QUARTERLY

OF

APPLIED MATHEMATICS

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VOLUME XLV 1987

CONTENTS

ELIAS C. AIFANTIS (*see* K. KUTTLER)
NICHOLAS D. ALIKAKOS AND DANIEL PHILLIPS: A remark on positively invariant regions for parabolic systems with an application arising in superconductivity 75
LARRY R. ANDERSON: Weighted Liapunov functions for a class of third-order autonomous differential equations 481
STEVEN P. ANDERSON AND ARTHUR D. GORMAN: Caustics associated with the asymptotic solution of the diffusion equation 783
W. T. ANG: A boundary integral equation for deformations of an elastic body with an arc crack 131
THOMAS C. ASSIFF AND DAVID H. Y. YEN: On the solutions of clamped Reissner–Mindlin plates under transverse loads 679
B. S. BERGER (*see* M. ROKNI)
D. BLANCHARD AND G. A. FRANCFORT: Asymptotic thermoelastic behavior of flat plates 645
L. L. CAMPBELL: Fourier transforms which are asymptotically Cauchy densities 93
M. M. CARROLL: Pressure maximum behavior in inflation of incompressible elastic hollow spheres and cylinders 141
P. CHADWICK AND T. C. T. TING: On the structure and invariance of the Barnett–Lothe tensors 419
LL. G. CHAMBERS: Note on the functional differential equation $\frac{d}{dx}\{\phi(x)\} - a\phi(x^\lambda) = 0$ 695
C. Y. CHAN AND Y. C. HON: A constructive solution for a generalized Thomas–Fermi theory of ionized atoms 591
D. S. CHANDRASEKHARAIAH: Complete solutions of a coupled system of partial differential equations arising in thermoelasticity 471
S. CHIRIŢĂ: On the asymptotic partition of energy in linear thermoelasticity 327
GIOVANNI CIMATTI: A rigorous justification of the Reynolds equation 627
DEAN S. CLARK: Stability in a system of difference equations 441
S. L. COLE: Transient waves produced by a moving pressure distribution ... 51
B. D'ACUNTO: The moving load on a string as free boundary problem 201
C. M. DAFERMOS: Trend to steady state in a conservation law with spatial inhomogeneity 313
A. M. J. DAVIS AND K. B. RANGER: A Stokes flow model for the drag on a blood cell 305
W. A. DAY: Adiabatic invariants for strings and membranes subjected to slowly-varying tension 349
W. A. DAY: Adiabatic invariants for strings, membranes, and beams of slowly-varying dimensions 389
W. A. DAY: Sinks and boundary temperatures that neutralize a heat source 185
R. W. DICKEY: Membrane caps 697
DAVID DURBAN: Plastic stresses induced by a rigid ring embedded in a thin anisotropic plate under uniform tension 341
F. ERDOGAN (*see* A. C. KAYA)
M. FABRIZIO (*see* A. MORRO)
G. A. FRANCFORT (*see* D. BLANCHARD)

ARTHUR D. GORMAN (*see* STEVEN P. ANDERSON)
T. B. GRIFFIN (*see* B. D. REDDY)
S. C. GUPTA: Temperature and moving boundary in two-phase freezing due to an axisymmetric cold spot 205
S. I. HARIHARAN: Nonlinear acoustic wave propagation in atmosphere 735
P. HENRICI AND G. R. WILKENS: An application of the multivariate Lagrange–Bürmann expansion in mathematical geodesy 165
Y. C. HON (*see* C. Y. CHAN)
KENNETH B. HOWELL: Asymptotic behavior of periodic, periodic biharmonic and periodic harmonic functions 279
TIMOTHY L. JOHNSON (*see* RONALD K. PEARSON)
M. C. JORGE: Local existence of the solution to a nonlinear inverse problem in gravitation 287
A. C. KAYA AND F. ERDOGAN: On a solution of integral equations with a generalized Cauchy kernel 455
A. C. KAYA AND F. ERDOGAN: On the solution of integral equations with strongly singular kernels 105
B. W. KNIGHT (*see* L. SIROVICH)
M. R. S. KULENOVIĆ, G. LADAS and A. MEIMARIDOU: On oscillation of nonlinear delay differential equations 155
K. KUTTLER AND ELIAS C. AIFANTIS: Existence and uniqueness in non-classical diffusion 549
G. LADAS (*see* M. R. S. KULENOVIĆ)
LUIZ A. C. LADEIRA AND PLÁCIDO Z. TÁBOAS: Periodic solutions of the equation $\ddot{x} + g(x) = E\cos t + \sigma h(t)\dot{x}$ 429
CHARLES G. LANGE (*see* HUBERTUS J. WEINITSCHKE)
LIVIU LIBRESCU: Refined geometrically nonlinear theories of anisotropic laminated shells 1
GERALD S. MANNING: Relaxed elastic line on a curved surface 515
GERALD S. MANNING: The winding of a relaxed elastic line on a cylinder .. 809
LUKE F. MANNION: Dynamic fracture of a beam under compression 713
J. B. MARTIN (*see* B. D. REDDY)
A. MEIMARIDOU (*see* M. R. S. KULENOVIĆ)
A. MORRO AND M. FABRIZIO: On uniqueness in linear viscoelasticity: a family of counterexamples 321
N. MOSTAGHEL: Response bounds for hysteretic second order systems 173
A. NADARAJAH AND R. NARAYANAN: On the completeness of the Rayleigh–Marangoni and Graetz eigenspaces and the simplicity of their eigenvalues .. 81
R. NARAYANAN (*see* A. NADARAJAH)
RICHARD D. NOREN: A linear Volterra integrodifferential equation for viscoelastic rods and plates 503
D. F. PARKER: Dynamical equations for the finite elastic bending, torsion, and stretching of rods 533
RONALD K. PEARSON AND TIMOTHY L. JOHNSON: Energy equipartition and fluctuation-dissipation theorems for damped flexible structures 223
THOMAS J. PENCE: Formulation and analysis of a functional equation describing a moving one-dimensional elastic phase boundary 293
N. PHAN-THIEN: A three-dimensional stretching flow of an Oldroyd fluid ... 23
DANIEL PHILLIPS (*see* NICHOLAS D. ALIKAKOS)

