite groups. 2. Algebraic function fields of one variable. 3. The Riemann hypothesis for function fields. 4. Plane curves. 5. The Cebotarev density theorem. 6. Ultra products. 7. Decision procedures. 8. Algebraically closed fields. 9. Elements of algebraic geometry. 10. Pseudo algebraically closed fields. 11. Hilbertian fields. 12. The classical Hilbertian fields. 13. Nonstandard structures. 14. Nonstandard approach to Hilbert's irreducibility theorem. 15. Profinite groups and Hilbertian fields. 16. The Haar measure. 17. Effective field theory and algebraic geometry. 18. The elementary theory of e-free PAC fields. 19. Examples and applications. 20. Projective groups and Frattini covers. 21. Perfect PAC fields of boundary corank. 22. Undecidability. 23. Frobenius fields. 24. On w-free PAC fields. 25. Galois stratification. 26. Galois stratification over finite fields.

Statistical Methods for the Analysis of Biomedical Data. By Robert F. Woolson. John Wiley & Sons, New York, 1987. pp. xx+513.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It was written with two audiences in mind. First, the book may fill the needs of medical researchers who would like to reference a book that is more substantial than an introductory biostatistical text. Second, it may be used as a textbook for an introductory sequence in biostatistics, particularly for majors in biostatistics and statistics. Chapter headings: 1. Introduction. 2. Descriptive statistics. 3. Basic probability concepts. 4. Further aspects of probability for statistical inference: sampling, probability distributions, and sampling distributions. 5. Confidence intervals and hypothesis testing: general considerations and applications. 6. Comparison of two groups: t-tests and rank tests. 7. Comparison of two groups: Chi-square and related procedures. 8. Tests of independence and measures of association for two random variables. 9. Least-square regression methods: predicting one variable from another. 10. Comparing more than two groups of observations: analysis of variance for comparing groups. 11. Comparing more than two groups of observations: rank analysis of variance for group comparisons. 12. Comparing more than two groups of observations: Chi-square and related procedures. 13. Special topics in analysis of epidemiologic and clinical data: studying association between a disease and a characteristic. 14. Estimation and comparison of survival curves.

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Drawing Inferences from Self-Selected Samples. Edited by Howard Wainer. Springer-Verlag, New York, 1986. pp. xii+163. $18.50

In addition to an introduction and overview by the editor, this book contains four chapters with discussions on each. The first chapter (The SAT as a Social Indicator, by H. Wainer) describes why one might want to draw inferences from college entrance examinations and points out some of the problems involved in the current approaches. The second chapter (Self-Selection and Performance-Based Ratings, by Burton Singer) presents a history of Methadone Maintenance Treatments. The third chapter (Alternation Methods for Solving the Problem of Selection Bias in Evaluating the Impact on Outcome, by James Heckman and Richard Robb) provides a description of one methodology—selection modelling—to begin to deal with these problems. The last chapter (Selection Modelling versus Mixture Modelling with Nonignorable Nonresponse, by Robert Glynn, Nan Laird and Donald Rubin) compares the selection modelling approach with Rubin's (1977) method of mixture modelling. The chapters are followed by discussions by John Hartigan, John Tukey, and Paul Holland.

Amorphous Polymers and Non-Newtonian Fluids. Edited by C. Dafermos, J. L. Ericksen and D. Kinderlehrer. Springer-Verlag, New York, 1987. pp. i+187.

This is volume 6 of the IMA Volumes in Mathematics and Its Applications. It is in part the proceedings of a workshop held in conjunction with the 1984–85 Program at the Institute of Mathematics and its Applications, University of Minnesota, entitled Continuum Physics and Partial Differential Equations. There are ten papers by R. Bird, B. Caswell, C. Dafermos, D. D. Joseph, E. A. Kearsley, M. Marcus and V. J. Mizel, J. A. Nohel and M. J. Renardy, Y. Rabin, M. J. Renardy and W. Hrusa, and R. P. Wool.

Global Analysis on Foliated Spaces. By Calvin C. Moore and Claude Schochet. Springer-Verlag, New York, 1988. pp. i+337. $34.00.

