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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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ANNUAL INDEX

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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0033-569X(200312)61:4*;1-L

The Physics of Plasmas. By T. J. M. Boyd and J. J. Sanderson, Cambridge University Press, 2003, xii + 532 pp., Hardback: $120.00, Paperback: $50.00

This comprehensive introduction to the subject, which has its origin in the authors' 1969 book *Plasma Dynamics*, discusses various models used to describe plasma physics, including particle orbit theory, fluid equations, ideal and resistive magnetohydrodynamics, wave equations, and kinetic theory. There is an emphasis on the physical interpretation of plasma phenomena, and exercises, testing the reader's understanding at several levels, are provided. There is a bibliography of about 200+ items without, alas, the titles of the papers referenced. Table of Contents: 1. Introduction; 2. Particle orbit theory; 3. Macroscopic equations; 4. Ideal magnetohydrodynamics; 5. Resistive magnetohydrodynamics; 6. Waves in unbounded homogeneous plasmas; 7. Collisionless kinetic theory; 8. Collisional kinetic theory; 9. Plasma radiation; 10. Non-linear plasma physics; 11. Aspects of inhomogeneous plasmas; 12. The classical theory of plasmas.

An Introduction to Multivariate Statistical Analysis. By T. W. Anderson, Wiley-Interscience, 2003, xx + 721 pp., $99.95

This is the third edition of a renowned volume in the Wiley Series in Probability and Statistics, the earlier editions dating from 1957 and 1984, respectively. It remains a mathematically rigorous development of statistical methods for observations consisting of several measurements or characteristics of each subject and a study of their properties. Among new items in the third edition are: a new chapter, "Patterns of Dependence; Graphical Models"; a systematic presentation of the topic of elliptically contoured distributions (which relaxes the limitation that in the multivariate normal the fourth order moments are determined by the first and second order moments); reduced rank regression; and others. The scope of the book is indicated by the chapter headings: 1. Introduction; 2. The multivariate normal distribution; 3. Estimation of the mean vector and the covariance matrix; 4. The distribution and uses of sample correlation coefficients; 5. The generalized T^2-statistic; 6. Classification of observations; 7. The distribution of the sample covariance matrix and the sample generalized variance; 8. Testing the general linear hypothesis; multivariate analysis of variance; 9. Testing independence of sets of variates; 10. Testing hypotheses of equality of covariance matrices and equality of mean vectors and covariate matrices; 11. Principal components; 12. Canonical correlations and canonical variables; 13. The distribution of characteristic roots and vectors; 14. Factor analysis; 15. Patterns of dependence; graphical models.

A Primer on Statistical Distributions. By N. Balakrishnan and V. B. Nevzorov, Wiley-Interscience, 2003, xvi + 305 pp., $84.95

This textbook is divided into an introductory chapter and three parts. The introductory chapter presents all statistical concepts and definitions needed in the body of the text. The three parts cover discrete, continuous, and multivariate distributions, respectively. Part I: The discrete uniform, degenerate, Bernoulli, binomial, geometric, negative binomial hypergeometric, Poisson, Polya, Pascal, and negative hypergeometric distributions; Part II: The uniform, Cauchy, triangular, power, Pareto, beta, arcsine, exponential, Laplace, gamma, extreme value, logistic, normal, Linnik, inverse Gaussian, chi-square, t, F, and noncentral distributions; Part III: The multinomial, multivariate normal, Dirichlet, and Liouville distributions. There follow an appendix with biographical sketches of pioneers in the field and a bibliography of about one hundred items.

Bayesian Field Theory. By Jörg C. Lemm, Johns Hopkins University Press, 2003, xiv + 411 pp., $69.95

Bayesian field theory stands for a nonparametric Bayesian approach to learning from observational data and a particular theory is defined by the combination of a likelihood model and a prior model. This monograph is intended to provide a toolbox for dealing with *a priori* information in nonparametric models. The particular likelihood models discussed are those of general likelihood estimation, Gaussian regression, clustering, classification, or pattern recognition, as well as specific models of inverse quantum theory. The nonparametric prior models treated include Gaussian processes, mixtures of Gaussian processes, non-quadratic potentials, as well as so-called hyperparameters, hyperfields, and auxiliary fields, all of which are seen as specific statistical field theories. A collection of practical methods is developed to adapt prior models to applications. In particular, the adaptation of mean functions and covariance operators of Gaussian process components is discussed in detail. Bayesian field theories are typically non-Gaussian and thus have to be solved numerically. Chapter headings: 1. Introduction; 2. Bayesian framework; 3. Gaussian prior factors; 4. Parameterizing likelihoods: variational methods; 5. Parameterizing priors: hyperparameters; 6. Mixtures of Gaussian prior factors; 7. Bayesian inverse quantum theory; 8. Summary.