A. PIVA: An alternative approach to elastodynamic crack problems in an orthotropic medium 97
JEAN-CLAUDE RAMIREZ: The three-dimensional stress intensity factor due to the motion of a load on the faces of a crack 361
K. B. RANGER (*see* A. M. J. DAVIS)
K. B. RANGER: Diffusion and convection of vorticity at low Reynolds numbers produced by a rotlet interior to a circular cylinder 669
B. D. REDDY, J. B. MARTIN and T. B. GRIFFIN: Extremal paths and holonomic constitutive laws in elastoplasticity 487
M. ROKNI AND B. S. BERGER: Lyapunov exponents and subspace evolution 789
STEVEN I. ROSENCRANS: On Amundson's model of the unsteady combustion of a slab of carbon 795
JACK SCHAEFFER: Discrete approximation of the Poisson–Vlasov system 59
GILBERTO SCHLEINIGER: Quasi-transonic flow past delta wings 265
JINSONG SHI (*see* CHIA-SHUN YIH)
R. E. SHOWALTER AND N. J. WALKINGTON: A hyperbolic Stefan problem 769
LAWRENCE SIROVICH: Turbulence and the dynamics of coherent structures .
Part I: Coherent structures 561
Part II: Symmetries and transformations 573
Part III: Dynamics and scaling 583
L. SIROVICH AND B. W. KNIGHT: Two-scale eigenfunction methods with an application to the visual system 749
S. H. SMITH: A note on the Stokes' paradox 529
CHARLES G. SPEZIALE: On helicity fluctuations in turbulence 123
CHARLES G. SPEZIALE: Second-order closure models for rotating turbulent flows 721
T. C. T. TING (*see* P. CHADWICK)
PLÁCIDO Z. TÁBOAS (*see* LUIZ A. C. LADEIRA)
A. VISINTIN: Supercooling and superheating effects in heterogeneous systems 239
N. J. WALKINGTON (*see* R. E. SHOWALTER)
ELIAS WEGERT: On a nonlinear problem of the theory of potential flows 691
HUBERTUS J. WEINITSCHKE AND CHARLES G. LANGE: Asymptotic solutions for finite deformation of thin shells of revolution with a small circular hole 401
G. R. WILKENS (*see* P. HENRICI)
D. E. WILSON: The unsteady boundary layer on a cylinder due to small transverse oscillations 601
DAVID H. Y. YEN (*see* THOMAS C. ASSIFF)
CHIA-SHUN YIH AND JINSONG SHI: Stability of time-periodic temperature fields 39
CHIA-SHUN YIH: A solitary group of two-dimensional deep-water waves 177
JIONGMIN YONG: Stabilization of linear systems by time-delay feedback controls 377

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

Vol. XLV, No. 4 **December 1987**

D. E. WILSON: The unsteady boundary layer on a cylinder due to small transverse oscillations 601

GIOVANNI CIMATTI: A rigorous justification of the Reynolds equation 627

D. BLANCHARD AND G. A. FRANCFORT: Asymptotic thermoelastic behavior of flat plates 645

K. B. RANGER: Diffusion and convection of vorticity at low Reynolds numbers produced by a rotlet interior to a circular cylinder 669

THOMAS C. ASSIFF AND DAVID H. Y. YEN: On the solutions of clamped Reissner–Mindlin plates under transverse loads 679

