QUARTERLY

OF

APPLIED MATHEMATICS

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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.

CONTENTS

Simulated Annealing and Optimization: Modern Algorithms with VLSI, Optimal Design, and Missile Defense Applications. Edited by Mark E. Johnson. American Sciences Press, 1988. $57.50.

This is volume 17 in the American Series in Mathematical and Management Sciences. It is a collection of eight papers on the subject, including a comprehensive annotated bibliography of about 300 papers and reports on the theory and applications of simulated annealing published to-date; these are also listed by application area as well as algorithm design (using 40 classification categories). The papers in the volume provide an overview of the simulated annealing algorithm in its most recent and successful forms, detailed applications to the areas stated in the title (including a FORTRAN code for the algorithm), and considerations of algorithm acceleration, neighborhood size, and benchmarking.

Functional Equations in Several Variables, with Applications to Mathematics, Information Theory and to the Natural and Social Sciences. By J. Aczél and J. Dhombres. Cambridge University Press, 1989. xiii+462 pp., $89.50.

This treatise is volume 31 of the Encyclopedia of Mathematics and its Applications, a distinguished series edited by Gian-Carlo Rota. It deals with the modern theory of functional equations in several variables, emphasizing applications in addition to theory, and keeping prerequisites to a minimum: calculus, linear algebra, and the basics of Lebesgue integration. Where more advanced topics are needed, references are given and the results carefully explained. The chapters can be read almost independently of each other. There is a chapter on the history of the subject, and an encyclopaedic bibliography of over 1600 items. The scope of the work is indicated by its chapter headings: 1. Axiomatic motivation of vector addition; 2. Cauchy's equation $f(x + y) = f(x) + f(y)$. Hamel basis; 3. Three further Cauchy equations. An application to information theory; 4. Generalizations of Cauchy's equations to several multiplace vector and matrix functions. An application to geometric objects; 5. Cauchy's equations for complex functions. Applications to harmonic analysis and to information measures; 6. Conditional Cauchy equations. An application to geometry and a characterization of the Heaviside functions; 7. Addundancy, extensions, quasi-extensions, and extensions almost everywhere. Applications to harmonic analysis and to rational decision making; 8. D'Alembert's functional equation. An application to noneuclidean mechanics; 9. Images of sets and functional equations. Applications to relativity theory and to additive functions bounded on particular sets; 10. Some applications of functional equations in functional analysis, in the geometry of Banach spaces and in valuation theory; 11. Characterizations of inner product spaces. An application to gas dynamics; 12. Some related equations and systems of equations. Applications to combinatorics and Markov processes; 13. Equations for trigonometric and similar functions; 14. A class of equations of generalizing d'Alembert and Cauchy Pexider-type equations; 15. A further generalization of Pexider's equation. A uniqueness theorem. An application to mean values. 16. More about conditional Cauchy equations Applications to additive number theoretical functions and to coding theory; 17. Mean values, mediality, and self-distributivity; 18. Generalized mediality. Connection to webs and nomograms; 19. Further composite equations. An application to averaging theory; 20. Homogeneity and some generalizations. Applications to economics; 21. Historical notes.

Ordinary and Partial Differential Equations—Proceedings of the Ninth Dundee Conference, 1986. Edited by B. D. Sleeman and R. J. Jarvis. Longman Scientific & Technical, and John Wiley & Sons, New York, 1987. pp. 1 + 216.

This is volume 157 in the Pitman Research Notes in Mathematics Series. There are fourteen papers, on theory, and applications in many fields.

Structural Equations with Latant Variables.   By Kenneth A. Bollen, John Wiley and Sons, 1989. xiv+514 pp., \$49.95.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is a comprehensive treatment of the general structural equation system known as the LISREL model. One purpose of the book is to demonstrate the generality of this model. Rather than treating path analysis, recursive and nonrecursive models, classical econometrics, and confirmatory factor analysis as distinct and unique, the author treats them as special cases of the general model. Other goals of the book are to emphasize the application of these techniques—empirical examples are discussed throughout—and the crucial role played by substantive expertise in most stages of the modeling process. Rather than going from the general to the particular, the author starts with the simpler regression/econometric and factor analysis models and presents them from the perspective of the general model. Chapter headings: 1. Introduction; 2. Model notation, covariances, and path analysis; 3. Causality and causal models; 4. Structural equation models with observed variables; 5. The consequences of measurement error; 6. Measurement models: the relation between latent and observed variables; 7. Confirmatory factor analysis; 8. The General Model, Part I: latent variable and measurement models combined; 9. The General Model, Part II: extensions.