This is volume 9 of Mathematical Research Institute Publications. It grew out of lectures by the first-named author at UC Berkeley and by the second-named author at UCLA, both in 1980. The book develops a variety of aspects of analysis and geometry on foliated spaces which should be useful in many contexts. These strands are then brought together to provide a context and to expose Connes' index theorem for foliated spaces, a theorem which asserts the equality of the analytic and the topological index (two real numbers) which are associated to a tangentially elliptic operator. Chapter headings: 1. Locally traceable operators. 2. Foliated spaces. 3. Tangential cohomology. 4. Transverse measures. 5. Characteristic classes. 6. Operator algebras. 7. Pseudodifferential operators. 8. The index theorem.

Theory and Analysis of Sample Survey Designs. By Daroga Singh and F. S. Chaudhary. A Halsted Press Book: John Wiley & Sons, New York, 1986. pp. xi+380. $24.95.

This book has been prepared as a reference manual for project planning and data analysis, and as a text book for graduate students. Its scope is indicated by its table of contents: 1. Basic concept of sample surveys. 2. Basic methods of simple random sampling. 3. Stratified random sampling. 4. Systematic random sampling. 5. Varying probability sampling. 6. Ratio estimators. 7. Regression estimators. 8. Cluster sampling. 9. Multi-stage sampling. 10. Multi-phase sampling. 11. Successive sampling. 12. Sequential sampling. 13. Non-sampling errors.

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Medical Uses of Statistics. Edited by John C. Bailar and Frederick Mosteller. NEJM Books, Waltham, Mass., 1986. pp. xxvi+425.

This volume is one of the products of a project started in 1977, designed to investigate how statistical techniques were being applied in current clinical studies, as exemplified by research papers published in recent volumes of the New England Journal of Medicine and some other important medical journals. Of the 20 chapters collected in this book, 13 have been published in the Journal and seven were written as part of the project. The orientation of the book is toward an understanding of ideas—when and why to use certain statistical techniques—and it does not concern itself with the details of statistical conclusions. The authors write in a straightforward style, aiming to make the book understandable to nonspecialists. The twenty chapters are divided into six groups: 1. Broad concepts and analytic techniques. 2. Design. 3. Analysis. 4. Communicating results. 5. Communicating among experts. 6. Reviews and meta-studies.

For All Practical Purposes. W. H. Freeman and Company, New York, 1988. pp. xii+450. $28.95.

This is the companion volume to the 26 part Public Broadcasting Service series with the same title, whose project director is Solomon Garfinkel of the Consortium for Mathematics and its Applications. It focuses on five areas—business management, statistics, social choice, the measurement of size and shape, and computers—in which a knowledge of mathematics can help readers better understand important issues that affect their personal, political, and economic existence. It aims to teach the fundamentals of key areas of mathematics by putting them in contexts familiar to all.

Statistical Analysis of Spherical Data. By N. I. Fisher, T. Lewis, and B. J. J. Embleton. Cambridge University Press, New York, 1987. pp. xiv+329. $65.00.

The analysis of data in the form of directions in space is required in many contexts of earth sciences, astrophysics, and other fields. While the contexts vary, the statistical methodology required is common to most of these data situations. Some methods date back to the beginning of the century, but the main developments have been from about 1950 onwards. A large body of results and techniques is now disseminated throughout the literature. This book aims to present a unified and up-to-date account of these methods for practical use. It is directed both to students and research workers, but priority has been given to providing a manual to the working scientist. Statistical notions are spelled out in some detail, whereas statistical theory underlying the method is, by and large, not included; for the statistician, references are given to this theory, and to related work. Chapter headings: 1. Introduction. 2. Terminology and spherical coordinate systems. 3. Descriptive and ancillary methods, and sampling problems. 4. Models. 5. Analysis of a single sample of unit vectors. 6. Analysis of a single sample of undirected lines. 7. Analysis of two or more samples of vectorial or axial data. 8. Correlation, regression and temporal/spatial analysis.

Chaotic Vibrations: An Introduction for Applied Scientists and Engineers. By Francis C. Moon. John Wiley & Sons, New York, 1987. pp. xv+309. $39.95.