ELIAS WEGERT: On a nonlinear problem of the theory of potential flows 691

LL. G. CHAMBERS: Note on the functional differential equation $\frac{d}{dx}\{\phi(x)\} - a\phi(x^{\lambda}) = 0$ 695

R. W. DICKEY: Membrane caps 697

LUKE F. MANNION: Dynamic fracture of a beam under compression 713

CHARLES G. SPEZIALE: Second-order closure models for rotating turbulent flows 721

S. I. HARIHARAN: Nonlinear acoustic wave propagation in atmosphere 735

L. SIROVICH AND B. W. KNIGHT: Two-scale eigenfunction methods with an application to the visual system 749

R. E. SHOWALTER AND N. J. WALKINGTON: A hyperbolic Stefan problem . 769

STEVEN P. ANDERSON AND ARTHUR D. GORMAN: Caustics associated with the asymptotic solution of the diffusion equation 783

M. ROKNI AND B. S. BERGER: Lyapunov exponents and subspace evolution 789

STEVEN I. ROSENCRANS: On Amundson's model of the unsteady combustion of a slab of carbon 795

GERALD S. MANNING: The winding of a relaxed elastic line on a cylinder . . . 809

NEW BOOKS 668, 720, 734, 782, 788, 794, 808, 816

Total Mean Curvature and Submanifolds of Finite Type. By Bang-yen Chan.World Scientific, 1984, available from: Heyden & Sons Inc., Philadelphia.

This is volume 1 of the Series in Pure Mathematics. It is an expanded version of the author's lectures at Michigan State University during 1982–1983. It provides a detailed account of results on the subject which has been developed over the last fifteen years.

Nonlinear Dynamics and Chaos. By. J. M. T. Thompson and H. B. Stewart. John Wiley & Sons, New York, 1986. pp. xvi + 376. $42.95.

The aim of this book is to present the new geometrical ideas that are revolutionizing dynamical systems theory in a readable and richly illustrated form for engineers and scientists, analysts and experimentalists of all disciplines, who are concerned to model and understand the time evolution of real systems. Continuous and discrete dynamical systems, described respectively by ordinary differential equations and finite difference equations (iterated maps), are considered in the book, and attention is focused predominantly on the typical dissipative systems, familiar from the damped, energy-absorbing systems of macroscopic physics. Very little analytical knowledge is required from the reader, except a little familiarity with simple differential equations. The topological principles governing the dynamical trajectories in phase space are introduced coherently and systematically in examples of gradually increasing complexity accompanied by over 200 diagrams, most of which come directly from computer solutions of basic archetypal equations. Chapter headings: 1. Introduction. 2. An overview of nonlinear phenomena. 3. Point attractors in autonomous systems. 4. Limit cycles in autonomous systems. 5. Periodic attractors in driven oscillators. 6. Chaotic attractors in forced oscillators. 7. Stability and bifurcations of equilibria and cycles. 8. Stability and bifurcation of maps. 9. Chaotic behaviour of one- and two-dimensional maps. 10. The geometry of recurrence. 11. The Lorenz system. 12. Rössler's band. 13. Geometry of bifurcation. 14. Subharmonic resonances of an offshore structure. 15. Chaotic motions of an impacting system. 16. The particle accelerator and Hamiltonian dynamics. 17. Experimental observations of order and chaos.

Galaxies. Axisymmetric Systems and Relativity: Essays Presented to W. B. Bonnor on His 65th Birthday. Edited by M. A. H. MacCallum. Cambridge University Press, Cambridge, 1985. pp. xx + 300. $49.50.

The twenty papers in this volume are organized under three headings: Galaxies and Cosmology, Axisymmetric Systems, and Relativity.

Super Computers: Algorithms, Architectures, and Scientific Computation. Edited by F. A. Matsen, and T. Tajima. University of Texas Press, Austin, 1986. pp. vi + 480. $35.00.

These are the proceedings of an international conference on supercomputers held at the University of Texas at Austin in March of 1985. There are 26 papers dealing with high-level languages, cosmology, biology, seismology, elementary particles, field theory, magnetism, superconductivity, quantum chemistry, and reservoir engineering.

Positive Operators. By Charalambos D. Aliprantis and Owen Burkinshaw. Academic Press, Inc. Orlando, 1985. pp. xvi + 367. $59.00.

This is a volume in Pure and Applied Mathematics—A Series of Monographs and Textbooks. It is divided into five chapters. Chapter 1 deals mainly with the elementary properties of positive operators. It covers extension properties of positive operators, order projections, order continuous operators, and positive linear functionals. Chapter 2 studies three specific classes of operators: the components of a positive operator, the lattice homomorphisms, and the orthomorphisms. Chapter 3 considers topological aspects of vector spaces. It covers topological vector spaces, weak topologies on Banach and Riesz spaces. The fourth chapter is devoted to Banach lattices. The fifth chapter of the book deals with compactness properties of positive operators. This is the most important chapter of the book. It makes a thorough study of compact, weakly compact, and Dunford–Pettis operators on Banach lattices.