Linear Algebra and Its Applications; Volume 2: More Advanced.   By D. H. Griffel. Halsted Press: a division of John Wiley and Sons, 1989. x+223 pp., \$49.95.

This is a volume in the Ellis Horwood Series in Mathematics and Its Applications. It is the second of a two-volume work, describing modern applications of linear algebra and its fundamental role in physics. The volume is divided into three parts (of two chapters each): 1. Matrix representations and diagonalisation; 2. Inner product spaces and self-adjoint operators; 3. Further developments (i.e., least squares, pseudo-inverse, duality).

Point Process Models with Applications to Safety and Reliability. By W. A. Thompson, Jr.; Chapman and Hall, 1988. xi+146 pp., \$39.95.

This monograph provides an elementary but rigorous treatment of models for the placement of points on a time axis according to some chance mechanism, assuming a first course in probability theory from the reader. The material presented is particularly useful for reliability, safety analysis, life distributions, and clustering. Its scope is indicated by its chapter headings: 1. Introduction; 2. Point processes; 3. Homogeneous Poisson processes; 4. Application of point processes to a theory of safety assessment; 5. Renewal processes; 6. Poisson processes; 7. Superimposed processes; 8. Markov point processes; 9. Applications of Markov point processes; 10. The order statistics process; 11. Competing risk theory.

Mathematical Introduction to Linear Programming and Game Theory.   By Louis Brickman. Springer Verlag, 1989. ix+130 pp., \$34.00.

This is a volume in the series Undergraduate Texts in Mathematics. Its principal objectives are to define linear programming and its usefulness, to explain the operation and elementary theory of the simplex algorithm, to present duality theory in a simple fashion, and to give a well-motivated account of matrix games. Only elementary notions of probability and sets are assumed. Chapter headings: 1. Simultaneous linear equations; 2. Linear programming foundations; 3. The simplex algorithm; 4. Dual tableaux and two-phase algorithms; 5. Dual LP problems; 6. Matrix games.

Spacetime and Singularities—An Introduction. By Gregory L. Naber. Cambridge University Press, 1988. ix+174 pp., $39.50 cloth, $16.95 paper.

This is volume 11 of London Mathematical Society Student Texts. The intention of this monograph is to provide students of mathematics and physics who may have had no previous exposure to relativity and/or differential geometry with a brief, reasonably self-contained and elementary introduction to the ideas required for rigorous understanding of the simplest of the theorems of Stephen Hawking concerned with the existence of cosmological singularities and those of Roger Penrose dealing with singularities that arise from gravitational collapse (black holes). The necessary ideas from general relativity and modern differential geometry are introduced along the way. The chapter headings are: 1. The geometry of Minkowski spacetime; 2. Some concepts from relativistic mechanics; 3. More general spacetimes: gravity; 4. The proof of Hawking's theorem.

Computer-Intensive Methods for Testing Hypotheses—An Introduction. By Eric W. Noreen. John Wiley and Sons, 1989. ix+229 pp., $24.95.

The methods reported here are called computer-intensive, because they require recomputing the test statistic for many (typically 100 to 1000) artificially constructed data sets. Virtually every nonparametric statistical test is a special case of one of the methods. The significance of almost any test statistic can be assessed using one of these methods. There are five chapters. Chapter 1 is introductory. Chapter 2 discusses the approximate randomization method which can be used to test the null hypothesis that one variable is unrelated to another. In chapter 3 Monte Carlo sampling is discussed; it can be used to draw inferences concerning a population from which a random sample has been drawn. Bootstrap sampling, which is a special case of Monte Carlo sampling, is discussed in chapter 4. In chapter 5 the three major computer-intensive methods for assessing the significance of a test statistic are reviewed and are contrasted with each other and with conventional parametric methods. Appendices give BASIC, FORTRAN, and PASCAL program listings that provide solutions for each of the examples in the text. In addition, a collection of exercises and solutions is available by writing to the author.