It is the purpose of this book to help translate mathematical ideas and techniques of its subject into language that engineers and applied scientists can use to study chaotic vibrations and to explain the relevance of this new language of dynamics—strange attractors, Poincaré maps, fractional dimension—to engineers, especially those who must study and measure vibrations. The author believes that these new geometric and topological concepts in dynamics will become part of the laboratory tools in vibration analysis in the same way that Fourier analysis has become a permanent part of engineering experimental technique. He assumes, as background, only ordinary differential equations, intermediate-level dynamics and vibration or systems dynamics courses. Chapter headings: 1. Introduction: A new age of dynamics. 2. How to identify chaotic vibrations. 3. A survey of systems with chaotic vibrations. 4. Experimental methods in chaotic vibrations. 5. Criteria for chaotic vibrations. 6. Fractional concepts in nonlinear dynamics.

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Traffic Processes in Queueing Networks: A Markov Renewal Approach. By Ralph L. Disney and Peter C. Kiessler. The Johns Hopkins University Press, Baltimore, 1987. pp. xix+251. $49.50.

This book is concerned specifically with traffic processes in queueing networks. Chapter 1 briefly discusses what queueing theory is all about so that the idea of a queueing network can be introduced. Chapter 2 collects several topics related to Markov renewal processes that are needed for study of traffic in queueing networks. Chapter 3 attempts to motivate the later work by presenting several examples. Chapter 4 begins with a Markov process whose countable state space includes a vector of queue length processes. These processes include Jackson (1959) networks as well as networks with Erlang service times. Then, by defining appropriate subsets of states and their entrance times (using the idea of traffic sets), the authors study traffic processes. It is shown that these traffic processes are Markov renewal processes, and their kernels are given. Using reversibility or dynamic reversibility arguments, the authors are then able to relate processes to each other. Chapter 5 ties together the ideas of a traffic set and a switching process. Chapter 6 provides a detailed study of traffic processes in several small networks, allowing a study of problems whose basic process is not necessarily a Markov process on a countable state space. In Chapter 7 the authors explore cross-correlational properties of two traffic processes. The basic idea here is to take one process with known properties, decompose it using various decompositional rules and study the correlational structure for the processes emanating from the switch. Chapter headings: 1. Introduction. 2. Background. 3. Examples of traffic processes. 4. Traffic processes in Markov networks. 5. The decomposition of traffic processes. 6. Output processes.

Stochastic Simulation. By Brian D. Ripley. John Wiley & Sons, New York, 1987. pp. xi+237. $32.95.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is intended for statisticians, operations researchers, and all those who use simulation in their work and need a comprehensive guide to the state of knowledge about simulation methods. It is a comprehensive guide, but most of the chapters contain explicit recommendations of methods and algorithms. Although simulation is easy to perform, some of the methods are subtle and their analysis is often complicated. Except for Chapter 2 on the theory of random number generators, the general mathematical level of the book is elementary. Chapter headings: 1. Aims of simulation. 2. Pseudo-random numbers. 3. Random variables. 4. Stochastic models. 5. Variance reduction. 6. Output analysis. 7. Uses of simulation.

Statistical Decision and Related Topics IV. Edited by S. S. Gupta and J. O. Berger. Springer-Verlag, New York, 1988. Vol. 1, pp. xii+418. Vol. 2, pp. xvi+399. $32.00 each volume.

These two volumes constitute the Proceedings of the Fourth Purdue Symposium on Statistical Decision Theory and Related Topics, June 15–20, 1986. There are 65 invited papers and discussions, which are grouped under the following headings: Volume I: 1. Conditioning and likelihood. 2. Bayes and empirical Bayes analysis. 3. Decision-theoretic estimation. Volume II: 1. Selection, ranking and multiple comparisons. 2. Asymptotic and sequential analysis. 3. Estimation and testing. 4. Design, and comparison of experiments and distribution.

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Introduction to Random Processes. Yuri A. Rozanov. Springer-Verlag, New York, 1987. pp. viii+117. $35.00.