Continued on page 720

Continued from page 668

Mathematics of Multi-Objective Optimization. Edited by P. Serafini. Springer-Verlag, Wien-New York, 1985. pp. 1 + 441. $26.60.

This is volume 289 of the series Courses and Lectures of the International Center for Mathematical Sciences, Udine, Italy, and constitutes the proceedings of a seminar held September 3–4, 1984. The proceedings are grouped into two parts: ten papers related to theory, and nine papers related to the modelling of multi-objective problems. The topics covered in the first part are: value functions both in a deterministic and in a stochastic setting, scalarization, duality, linear programming, dynamic programming and stability; the second part covers comparison of mathematical models, interactive decision making, weight assessment, scalarization models and applications (i.e., compromise and goal programming, etc.).

Introduction to Fuzzy Arithmetic: Theory and Applications. By Arnold Kaufmann and Madan M. Gupta. Van Nostrand Reinhold Company, New York, 1985. pp. xvii + 351. $44.95.

The authors base the concept of fuzziness on that of the interval of confidence, extending into the range of levels between 0. and 1. Fuzzy arithmetic is here considered as a domain of fuzzy set theory. The authors introduce random data into their discussions and show how they differ from fuzzy material, and how random data and fuzzy material can be used together. Chapter headings: 1. Definitions and main properties of fuzzy numbers. 2. A large sample of novel concepts and tools. 3. Arithmetic and combinatorics with uncertain numbers. 4. Some complements.

The Second Law. By P. W. Atkins. Scientific American Library, New York, 1984. pp. ix + 230. $29.95.

This is volume 10 of the Scientific American Library. It is a beautifully illustrated account of the Second Law of Thermodynamics, addressed to the general reader without mathematical background, but also well suited for the scientifically sophisticated who will enjoy the original insights and new angles provided by the author, an Oxford chemist. Chapter headings: 1. Nature's dissymmetry. 2. The signpost of change. 3. Collapse into chaos. 4. The enumeration of chaos. 5. The potency of chaos. 6. Transformations of chaos. 7. Powers of temperature. 8. Constructive chaos. 9. Patterns of chaos.

Stochastic Models of Air Pollutant Concentration. By Jan Grandell. Springer-Verlag, New York, 1985. pp. 1 + 110. $26.60.

This is volume 30 of Lecture Notes in Statistics. It discusses the Markov model for the precipitation intensity of air pollutants and computes the distribution of the residence time of an aerosol particle. Chapter headings: 1. Introduction. 2. Some basic probability. 3. The general model. 4. Residence times and mean concentrations. 5. The variance of the concentrations. 6. The Gibbs and Slinn approximation. 7. Precipitation scavenging. 8. The concentration process.

Asymptotic Expansions for General Statistical Models. By J. Pfanzagl. Springer-Verlag, New York, 1985. pp. vii + 505. $36.00.

This is volume 31 of Lecture Notes in Statistics. Chapter headings: 0. Introduction. 1. Differentiability of paths. 2. Methodological remarks about derivatives and tangent spaces. 3. Examples of derivatives and tangent spaces. 4. Differentiability of functionals. 5. Examples of functionals and gradients. 6. Asymptotic expansions for power functions. 7. Evaluating the performance of estimators. 8. Asymptotic bounds for the performance of confidence procedures and estimators. 9. The possible forms of Edgeworth expansions for asymptotically efficient estimator-sequences. 10. Statistics with stochastic expansion. 11. Examples. 12. Quantiles: An example of an irregular functional. 13. Lemmas.

Continued on page 734

Continued from page 720

Analysis of Experiments with Missing Data. By Yadolah Dodge. John Wiley & Sons, New York, 1985. pp. xvii + 499.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is its purpose to present recently developed theories for analyzing a data set resulting from designed experiments with missing data, giving complete results in analyzing experiments with arbitrary patterns. The treatment is theoretical but many examples along with computer programs are provided to clarify the concepts. There are many references at the end of each chapter, but there is no author index. Also, it seems that the references to the sources quoted in the preface are missing. Chapter headings: 1. Prologue. 2. One factor experiments: comparing treatments. 3. Experiments involving two factors. 4. Complete $2n$ factorial experiments. 5. Additive two-way classification with missing observations: estimability and analysis. 6. Additive three-way classification with missing observations: estimability and analysis. 7. n-way classifications with missing observations: estimability and analysis. 8. Generalized inverses for classification models. 9. Minimally connected factorial experiments and the problem of selecting a factorial experiment.