3-D Computer Graphics—A Mathematical Introduction with Open GL. By Samuel R. Buss, Cambridge University Press, 2003, xvi + 371 pp., $65.00

This book is an introduction to 3-D computer graphics with particular emphasis on fundamentals and the mathematics underlying computer graphics. Topics include a thorough treatment of transformations and viewing, lighting and shading models, interpolation and averaging, Bézier curves and B-splines, ray tracing and radiosity, and intersection testing with rays. Chapter headings: 1. Introduction; 2. Transformation and viewing; 3. Lighting, illumination, and shading; 4. Averaging and interpolation; 5. Texture mapping; 6. Color; 7. Bézier curves; 8. B-Splines; 9. Ray tracing; 10. Intersection testing; 11. Radiosity; 12. Animation and kinematics. Two appendices give mathematics background and a description of the RayTrace software package, respectively. The software is available freely from the author's Web site.

Complex Variables—Introduction and Applications. By Mark J. Ablowitz and Athanassios S. Fokas, Cambridge University Press, 2003, xii + 647 pp., $48.00

This is the second edition of a volume in the series Cambridge Texts in Applied Mathematics. Part I (chapters 1–4) provides an introduction to the study of complex variables and Part II (chapters 5–7) contains the study of conformal mappings, asymptotic evaluation of integrals, the so-called Riemann-Hilbert and DBAR ($\overline{\partial}$) problems, and many of their applications. Topics not usually covered in complex variable texts include the study of ODE's in the complex plane, the solution of linear PDE's by integral transforms, asymptotic evaluation of integrals, and the Riemann-Hilbert problems. Chapter headings: 1. Complex numbers and elementary functions; 2. Analytic functions and integration; 3. Sequences, series, and singularities of complex functions; 4. Residue calculus and applications of contour integration; 5. Conformal mappings and applications; 6. Asymptotic evaluation of integrals; 7. Riemann-Hilbert problems.

Probability Theory: The Logic of Science. By E. T. Jaynes, edited by G. Larry Bretthorst, Cambridge University Press, 2003, xxix + 727 pp., $60.00

This work seems to have been inspired by Sir Harold Jeffreys, to whom it is dedicated. Other writers influencing the author were R. T. Cox, Claude Shannon, and, particularly, George Pólya with his two-volume work *Mathematics and Plausible Reasoning.* The author did not live to finish the book, a task which was accomplished by G. Larry Bretthorst who provides a Foreword explaining the extent of his role. Although the author originally regarded his system of probability as quite different from Kolmogorov's in style, philosophy, and purpose, he eventually found himself, to his surprise, in agreement with Kolmogorov and in disagreement with Kolmogorov's critics on nearly all technical issues. He came to conclude that his system was not contradicting Kolmogorov's, but was rather seeking a deeper logical foundation that would permit its extension in the directions that were needed for modern applications. Although at first glance it seemed to everyone, including the author, that his system was in very close agreement with the de Finetti system of probability, the author came to conclude that there is little more than a loose philosophical agreement and that he disagrees strongly with de Finetti on many technical issues. The work represents the author's development from being an outspoken partisan of Bayesian as against frequentist methods of inference, to the conclusion that neither approach is universally applicable, and in the present, more general work, he takes a broader view of things: his theme is *probability theory as extended logic.* The chapters in the book are divided into two parts: I. Principles and Elementary Applications (chapters 1–10); II. Advanced Applications (chapters 11–22). Chapter headings: 1. Plausible reasoning; 2. The quantitative rules; 3. Elementary sampling theory; 4. Elementary hypothesis testing; 5. Queer uses for probability theory; 6. Elementary parameter estimation; 7. The central, Gaussian or normal distribution; 8. Sufficiency, ancillarity, and all that; 9. Repetitive experiments: probability and frequency; 10. Physics of 'random experiments'; 11. Discrete prior probabilities: the entropy principle; 12. Ignorance priors and transformation groups; 13. Decision theory: historical background; 14. Simple applications of decision theory; 15. Paradoxes of probability theory; 16. Orthodox methods: historical background; 17. Principles and pathology of orthodox statistics; 18. The A_p distribution and rule of succession; 19. Physical measurements; 20. Model comparison; 21. Outliers and robustness; 22. Introduction to communication theory. There are three appendices: A. Other approaches to probability theory; B. Mathematical formalities and style; C. Convolutions and cumulants. The author's references comprise over 300 items and a bibliography provided by the editor about another 300 items.