This is part of the Springer Series in Russian Mathematics, and is translated by Birgit Röthinger; it was first published in Russian in 1982. It is an introduction to random processes, using relatively simple mathematical models which are, however, important in applications. Chapter headings: 1. Random processes with discrete state space. Examples. 2. Homogeneous Markov processes with a countable number of states: Kolmogorov's differential equations. 3. Homogeneous Markov processes with a countable number of states: Convergence to a stationary distribution. 4. Branching processes. Method of generating functions. 5. Brownian motion. The diffusion equation and some properties of the trajectories. 6. Random processes in multi-server systems. 7. Random processes as a function in Hilbert space. 8. Stochastic measures and integrals. 9. The stochastic Ito integral and stochastic differentials. 10. Stochastic differential equations. 11. Diffusion processes: Kolmogorov's differential equations. 12. Linear stochastic differential equations and linear random processes. 13. Stationary processes. Spectral analysis and linear transformations. 14. Some problems of optimal estimation. 15. A filtration problem. Kalman–Bucy filter.

Kleinian Groups. By Bernard Maskit. Springer-Verlag, New York, 1988. pp. xiii+326.

This is volume 287 of Grundlehren der mathematischen Wissenschaften, a Series of Comprehensive Studies in Mathematics. It was designed to be usable as a textbook for a one-year advanced graduate course in Kleinian groups, the modern theory of which started with the work of Lars Ahlfors and Lipman Bers. Except for Chapter 3 (included as a reference for facts about regular covering of surfaces) and Chapter 8 (a collection of Kleinian groups), one could follow the material in the order given for such a course. Chapter headings: 1. Fractional linear transformations. 2. Discontinuous groups in the plane. 3. Covering spaces. 4. Groups of isometries. 5. The geometric basic groups. 6. Geometrically finite groups. 7. Combination theorems. 8. A trip to the zoo. 9. B-groups. 10. Function groups.

Correlation Theory of Stationary and Related Random Functions: Volume II: Supplementary Notes and References. By A. M. Yaglom. Springer-Verlag, New York, 1987. pp. vii+258. $56.50.

This is a volume in the Springer Series in Statistics. The material of this volume supplements that of volume 1 (previously noted in these pages). The central place is occupied by some 400 notes to some statements in volume 1. Some give a more detailed mathematical derivation of results whose proofs are only briefly outlined, or altogether omitted, in volume 1. Others contain generalizations of results in volume 1 or references to sources. Still others deal with the history of questions at hand or contain additional examples of new interesting applications. There is also a bibliography occupying 59 pages.

Stochastic Differential Systems, Stochastic Control Theory and Applications. Edited by W. Fleming and P. L. Lions. Springer-Verlag, New York, 1988. pp. ix+609. $49.80

This is volume 10 of the IMA Volumes in Mathematics and Its Applications. It is the proceedings of a workshop which was part of the 1986–87 IMA program on Stochastic Differential Equations and their Applications at the University of Minnesota. The workshop emphasized topics in the following areas: (1) Mathematical theory of stochastic differential systems, stochastic control and nonlinear filtering for Markov diffusion processes. Connections with partial differential equations; (2) Applications of stochastic differential systems theory, in engineering and management science. Adaptive control of Markov processes. Advanced computational methods in stochastic control and nonlinear filtering; (3) Stochastic scheduling, queueing networks, and related topics. Flow control, multi-arm bandit problems, applications to problems of computer networks and scheduling of complex manufacturing operations; (4) Simulated annealing and related stochastic gradient algorithms. Connections with statistical mechanics and combinatorial optimization. There are 34 papers in this collection.

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Game-Theoretical Control Problems. By N. N. Krasovskii and A. I. Subbotin. Springer-Verlag, New York, 1988. $125.00.