Mathematical Methods in Medicine. By Richard Bellman. World Scientific, Heyden & Sons, Singapore, 1983. 1 + 246 pp. $33.00 hardcover, $18.00 softcover

This is volume 1 of the series Studies in Modern Applied Mathematics. It is its purpose to show how mathematical problems arise in medicine and its theme is the administration of drugs. Chapter headings: 1. One- and two-compartment models; 2. Matrices and multi-compartment models; 3. Observation and testing; 4. Pharmacokinetic properties; 5. The sorcerer's apprentice: the digital computer; 6. Numerical algorithms; 7. Optimal dosage and control theory; 8. Clinical treatment and constraints; 9. Decision processes and dynamic programming; 10. Analytic and computational techniques; 11. Uncertainty; 12. Tumor detection and scan-rescan processes; 13. Radiotherapy and radiative transfer.

Monte Carlo Methods-Volume 1: *Basics.* By Malvin H. Kalos and Paula A. Whitelock. John Wiley & Sons, New York, 1986. pp. ix + 186. $29.95.

This introduction to Monte Carlo Methods seeks to identify and study the unifying elements that underly their effective application. It focuses on two basic themes. The first is the importance of random walks as they occur both in natural stochastic systems and their relationship to integral and differential equations. The second theme is that of variance reduction in general and importance sampling in particular as a technique for efficient use of the methods. Random walks are introduced with an elementary example in which the modelling of radiation transport arises directly from a schematic probabilistic description of the interaction of radiation with matter. Building on that example, the relationship between random walks and integral equations is outlined. The applicability of these ideas to other problems is shown by an introduction to the solution of the Schrödinger equation by random walks. The detailed discussion of variance reduction includes Monte Carlo evaluation of finite-dimensional integrals. Special attention is given to importance sampling, partly because of its intrinsic interest in quadrature, partly because of its general usefulness in the solution of integral equations.

Infinitely Divisible Statistical Experiments. By Arnold Janssen, Hartmut Milbrodt, and Helmut Strasser. Springer-Verlag, New York, 1985. pp. vi + 163. $13.20.

This is volume 27 of Lecture Notes in Statistics. It is intended to give an account of the theory of infinitely divisible statistical experiments, starting with LeCam's basic result of 1974 (a presentation of which is included), as well as new developments in the field. The book consists of four chapters, written by different authors, as follows: 1. Limits of triangular arrays of experiments, by H. Milbrodt and H. Strasser. 2. The Lévy-Khintchine formula for infinitely divisible experiments, by A. Janssen. 3. Representation of Poisson experiments, by H. Milbrodt. 4. Statistical experiments with independent increments.

Continued on page 782

Continued from page 734

The Cowles Commission in Chicago, 1939–1955. By Clifford Hildreth. Springer-Verlag, New York, 1986. pp. iii + 176. $19.30.

This is volume 271 of Lecture Notes in Economics and Mathematical Systems. The introduction surveys the history of the Cowles Commission, and the others review the work of the commission under the three headings: Simultaneous Equations, Activity Analysis, and Related Topics.

Mathematical Models in Applied Mechanics. By A. B. Tayler. Clarendon Press, Oxford, 1986. pp. viii + 280. $29.95 Hardcover, $14.95 Paperback.

This is a volume in the Oxford Applied Mathematics and Computing Science Series. The graduate M.Sc. program in Applied Mathematics at Oxford University contains a full-year course which develops the theory and applications of partial differential equations through the solution of a series of applicable problems. Most of the problems, which may vary from year to year, have arisen from industrial research through the Oxford Study Groups with Industry, and particular attention has been paid to the formulation of each problem. This book is based on the experiences of the author and his colleagues in teaching this course and in developing the Study Group project. Its objectives are to demonstrate the skills of formulating problems in Applied Mechanics at the same time as coherently developing the theory and methods of partial differential equations. The book is not intended as a research monograph on industrial problems nor as a standard text on differential equations, which, however, are its main mathematical themes. Rather, it is an attempt to demonstrate the power of mathematics and the diversity of its application, in the hope of stimulating readers with some background knowledge of Applied Analysis and Mechanics into constructing their own models of new situations. It is designed to be a coherent text so that each problem described develops the theme, and each extension of the theme leads on to a new problem.

Norbert Wiener: Collected Works: Volume II. Edited by P.Masani. The MIT Press, Cambridge, Massachusetts, 1985. pp. xx + 1083. $70.00.

The invaluable feature of this as well as earlier volumes edited by Professor Masani is the placement of the bulk of Wiener's profound contributions (not only to the many areas of mathematics, but also to philosphy, relativity, quantum mechanics, communication engineering, the physiology of the heart and nervous system, brain wave encephalography, sensory prosthesis–in short, the field now known as cybernetics) in the context of present day research by means of commentaries, tracing both their genesis and aftermath, written by eminent contemporary scholars. This volume contains the following sections: Pre-Cybernetical Papers, Cybernetical Papers (computing machines, teleology, information theory, time and organization, homeostasis, prosthesis, scientific models, and physiology); Cybernetics; Science and Society; Aesthetics and Literary Criticism; Educational Articles; Reports and Miscellaneous Articles; Encyclopedia Articles; Book Reviews, Prefaces and Abstracts; Obituaries. There is also an Introduction by P. Masani and a Bibliography of Norbert Wiener.