Introductory Biostatistics for the Health Sciences—Modern Applications Including Bootstrap. By Michael R. Chernick and Robert H. Friis, Wiley-Interscience, 2003, xvii + 406 pp., $89.95

This text is intended for an introductory course in classical and modern statistical methods that emphasizes the methods most commonly used in the health sciences. Chapter headings: 1. What is statistics? How is it applied in the health sciences? 2. Defining populations and selecting samples; 3. Systematic organization and display of data; 4. Summary statistics; 5. Basic probability; 6. The normal distribution; 7. Sampling distributions for means; 8. Estimating population means; 9. Tests of hypotheses; 10. Inferences regarding proportions; 11. Categorical data and chi-square tests; 12. Correlation, linear regression and logistic regression; 13. One-way analysis of variance; 14. Nonparametric methods; 15. Analysis of survival data; 16. Software packages for statistical analysis.

Perspectives and Problems in Nonlinear Science—A Celebratory Volume in Honor of Lawrence Sirovich. Edited by Ehud Kaplan, Jerrold E. Marsden, and Katepalli R. Sreenivasan, Springer-Verlag, 2003, xiii + 443 pp., $99.00

This volume is dedicated to Lawrence Sirovich on his 70th birthday to mark his distinguished contributions over the years to the kinetic theory of gases, methods of applied mathematics, theoretical fluid dynamics, hydrodynamic turbulence, the biophysics of vision, and the dynamics of neuronal populations. There are fourteen papers on subjects such as neural encoding, Boolean dynamics, oscillatory binary fluid convection, solid flame waves, coupled oscillator networks, granular materials, nonsmooth continuum mechanics, nonstationary time series, dynamics of the visual cortex, nonlinear eigenvalue problems, wave propagation in confined basins, seasonal temperature variation in mid-latitudes, receptive fields of visual neurons, and pseudochaos.

Kinetic Formulation of Conservation Laws. By Benoît Perthame, Oxford University Press, 2002, xi + 198 pp.

This is volume 21 in the series Oxford Lecture Series in Mathematics and its Applications. It surveys various relations between some hyperbolic conservation laws and kinetic equations, i.e., the first-order partial differential equations in which the advection velocity is a free variable, as they arise classically in kinetic physics (Boltzmann and Vlasov theories). The long-term motivation behind the study of such relations is to prove the compressible limit of the Boltzmann equation. Chapter headings: 1. A brief overview of the kinetic approach; 2. The function χ, entropies, and representation of nonlinear functions; 3. Kinetic formulation of multidimensional scalar conservation laws; 4. Uniqueness of solutions to scalar conservation laws and consequences; 5. Cancellation of oscillations, averaging lemmas, regularizing effects; 6. Kinetic schemes for scalar conservation laws; 7. Isentropic gas dynamics; 8. Kinetic schemes for gas dynamics.

Large-Scale Atmosphere-Ocean Dynamics II—Geometric Methods and Models. Edited by Jon Norbury and Ian Roulstone, Cambridge University Press, 2002, xxx + 364 pp., $80.00