This volume is part of the Springer Series in Soviet Mathematics. It is a substantially revised version of a monograph published in Moskow in 1974, translated by Samuel Kotz. The problems investigated can be stated as follows. Let a control system be given, the dynamics of which are described by ordinary differential equations. It is necessary to construct a strategy, i.e., a control based on the feedback principle which will assure a definite quality for the controlled process under the conditions when the process is subject to the action of uncertain factors. These factors may be either a disturbance or a controlling action of the opposite side. In the framework of the theory of differential games, this type of problem is considered in conjunction with the inverse problem. Joint considerations of the two inverse problems turn out to be useful not only in situations when the two opposing sides (two players) control the system, but also in cases where the controlled system (by a single player) is subject to an uncertain disturbance. In this book a formalization of differential games is presented, existence theorems for equilibrium are proved, and certain properties of value functions are derived. A substantial amount of attention is devoted to the construction of optimal strategies. Chapter headings: 1. Game-theoretical control. 2. Differential game of approach-evasion. 3. Existence of the value for a positional differential game. 4. Dynamic programming. 5. Extremal aiming. 6. Extremal aiming for nonlinear differential games. 7. Prior stable sets. 8. Qualitative problems in the theory of differential games. 9. Mixed strategies in differential games. 10. Lower and upper differential games. 11. Differential-functional games.

Mathematical Aspects of Hodgkin–Huxley Neural Theory. By Jane Cronin. Cambridge University Press, New York, 1987. pp. xi+261. $49.50

This is volume 7 of Cambridge Studies in Mathematical Biology. The purpose of this book is, first, to provide an introductory description of the work of Hodgkin and Huxley and the later work that is based on the techniques that are introduced. The main emphasis is the theoretical aspects of the Hodgkin–Huxley work, that is, the derivation and analysis of their mathematical models (nonlinear ordinary and partial differential equations); the second purpose of this book is to describe some of the mathematics that is used to study these differential equations. In Chapter 2 the work of Hodgkin and Huxley is described in some detail: first the experimental work and then the derivation of the equations. It also summarizes some of the numerical analysis that was carried out by Hodgkin and Huxley. In Chapter 3, the author describes some other mathematical models of nerve conduction including various simplifications and modifications of the Hodgkin–Huxley equations. Chapter 4 describes some mathematical models of other electrically active cells that were obtained by using basic techniques and ideas introduced by Hodgkin and Huxley. In Chapter 5 the author turns to the problem of analyzing mathematically the models that have been described. The emphasis is on singularly perturbed ordinary differential equations. The material from reaction-diffusion equations, needed to study the full Hodgkin–Huxley equations, is described fully. In Chapter 6, the theory of Chapter 5 is used to study the models derived earlier. Chapter headings: 1. Introduction. 2. Nerve conduction: the work of Hodgkin and Huxley. 3. Nerve conduction: other mathematical models. 4. Models of other electrically excitable cells. 5. Mathematical theory. 6. Mathematical analysis of physiological models.

Directional Hearing. Edited by William A. Yost and George Gourevitch. Springer-Verlag, New York, 1987. pp. x+305.

This volume evolved from a conference held in 1983 at the meeting of the Acoustical Society of America in Cincinnati. It introduces the reader to the current facts and theories on how vertebrates, from fish to man, locate sound sources in space. The twelve papers are divided into four groups: 1. The physical and psychoacoustical foundations of directional hearing. 2. Structure and function of the mammalian binaural nervous system. 3. Directional hearing in vertebrates: animal psychophysics and special adaptations. 4. Problems and solutions of directional hearing in the real world.

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Numerical Simulation in Oil Recovery. Edited by M. F. Wheeler. Springer-Verlag, New York, 1988. pp. vii+238. $25.95.

This is volume 11 of the IMA Volumes in Mathematics and Its Applications. It is the proceedings of a workshop which was part of the 1986–87 IMA program on Scientific Computation at the University of Minnesota. The major research emphasis of this meeting was the modeling of fractures, heterogenetics, viscous figuring, and diffusion dispersion effects in the flow in porous media. The participants included applied mathematicians, chemical engineers, physicists and hydrologists from universities, national laboratories, and industrial companies. The objective of this meeting was to develop interaction and cooperation between researchers with similar interests in fluid flow but with somewhat diverse research backgrounds. There are 17 papers.

Applied Mathematics: A Contemporary Approach. By J. David Logan. John Wiley & Sons, New York, 1987. pp. xvii+572. $44.95.