Initial-Boundary Value Problems and the Navier-Stokes Equations. By Heinz-Otto Kreiss and Jens Lorenz. Academic Press, 1989. xi+402 pp., $54.50.

This is volume 136 in the series Pure and Applied Mathematics. It is its aim to develop a theory of initial-boundary value problems for linear and nonlinear partial differential equations, and to fill the gap between elementary and rather abstract books. To illustrate the theory, the authors have chosen the compressible and incompressible Navier-Stokes equations, a choice dictated by the desire to find a system which is so rich in phenomena that the whole power of the mathematical theory is needed to discuss existence, smoothness, and boundary conditions. The authors develop the theory in the following way, which they claim to be closer to computing than alternative ones: First they show, by using difference approximations for linear problems and linearization for nonlinear problems, that there is a set of C^∞-smooth data, dense in L_2, for which the equations they discuss have C^∞-smooth solutions. These solutions and their derivatives can be estimated in terms of the data. The authors then use the usual closure argument to define weak solutions if the data are less smooth. Chapter headings: 1. The Navier-Stokes equations; 2. Constant-coefficient Cauchy problems; 3. Linear variable-coefficient Cauchy problems in one dimension; 4. A nonlinear example: Burger's equation; 5. Nonlinear systems in one space dimension; 6. The Cauchy problem for systems in several dimensions; 7. Initial-boundary value problems in one space dimension; 8. Initial-boundary value problems in several space dimensions; 9. The incompressible Navier-Stokes equations: the spatially periodic case; 10. The incompressible Navier-Stokes equations under initial and boundary conditions.

Chaos and Integrability in Nonlinear Dynamics—An Introduction. By Michael Tabor. John Wiley and Sons, 1989. xiii+364 pp., $55.00.

It is the aim of this introductory text to provide the transition from traditional courses in differential equations and classical mechanics to the areas of nonlinear dynamics and chaos and to present both the old and the new in a broad and unified perspective. The relationship between the two is emphasized through Hamilton's equations of motion, which provide the natural framework in which to discuss the phase-space dynamics of systems of differential equations that are capable of displaying both integrable and chaotic behaviour. Considerable emphasis is here placed on the concept of integrability, which also provides the background for a later chapter on integrable partial differential equations and soliton dynamics. Chapter headings: 1. The dynamics of differential equations; 2. Hamiltonian dynamics; 3. Classical perturbation theory; 4. Chaos in Hamiltonian systems and area-preserving mappings; 5. The dynamics of dissipative systems; 6. Chaos and integrability in semiclassical mechanics; 7. Nonlinear evolution equations and solitons; 8. Analytic structure of dynamical systems.

Principles of Earthquake Source Mechanics. By B. V. Kostrov and Shamita Das. Cambridge University Press, 1988. xvii+286 pp., $52.50.

This is a volume in the Cambridge Monographs on Mechanics and Applied Mathematics. Parts I (Continuum and Fracture) and II (Inversion for Source Parameters) are a translation, with extensive revisions, of a work by B. V. Kostrov first published in Russian in 1975, and part III (Specific Earthquake Source Models) is original to this monograph. Each part consists of two chapters. Part I: 1. Basic mechanical principles of the theory of tectonic earthquake sources; 2. General concepts of fracture mechanics; Part II: 3. The inverse problem of earthquake source theory; 4. Seismic moment tensor; Part III: 5. The boundary-integral equation method; 6. Far-field radiation from numerical source models. The Book is an attempt to summarize the fundamental principles and concepts of earthquake source theory, limited to the mechanical aspect of the theory and, in particular, to that of the earthquake in progress. The three parts are relatively independent. The first presents the basics of continuum and fracture mechanics as applied to earthquake source, the second is devoted to an analysis of the solvability of the inverse problem and related topics, and the third part describes a numerical method for solving three-dimensional crack problems and determining the resulting seismic radiation, presenting some solutions that illustrate the general discussion of the previous parts as well as the power of the numerical approach.