The two volumes, of which this is the second, provide an up-to-date account of the mathematics and numerical modelling that underpins weather forecasting, climate change simulations, dynamic meteorology, and oceanography. They are the result of the stimulus provided by the programme on *The Mathematics of Atmosphere and Ocean Dynamics* held at the Isaac Newton Institute for Mathematical Sciences, Cambridge, in 1996, together with a follow-up meeting there in December 1997. There is an introductory paper entitled "Introduction and Scientific Background" by J. C. R. Hunt and the editors, and there are eight papers: 1. Balanced models in geophysical fluid dynamics: Hamiltonian formulation, constraints and formal stability, by O. Bokhove; 2. The swinging spring: a simple model of atmospheric balance, by P. Lynch; 3. On the stationary spectra for an ensemble of plane weakly nonlinear internal gravity waves, by P. Caillol and V. Zeitlin; 4. Hamiltonian description of shear flow, by N. J. Balmforth and P. J. Morrison; 5. Some applications of transformation theory in mechanics, by M. J. Sewell; 6. Legendre-transformable semi-geostropic theories, by R. James Purser; 7. The Euler-Poincaré equations in geophysical fluid dynamics, by D. D. Holm, J. E. Marsden and T. Ratiu; 8. Are there higher-accuracy analogues of semi-geostropic theory? by M. E. McIntyre and I. Roulstone.

Probability and Statistics for Computer Science. By James L. Johnson, Wiley-Interscience, 2003, xvi + 744 pp., $98.00

This text presents introductory topics in probability and statistics with particular emphasis on concepts that arise in computer science, but is distinguished also by the feature that it develops all the necessary supporting mathematics in a thorough and rigorous fashion. Although the presentation is as rigorous as a pure mathematics text, computer science students comprise the book's primary intended audience and many of the illustrative examples are computer science applications, such as client-server performance evaluation, and the early emphasis on discrete distributions reflects this orientation. Chapter headings: 1. Combinatorics and probability; 2. Discrete distributions; 3. Simulation; 4. Discrete decision theory; 5. Real-line probability; 6. Continuous distributions; 7. Parameter estimation. There is an appendix reviewing the analytical tools required in the text.

Statistical Computing—An Introduction to Data Analysis using S-Plus. By Michael J. Crawley, John Wiley & Sons, 2002, ix + 761 pp., 93.00 Euros

This is a practical introduction to statistics by a distinguished ecologist using the powerful statistical and programming software S-Plus (or the free software package R). The aim is to help the reader acquire a working knowledge of a wide range of statistical techniques rather than master the mathematical statistical foundations. As the list of chapter headings indicates, the book succeeds in covering most if not all techniques a practitioner of statistics is likely to encounter: statistical methods, introduction to S-Plus, experimental design, central tendency, probability, variance, the normal distribution, power calculations, understanding data: graphical analysis and tubular analysis, classical tests, bootstrap and jackknife, statistical models in S-Plus, regression, analysis of variance and covariance, model criticism, contrasts, split-lot anova, nested designs and variance component analysis, graphs, functions and transformations, curve fitting and piecewise regression, non-linear regression, multiple regression, model simplification, probability distributions, generalised linear models, proportion data: binomial errors, count data: Poisson errors, binary response variables, tree models, non-parametric smoothing, survival analysis, time series analysis, mixed effects models, spatial statistics. The book's website makes available all of the data sets and S-Plus code used in the book; it also adds further topics such as gamma errors, nonlinear mixed effects models, general additive models, and multivariate statistics. The book does not by any means cover all the sophisticated statistical and graphical features of the S-Plus system, but provides a first class starting point—and, probably, for most readers, a sufficient end point.

The Analysis of Time Series—An Introduction. By Chris Chatfield, Chapman & Hall/CRC, 2003, xii + 333 pp., $49.95

This is the sixth (and, according to the author, final) edition of a well-known text first published in 1975. It has been substantially revised, and expanded by nearly 20 percent over the fifth edition, remaining a very readable book, wide-ranging and up-to-date, that covers both theory and practice. There are some new topics, such as a section on handling real data and one on prediction intervals. The chapter on advanced topics (#13) has been completely revised and restructured to give brief introductions to a variety of topics such as the aggregation of time-series, the analysis of time-series in finance, and discrete valued time-series. A new chapter (#14) gives more practical advice, reflecting the great change in the computing environment. An appendix presents some relevant MINITAB and S-PLUS commands. Chapter headings: 1. Introduction; 2. Simple descriptive techniques; 3. Some time-series models; 4. Fitting time-series models in the time domain; 5. Forecasting; 6. Stationary processes in the frequency domain; 7. Spectral analysis; 8. Bivariate processes; 9. Linear systems; 10. State-space models and the Kalman filter; 11. Non-linear models; 12. Multi-variate time-series modelling; 13. Some more advanced topics; 14. Examples and practical advice.