This is a textbook designed to introduce applied mathematics to seniors and beginning graduate students majoring in mathematics, engineering, and the physical sciences. Prerequisites include a good command of calculus, elementary linear algebra (matrices), and postcalculus differential equations, as well as familiarity with a few concepts presented in an elementary physics course. It differs from other books in that an attempt is made to present some of the more current topics in applied mathematics in an elementary format. These include singular perturbations, nonlinear waves, similarity methods, and bifurcation phenomena. An effort was made to write in a style that makes the topics accessible to students with widely varying backgrounds and interests but who have a common need to know the rudiments of these subjects.

Statistics and Data Analysis: An Introduction. By Andrew F. Siegel. John Wiley & Sons, New York, 1988. pp. xxv+518. $33.00.

The author's object in writing this book was to provide an introductory undergraduate statistics textbook for the nontechnical student that integrates the traditional foundations of statistical inference with the more modern ideas of exploratory data analysis. Chapter headings: 1. Introduction. 2. Displaying a single group of numbers. 3. Recognizing shapes of distributions. 4. Finding the center of a distribution. 5. Measuring variability. 6. Grouped data. 7. Cumulative distributions and percentiles. 8. Simple plots for a group of numbers. 9. Transforming data. 10. Probability. 11. Random variables and the normal distribution. 12. Toward statistical inference. 13. Confidence intervals. 14. Testing a hypothesis about a mean. 15. Comparing two groups of numbers. 16. Several groups of numbers. 17. Pairs of numbers: bivariate data. 18. Analyzing a linear relationship. 19. Categorical data and Chi-squared analysis.

Cell-to-Cell Mapping: A Method of Global Analysis for Nonlinear Systems. By C. S. Hsu. Springer-Verlag, New York, 1987. pp. xii+352.

This is volume 64 of the series Applied Mathematical Sciences. There are essentially three parts in this book. The first part, consisting of Chapters 2 and 3, discusses point mapping to provide a background for cell mapping. The second part, from Chapters 4 to 9, treats simple cell mapping and its applications. Generalized cell mapping is then studied in the third part, from Chapters 10 to 13. The discussions of the methodologies of simple and generalized cell mapping culminate in an iterative method of global analysis presented in Chapter 12. Chapter headings: 1. Introduction and overview. 2. Point mapping. 3. Analysis of impulsive parametric excitation problems by point mapping. 4. Cell state space and simple cell mapping. 5. Singularity of cell functions. 6. A theory of index for cell functions. 7. Characteristics of singular entities of simple cell mapping. 8. Algorithms for simple cell mapping. 9. Examples of global analysis by simple cell mapping. 10. Theory of generalized cell mapping. 11. Algorithms for analyzing generalized cell mapping. 12. An iterative method, from large to small. 13. Study of strange attractors by generalized cell mapping. 14. Other topics of study using the cell state space concept.

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Introduction to Stochastic Differential Equations. By Thomas C. Gard. Marcel Dekker, Inc., New York, 1988. pp. xi+234.

This is volume 114 of Pure and Applied Mathematics, A Program of Monographs, Textbooks and Lecture Notes. It presents the fundamental theory of stochastic differential equations in the simplest setting so that individuals having only an introductory course in real analysis with some ordinary differential equations theory and probability, including basics of continuous time stochastic processes, can follow. A concise summary of the probability theory required as background opens the discussion in Chapter 1. Then Chapters 2 and 3 establish the basic machinery of the Ito stochastic calculus, as the Ito integral is defined and the fundamental existence, uniqueness, and dependence on parameters results for stochastic differential equations are given. Methods for obtaining explicit expressions for solutions of stochastic differential equations are exhibited in Chapter 4. When explicit solutions cannot be obtained, one resorts to qualitative and/or quantitative techniques for obtaining information about solutions. These methods are discussed in Chapters 5 and 7 with the focus on stability and local error, respectively. A treatment of applications to population biology is given in Chapter 6. The emphasis of this book is on the most important tool of stochastic analysis—namely, Ito's formula, the stochastic chain rule. The last three chapters demonstrate the central role of Ito's formula in the analytic theory and applications of stochastic differential equations. Chapter headings: 1. Probability and stochastic processes. 2. Stochastic integrals and Ito's formula. 3. Basic theory of stochastic differential equations. 4. Solving stochastic differential equations. 5. Qualitative theory of stochastic differential equations. 6. Applications in biology: population dynamics. 7. Quantitative theory of stochastic differential equations: sample path approximations.