The Theory of Evolutions and Dynamical Systems. By Josef Hofbauer and Karl Sigmund. Cambridge University Press, 1988. viii+341 pp., $65.00 cloth, $19.95 paper.

This is volume 7 in the series London Mathematical Society Student Texts, and is a translation of the monograph first published in German by Verlag Paul Parey in 1984. The authors intend it to be (i) an introduction to the theory of dynamical systems (and in particular the qualitative theory of differential equations), based entirely on examples from biology, and (ii) a survey of recent developments on four branches of the theory of evolution, namely population genetics, mathematical ecology, prebiotic evolution of macromolecules, and game theoretic modeling of animal behaviour. The book is divided into seven parts (which comprise together 29 chapters): 1. Selection dynamics and population genetics; 2. Growth rates and ecological models: an ABC on ODE; 3. Test tube evolution and hypercycles: a prebiotic primer; 4. Strategies and stability: an opening in game dynamics; 5. Compete, predate, or cooperate: the struggle for permanence; 6. Back to the gene pool: gradients and cycles; 7. On sex and games: strategic and genetic evolution.

Baysian Statistics 3—Proceedings of the Third Valencia International Meeting. Edited by J. M. Bernardo, M. H. Degroot, D. V. Lindley, and A. F. M Smith. Oxford University Press, 1989. xi+805 pp., $125.00.

This meeting, the third in a series on Baysian statistics held in Valencia, Spain, every four years, took place on June 1–5, 1987. It consisted of 31 invited papers, all of which are contained in these Proceedings, together with contributed papers, of which a selection of 33 refereed ones is printed here. They encompass a wide range of theoretical and applied research in Baysian statistics. Authors of the invited papers are: R. E. Barlow, S. Wechsler, and F. Spizzichino; G. A. Barnard; M. J. Bayarri and M. H. DeGroot; J. O. Berger and A. O'Hagan; J. M. Bernargdo and F. J. Girón; D. A. Berry; A. P. Dawid; P. Diaconis; W. H. DuMouchel; S. Geisser; S. Geman; P. K. Goel; M. Goldstein; B. M. Hill; J. B. Kadane and C. A. Hastorf; R. E. Kass, L. Tieerney, and J. B. Kadane; C. E. Kim and M. J. Schervish; D. V. Lindley; C. N. Morris; A. O'Hagan; L. R. Pericchi and K. Pötzelberger; D. B. Rubin; H. Rubin; J. E. H. Shaw; A. F. M. Smith; T. M. F. Smith; D. J. Spiegelhalter and L. S. Freedman; G. Wahba; M. West; A. Zellner.

Logic-Based Knowledge Representation. By Peter Jackson, Han Reichgelt, and Frank van Harmelen. The MIT Press, 1989. 255 pp., $35.00.

This is a volume in the MIT Press Series in Logic Programming. The research described in it is an investigation into the usefulness of logic for the representation of knowledge and the control of its application to problem solving. The long-term goal was to design and build an environment for specifying knowledge-based systems that was based upon the use of logic as (i) a representation language for domain-specific knowledge, and (ii) a metalanguage for describing task-specific control regimes. The basic idea was that a user should be able to produce a prototype simply by describing both the object-level knowledge of the problem domain and the meta-level knowledge for performing the task. The declarative description language would then be procedurally interpreted to generate the desired behaviours. The monograph is divided into two parts, the first (four chapters) providing an abstract knowledge-based architecture (called "Socrates") which is capable of being specialized and configured for particular applications, and the second reporting some novel research which enlarges current theorem-proving technology.

Theory of Duality in Mathematical Programming. By Manfred Walk. Springer Verlag, 1989. 178 pp., $49.00.