Graphical Exploratory Data Analysis. By S. H. C. du Toit, A. G. W. Steyn, R. H. Stumpf. Springer-Verlag, New York, 1986. pp. ix + 314.

This is a volume in Springer Texts in Statistics. The book attempts to give a sound overview of most of the well-known and widely used methods of analyzing and portraying data graphically. Throughout the book the emphasis is on exploratory techniques. Working computer programs are provided in almost every case. Graphic representations are illustrated throughout by making use of real-life data. Two such data sets are used throughout the text. Chapter headings: 1. The role of graphics in data exploration. 2. Graphics for univariate and bivariate data. 3. Graphics for selecting a probability model. 4. Visual representation of multivariate data. 5. Cluster analysis. 6. Multidimensional scaling. 7. Graphical representations in regression analysis. 8. CHAID and XAID; Exploratory techniques for analyzing extensive data sets. 9. Control charts. 10. Time series representations. 11. Further useful graphics.

Continued on page 788

Continued from page 782

The Mathematics of Computerized Tomography. By. F. Natterer. John Wiley & Sons, New York, 1986. pp. x + 222. $49.95.

By computerized tomography (CT) is meant the reconstruction of a function from its line or plane integrals, irrespective of the field where this technique is applied. This book collects some mathematics which is of interest both to the research mathematician who wants to understand the theory and algorithms of CT and to the practitioner who wants to apply CT in his special field of interest. The author restricts himself to the original problem of CT, and does not discuss the statistical aspects of the subject. The necessary mathematical background is reviewed in the last chapters. Chapter headings: 1. Computerized tomography. 2. The Radon transform and related transforms. 3. Sampling and resolution. 4. Ill-posedness and accuracy. 5. Reconstruction algorithms. 6. Incomplete data. 7. Mathematical tools.

A First Course in Coding Theory. By Raymond Hill. Oxford University Press, New York, 1986. pp. xii + 251. $35.00.

This is a volume in the Oxford Applied Mathematics and Computing Science Series. The aim of the book is to provide an elementary treatment of the theory of error-correcting codes, assuming no more than high school mathematics and matrix arithmetic. Chapter headings: 1. Introduction to error-correcting codes. 2. The main coding theory problem. 3. An introduction to finite fields. 4. Vector spaces over finite fields. 5. Introduction to linear codes. 6. Encoding and decoding with a linear code. 7. The dual code, the parity-check matrix, and syndrome decoding. 8. The Hamming codes. 9. Perfect codes. 10. Codes and Latin squares. 11. A double-error correcting decimal code and an introduction to BCH codes. 12. Cyclic codes. 13. Weight enumerators. 14. The main linear coding problem. 15. MDS codes. 16. Concluding remarks, related topics, and further reading.

Statistics for Nuclear and Particle Physics. By Louis Lyons. Cambridge University Press, Cambridge, 1986. pp. xii + 226.

The material in this book is an enlarged version of a short course given to graduate students in the Nuclear Physics Laboratory, Oxford. The emphasis is on practical applications and how to use statistics to obtain the best results from one's data and to know the limitations of the results. Chapter headings: 1. Experimental errors. 2. Probability and statistics. 3. Distributions. 4. Parameter fitting and hypothesis testing. 5. Detailed examples of fitting procedures. 6. Monte Carlo calculations.

Current Advances in Distributed Computing and Communications. Edited by Yechiam Yemini. Computer Science Press, Rockville, Maryland, 1987. pp. 1 + 377. $49.95.

This book grew out of a series of seminars at Columbia University. There are 15 papers, grouped under the headings Performance Analysis and Communication in Distributed Systems.

Numerical Derivatives and Nonlinear Analysis. By Harriet Kagiwada, Robert Kalaba, Nima Rasakhoo, and Karl Spingarn. Plenum Press, New York, 1986. pp. x + 201. $35.00.

This is volume 31 of the series Mathematical Concepts and Methods in Science and Engineering. The purpose of this text is to familiarize computer users with a simple and practical method for obtaining partial derivatives of complicated mathematical expressions. The text illustrates the use of automatic derivative evaluation subroutines to solve a wide range of nonlinear least-squares, optimal control, system identification, two-point boundary value problems, and integral equations. The numerical values of the derivatives are evaluated exactly, except for roundoff, using simple FORTRAN or BASIC subroutines. These derivatives are divided automatically behind the scenes, from the equivalent of analytical expressions, without any effort from the user. In many cases, such as in optimization problems, the user of the program need only to enter an analytical expression into the program. The derivatives, as well as complete solutions, are then evaluated automatically. Chapter headings: 1. Methods for numerical differentiation. 2. Nonlinear least squares. 3. Optimal control. 4. System identification. 5. Sukhanov's variable initial value method for boundary value problems. 6. Nonlinear integral equations.