Annual Review of Computer Science: Volume 1, 1986. Edited by Joseph F. Traub, Barbara J. Grosz, Butler W. Lamson and Nils J. Nilsson. Annual Reviews, Inc., Palo Alto, Ca. 1986. pp. xiii+459. $39.00.

With this volume, the field of Computer Science receives the accolade of being included in the distinguished series of review volumes published by Annual Reviews, Inc. (there are now 27 sciences reviewed each year). The titles of the chapters in this volume are: 1. DADO: A tree-structured architecture for artificial intelligence computation. 2. Frame-buffer display architecture. 3. Natural-language interface. 4. Advances in computer technology. 5. Computer system performance evaluation using queueing network models. 6. Architecture and applications of a heterogeneous, massively parallel machine. 7. Computerized reconstruction and 3-D imaging in medicine. 8. Programming environments today. 9. Sequential and parallel algorithms for finding maximum matchings in graphs. 10. Dataflow architectures. 11. Knowledge representation and reasoning. 12. Type architectures, shared memory, and the corollary of modest potential. 13. Information-based complexity. 14. Qualitative student models.

Annual Review of Computer Science: Volume 2, 1987. Edited by Joseph F. Traub, Barbara J. Grosz, Butler W. Lampson, and Nils J. Nilsson. Annual Reviews, Inc., Palo Alto, Ca. 1987. pp. vii+565. $39.00.

In this volume, the seventeen papers are grouped under five headings: Artificial intelligence (9 papers); Hardware (1 paper); Software (2 papers); Theory (4 papers); Applications (1 paper).

Introduction to Group Characters. By Walter Letterman. Cambridge University Press, New York, 1987. pp. x+227. $14.95 paperback, $49.50 hardcover.

This is an enlarged second edition of a book first published in 1977. The emphasis is still on group characters rather than on the underlying representations. The new material includes further work on tensor products, arithmetical properties of character values, and the criterion for real representations due to Frobenius and Schur. Chapter headings: 1. Group representations. 2. Elementary properties of group characters. 3. Induced characters. 4. Permutation groups. 5. Group theoretical applications. 6. Arithmetic properties of group characters. 7. Real representations.

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Brownian Motion and Stochastic Calculus. By Ioannis Karatzas and Steven E. Shreve. Springer-Verlag, New York, 1988. pp. xxiii+470. $68.00.

This is volume 113 in the series Graduate Texts in Mathematics. It is written for readers who are acquainted with the ideas of Markov property and martingale property in the discrete-time setting, and who wish to explore stochastic processes in their continuous time context. It has been the authors goal to write a systematic and thorough exposition of this subject, leading in many instances to the frontiers of knowledge. At the same time, they have endeavored to keep the mathematical prerequisites as low as possible, namely, knowledge of measure-theoretic probability and some familiarity with discrete-time processes. The vehicle they have chosen for this task is Brownian motion, which they present as the canonical example of both a Markov process and a martingale. They support this point of view by showing how, by means of stochastic integration and random time change, all continuous-path martingales and a multitude of continuous-path Markov processes can be represented in terms of Brownian motion. Chapter 1 presents the basic properties of martingales, as they are used throughout the book. Chapter 2 contains three different constructions of Brownian motion, as well as discussions of the Markov and strong Markov properties for continuous-time processes. The theory of stochastic integration with respect to continuous martingales is developed in Chapter 3. Chapter 4 is a digression on the connections between Brownian motion, Laplace's equation, and the heat equation. Sharp existence and uniqueness theorems for both of these equations are provided by probabilistic methods. Chapter 5 returns to the main theme of stochastic integration and differential equations. In this chapter, stochastic differential equations are driven by Brownian motion and the notions of *strong* and *weak* solutions are presented. Chapter 6 is for the most part derived from Paul Lévy's profound study of Brownian excursions. The headings of these chapters are: 1. Martingales, stopping times, and filtrations. 2. Brownian motion. 3. Stochastic integration. 4. Brownian motion and partial differential equations. 5. Stochastic differential equations. 6. P. Lévy's theory of Brownian local time.

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