The author's aim in this book is to introduce students of mathematics, science, economics, and management to the qualitative theory of mathematical programming in vector spaces. A basic knowledge of analysis and linear algebra is required, and the author also applies some elementary ideas of functional analysis for a more rigorous construction of proofs and for some generalizations of the finite dimensional theory. Many different concrete programming problems possess the same theoretical basis, which the author formulates as a principle of duality. In generalizing this from linear to nonlinear programming, the Fenchel theory of conjugate functions plays an important role. The main theme of this book is to represent such relations of duality and to consider a general theoretical basis for different special programming problems. It discusses some of the most important such problems by concentrating on specially chosen Lagrangian forms. For linear programming the investigations are extended by constructing the theory in Banach spaces. In infinite dimensional Banach spaces the author gives a generalization of the transportation and potential problems in finite directed graphs. The first chapter gives a collection of relations between convex sets, hyperplanes, and extremal points required later. In the second chapter, relations of duality are formulated and equivalence theorems proved with respect to saddle-point, duality, and minimax theorems. The third chapter deals with the embedding of different programming problems in connection with specially chosen Lagrangian forms.

Bayesian Statistics: Principles, Models, and Applications. By S. James Press. John Wiley and Sons, 1989. xvi+237 pp., $34.95.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. Part I (chapters 1–4) focuses on the theoretical aspects of Bayesian statistics. It begins with the studies of James Bernoulli in 1713, then moves on to offer detailed coverage of the fundamentals, including probability and decision-making axiom systems, coherence and probability definitions, plus the principles of Bayes Theorem, decision theory, and DeFinetti's theorem. In Part II (chapters 5–8), models and applications are provided in step-by-step detail. Topics include Bayesian inference in simple linear regression, Bayesian multivariate analysis of variance and covariance, and Bayesian inference in classification and discrimination. There are also some case studies, such as the disputed authorship of the Federalist papers, and the results of a RAND corporation experiment assessing the probability of nuclear war in the 1980's. The original essay by Bayes is reproduced in its entirety, with a biographical sketch.

Noise in Nonlinear Dynamical Systems. Edited by Frank Moss and P. V. E. McClintock, Cambridge University Press, 1989. *Volume 1: Theory of continuous Fokker-Planck systems,* xvi+353 pp., $85.00; *Volume 2: Theory of noise induced processes in special applications,* xviii+388 pp., $85.00; *Volume 3: Experiments and simulations,* xvi+278 pp., $75.00.

The purpose of these volumes is twofold. First, the editors hope that their publication will help to stimulate new experimental activity by contrasting the smallness of the number of existing experiments with the many research opportunities raised by the chapters on applications. Secondly, it has been the editors' aim to collect together in one place a complete set of authoritative reviews with contributions representative of all the major practitioners in the field. Although there is a strong underlying theme running through all three volumes—the influence of noise on dynamical systems—each chapter should be considered as a selfcontained account of the authors' most important research in the field and can be read either alone or in concert with the others. The early development of the field is reviewed in the nine chapters of volume 1, with treatments confined exclusively to Fokker-Planck systems. There is, for instance, a historical sketch by Rolf Landauer, and a review of Markov methods by a pioneer of the field, R. L. Stratonovich. In an appendix, there is a translation of the classical (1933) paper "On the statistical treatment of dynamical systems" by L. Pontryagin et al. In the thirteen chapters of volume 2, a range of contemporary problems, indicative of the rich diversity of applications of noise driven dynamics, is reviewed. Though most problems currently treated are classical, recent work on dissipative quantum tunnelling has focused attention on quantum mechanical applications. Credible experimental tests of stochastic theory have been completed on only a relatively small number of natural systems. These include, particularly, superfluid helium, liquid crystals and laser, whose diverse properties provide the subject matter of chapters 1–6 of volume 3. In that volume, also, digital simulation techniques are discussed in chapter 7 and analogue techniques and their application to a wide variety of physical systems in chapters 8 and 9.

The Analysis of Categorical Data Using GLIM. By James K. Lindsey. Springer-Verlag, New York, 1989. v+168 pp., $19.95.