Continued on page 794

Continued from page 788

Markov Processes: Characterization and Convergence. By Stewart N. Ethier and Thomas G. Kurtz. John Wiley & Sons, New York, 1986. pp. x + 534. $47.50.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. The authors state that the original aim of this book was a discussion of weak approximate results for Markov processes, but that the scope has widened to include characterization results as well as convergence properties. The three techniques discussed for proving convergence problems are: those based on operator semigroup convergence theorems; those based on the martingale characterization of Markov processes; and those depending on the representation of the processes as solutions of stochastic equations. Chapter headings: 1. Operator semigroups. 2. Stochastic processes and martingales. 3. Convergence of probability measures. 4. Generators and Markov processes. 5. Stochastic integral equations. 6. Random time changes. 7. Invariance principles and diffusion approximations. 8. Examples of generators. 9. Branching processes. 10. Genetic models. 11. Density dependent population processes. 12. Random evolutions.

Finite Element Methods for Navier–Stokes Equations. By Vivette Girault and Pierre-Arnaud Raviart. Springer-Verlag, New York, 1986. pp. x + 374. $90.00.

This volume in the Springer Series in Computational Mathematics is an extended version of a text first published in 1979 as volume 749 of the Springer Lecture Notes in Mathematics. It is its purpose to provide a fairly comprehensive treatment of the most recent developments in the field. The authors restrict themselves to stationary problems, and do not discuss implementation of the methods, which are discussed in other texts. The text is self-contained, with proofs of all theoretical results required. Chapter headings: 1. Mathematical foundations of the Stokes problem. 2. Numerical solution of the Stokes problem in the primitive variables. 3. Incompressible mixed finite element methods for solving the Stokes problem. 4. Theory and approximation of the Navier–Stokes problem.

Ferrohydrodynamics. By R. E. Rosensweig. Cambridge University Press, Cambridge, 1985. pp. xv + 344. $69.50.

This is a volume in the series Cambridge Monographs on Mechanics and Applied Mathematics. In it, the author develops a framework for understanding the behavior and dynamics of magnetic fluids. Magnetic fluids, like iron, become magnetized in the presence of an external magnetic field, but also exhibit properties characteristic of fluids. The treatment is self-contained and builds stepwise on the theory of electromagnetism, fluid mechanics, and thermodynamics. The author also discusses some unusual associated phenomena such as remote positioning, levitation of dense objects, prevention of flow instabilities, and the self-organization of the magnetic fluid into patterns. Chapter headings: 1. Introduction. 2. Magnetic fluids. 3. Electromagnetism and fields. 4. Stress tensor and the equation of motion. 5. The ferrohydrodynamic Bernoulli equation. 6. Magnetocaloric energy conversion. 7. Ferrohydrodynamic instabilities. 8. Magnetic fluids and asymmetric stress. 9. Magnetic two-phase flow.

Wave Interactions and Fluid Flows. By A. D. D. Craik. Cambridge University Press, Cambridge, 1985. pp. x + 322. $59.50.

This is a volume in the Cambridge Monographs on Mechanics and Applied Mathematics. It is a comprehensive, up-to-date and coherent account of theory and experiment on wave-interaction phenomena, both in fluids at rest and in shear flows. On the one hand, this includes water waves, their evolution and interaction and associated wave-driven mean flows; on the other, phenomena of nonlinear hydrodynamic stability, especially those leading to the onset of turbulence. Close similarities and crucial differences exist between these two classes of phenomena, and their treatment in this single study provides a bridge between more specialised, but related, disciplines. Chapter headings: 1. Introduction. 2. Linear wave interaction. 3. Introduction to nonlinear theory. 4. Waves and mean flows. 5. Three-wave resonance. 6. Evolution of a nonlinear wave train. 7. Cubic three- and four-wave interactions. 8. Strong interactions, local instabilities and turbulence: a postscript.

Continued on page 808

Continued from page 794

Real and Stochastic Analysis. Edited by M. M. Rao. John Wiley & Sons, New York, 1986. pp. xi + 347.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. The five chapter headings and their authors are: 1. Bimeasures and nonstationary processes, by Derik K. Chang and M. M. Rao. 2. Besicovitch–Orlicz spaces of almost periodic functions, by Theodore R. Hillmann. 3. Diffusion processes in Hilbert space and likelihood ratios, by Alan Krinik. 4. Chains in Banach spaces, by Stephen V. Noltie. 5. Two-parameter stochastic differential equations, by J. Yeh.