This is volume 56 of Lecture Notes in Statistics. It discusses the analysis of categorical data using log linear models within the overall body of models known as general linear models, treated by the GLIM statistical analysis system. There are many examples.

Modelling Brain Function: The World of Attractor Neural Networks. By Daniel J. Amit. Cambridge University Press, New York, 1989. xvii+504 pp., $39.50.

This book summarizes the ideas, techniques, and results developed in the last 5–6 years in the physics community about the collective properties of large assemblies of neurons. The author set himself the task of combining the presentation of the qualitative results with an attempt to communicate across disciplines. The book introduces and explains the techniques brought from physics to the study of neural networks. It is written at a level accessible to a wide range of readers. Chapter headings: 1. Introduction. 2. The basic attractor neural network. 3. General ideas concerning dynamics. 4. Symmetric neural networks at low memory loading. 5. Storage and retrieval of temporal sequences. 6. Storage capacity of ANN's. 7. Robustness: Getting closer to robustness. 8. Memory data structures. 9. Learning. 10. Hardware implementations of neural networks.

The Bending and Stretching of Plates. By E. H. Mansfield. Cambridge University Press, New York, 1989. xi+226 pp., $59.50.

This is the second edition of a monograph first published by Penguin Press in 1964. It presents a concise and unified introduction to elastic plate theory. This second edition includes thermal stress effects, the behavior of multi-layered composite plates and much additional material on plates in the large deflection regime. The objective throughout is to derive continuum or analytical solutions rather than solutions based on numerical techniques such as finite elements. Chapter headings: 1. Derivation of the basic equations. 2. Rectangular plates. 3. Plates of various shapes. 4. Plates whose boundaries are amenable to conformal transformation. 5. Plates with variable rigidity. 6. Approximate methods. 7. General equations and some exact solutions. 8. Approximate methods in large-deflexion analysis. 9. Asymptotic large-deflexion theories for very thin plates.

The Numerical Solution of Ordinary and Partial Differential Equations. By Granville Sewell. Academic Press, 1988. xii+271 pp., $39.95.

This text aims to give a solid introduction to the computer solution of ordinary and partial differential equations, appropriate for senior undergraduate or first year graduate courses. Chapter headings: 0. Direct solution of linear systems; 1. Initial value ordinary differential equations; 2. The initial value diffusion problem; 3. The initial value transport and wave problems; 4. Boundary value problems; 5. The finite element method.

Lattice Points. By P. Erdös, P. M. Gruber, and J. Hammer. Longman Scientific & Technical, and John Wiley & Sons, 1989. vii+184 pp., $79.95.

This is volume 39 of Pitman Monographs and Surveys in Pure and Applied Mathematics. In it, the authors discuss geometric, number theoretic, combinatorial and analytic results, theories and problems related to lattice points. Problems of the geometry of numbers make up a substantial part of the book, but topics covered also include dissection problems, lattice polytopes, packing, covering and tiling problems, combinatorics, graph theory, mathematical crystallography, applications to numerical integration, coding and several others. Only a small number of proofs are included, but heuristic arguments and intuitive descriptions are given.

Principles of Statistical Radiophysics 3: Elements of Random Fields. By Sergei M. Rytov, Yurii A. Kravtsov, and Valeryan I. Tatarskii. Springer Verlag, 1989. x+239 pp., $99.00.

This is a translation, by Alexander P. Repyev, of the original Russian edition published by Nauka, Moscow, in 1978. The two earlier volumes of the set were entitled Elements of Random Process Theory and Correlation Theory of Random Processes, respectively, and the fourth volume will be on Wave Propagation through Random Media. Unlike the preceding two volumes devoted to random functions of one variable, the volume is concerned with the more general case of multi-variate functions, i.e., random fields. The variables are usually time t and spatial coordinates $r = \{x, y, z\}$. Some problems only involve subsets of these variates. Chapter headings: 1. Fundamentals; 2. Radiation and diffraction of random wave fields; 3. Thermal electromagnetic fields; 4. Single scattering theory.

The Matching Methodology: Some Statistical Properties. By Prem K. Goel and T. Ramalingam. Springer Verlag 1989. 152 pp., $20.60.

This is volume 52 of Lecture Notes in Statistics. It deals with the incomplete-data problems that arise in the merging of micro-data files, the methodology of file-merging being used by many federal agencies to create comprehensive files from multiple but incomplete sources of data. The validity and the efficacy of the file-merging methodology can be assessed by means of statistical models underlying the mechanism which may generate the incomplete files. This monograph is an attempt in this direction. Chapter headings: 1. Introduction and summary; 2. Merging files of data on same individuals; 3. Merging files of data on similar individuals.

Mathematics in Oil Production. Edited by Sir Sam Edwards and P. R. King. Oxford University Press, 1989. x+375 pp., $75.00.

This is volume 18 in The Institute of Mathematics and its Applications Conference Series, and is based on the proceedings of a conference organized by the Institute at Robinson College, Cambridge, in July 1987. The fourteen papers presented here address questions such as: How do two or three fluid phases move together? How does a less dense fluid move through a denser? What are the relationships between flows in porous and fractured materials? These practical questions lead to theoretical problems, and the papers discuss both the mathematical and the computational problems confronting the applied mathematician who wishes to tackle them.

A Handbook of Fourier Theorems. By D. C. Champeney. Cambridge University Press, 1989. ix+185 pp., $17.95.

This handbook is intended to assist those scientists, engineers, and applied mathematicians who are already familiar with Fourier theory and its applications in a nonrigorous way, but who wish to find out the exact mathematical conditions under which particular results can be used. Only a traditional (English) first year university course in mathematics taken by physical scientists and engineers is assumed. Chapters 1-5 are an introduction to the necessary additional mathematics, and chapters 6-16 consist of rigorous statements of the most important theorems in Fourier theory, together with explanatory comments and examples.

Lectures on Buildings. By Mark Ronan. Academic Press, 1989. xiii+201 pp., $27.95.

This is not a book on civil engineering. The term "building" is due to Bourbaki, and the theory of buildings was developed mainly by Jacques Tits in the 1950's in an attempt to develop a systematic interpretation of semi-simple Lie groups, particularly the exceptional groups. This book presents an up-to-date account of this theory.

Statistics for Biologists. By R. C. Campbell. Cambridge University Press, 1989. xviii+446 pp.

This is the third edition of a text first published in 1967, second edition in 1974. The main object of the new material in this edition is to illustrate the potential usefulness of computers to biologists engaged in statistical analyses. Computer analyses of a selection of the examples and exercises are given, using several different statistical languages.

Statistical Analysis and Mathematical Modelling of AIDS. Edited by J. C. Jager and E. J. Ruitenberg. Oxford University Press, 1988. xix+167 pp., $56.50.

This book contains the methodological studies presented at a workshop on the title subject, held at the National Institute of Public Health and Environmental Hygiene, Bilthoven, The Netherlands, in December 1986. Its presents an overview of the main quantitative techniques available five years after the first recognition of AIDS in the USA.

Probability and Statistics—Theory and Applications. By Gunnar Blom. Springer Verlag 1989. xi+356 pp., $59.00.

This is a volume in the series Springer Texts in Statistics. It is an extended and modified translation of the third edition of a text first published in Swedish in 1969 and used for many years at the Royal Institute of Technology in Stockholm. The author's aim has been to do justice both to mathematical arguments and to practical applications, and to make the text suitable for students with a calculus background. He treats elementary probability theory with applications, statistical theory with applications, and includes a chapter on planning statistical investigations.

Nonparametric Curve Estimation from Time Series. By Lázló Györfi, Wolfgang Härdle, Pascal Sarda, and Phillipe Vieu. Springer-Verlag, New York, 1989. viii+153 pp., $19.95.

This is volume 60 of Lecture Notes in Statistics. Its aim is to construct bridges between two major themes in mathematical statistics: time series and smoothing. There are six chapters: 1. Introduction. 2. Dependent samples. 3. Regression estimation and time series analysis. 4. Density estimation. 5. Distribution and hazard function estimation. 6. How to select the smoothing parameter.