The Propagation of Radio Waves: The Theory of Radio Waves of Low Power in the Ionosphere and Magnetosphere. By K. G. Budden, F. R. S. Cambridge University Press, Cambridge, 1985. pp. xvi + 669. $89.50.

Dr. Budden's "Radio waves in the ionosphere" (RWI) was first published in 1961. Advances since then which have affected the study of radio propagation include: the use of space vehicles and rockets, the advances in plasma physics, and the use of computers. Also, some important textbooks have appeared since then. (e.g., Stix; Rawer and Suchy; Ginzburg). The study of W.K.B. solutions (of importance in ray theory), and of ordinary linear homogeneous differential equations have advanced greatly. The present volume covers roughly the same topics as RWI but most of them have been treated differently, making this a new book with a new title. The stress throughout is on understanding the basic physical principles. Chapter headings: 1. The ionosphere and magnetosphere. 2. The basic equations. 3. The constructive relations. 4. Magnetoionic theory: Polarisation and refractive index. 5. Magnetoionic theory: Rays and group velocity. 6. Stratified media. The Booker quartic. 7. Slowly varying medium. The W.K.B. solutions. 8. The Airy integral function and the Stokes phenomenon. 9. Integration by steepest descents. 10. Ray tracing in a loss-free stratified medium. 11. Reflection and transmission coefficients. 12. Ray theory results for isotropic ionosphere. 13. Ray theory results for anisotropic plasmas. 14. General ray tracing. 15. Full wave solutions for isotropic ionosphere. 16. Coupled wave equations. 17. Coalescence of coupling points. 18. Full wave methods for anisotropic stratified media. 19. Applications of full wave methods.

Optimization and Design of Geodetic Networks. Edited by Erik W. Grafarend and Fernando Sansò. Springer-Verlag, New York, 1985. pp. xv + 606. $39.00.

These are the proceedings of the Third Course of the International School of Advanced Geodesy, held April 25th to May 10th, 1984 in Erice, Italy. There are eighteen papers, dealing mainly with the zero, first, second, and third-order design problems of optimization theory. The zero-order design deals with the estimability problem, in other words, with the definition of which parameters are estimable from a given set of observations. The first-order design deals with the problem of varying location of the points of a given network as well as the existence and the type of the observations that can be performed between them. The second-order design is focused on the problem of the choice of the weights to be given to the various possible observations in the network, in order that the estimates of the coordinates exhibit prefixed statistical properties, such as equal variance for the estimates of all the coordinates or uncorrelated estimates of some of the coordinates. The third-order design deals with the optimal introduction of new points and measurements in order to improve the characteristics of a network; it is the so-called densification problem.

Collected Papers, Volume 2: Constructive Field Theory. Selected Papers. By James Glimm and Arthur Jaffe, Birkhäuser, Boston, 1985. pp. x + 533.

This is a companion volume to "Quantum Field Theory and Statistical Mechanics". The papers have been grouped into the following areas: 1. Construction of $P(\phi)_2$. 2. Phase cell localization and ϕ_3^4 stability. 3. Phase transitions exist. 4. Phase transitions and critical behavior. 5. Particle structure. 6. Bounds on coupling constants. 7. Confinement and instantons. 8. Reflection positivity.

Continued on page 816

Continued from page 808

The Theory of Classical Dynamics. By J. B. Griffiths. Cambridge University Press, New York, 1985. pp. xiv + 315. $39.50.

This is a textbook for the undergraduate course in the classical theory of dynamics for physicists or mathematicians, up to and including variational principles as well as Hamilton–Jacobi theory.

Introduction to the Theory of Games. By J. Szép and F. Forgó. D. Reidel Publishing Company, Boston, 1985. pp. xviii + 392. $49.00.

This is a volume in the series Mathematics and its Applications (East European Series). The scope of the text is apparent from the chapter headings: 1. On equilibrium of systems. 2. The n-person game. 3. Existence theorems of equilibrium points. 4. Special n-person games and methods to solve them. 5. The Scarf–Hansen algorithm for approximating an equilibrium point of a finite n-person game. 6. The oligopoly game. 7. Two-person games. 8. Bimatrix games. 9. Matrix games. 10. Symmetric games. 11. Connection between matrix games and linear programming. 12. Methods for solving general matrix games. 13. Some special games and methods. 14. Decomposition of matrix games. 15. Examples of matrix games. 16. Games played over the unit square. 17. Some special classes of games on the unit square. 18. Approximate solution of two-person zero-sum games played over the unit square. 19. Two-person zero-sum games over metric spaces. 20. Sequential games. 21. Games against nature. 22. Cooperation games in characteristic function form. 23. Solution concepts for n-person cooperative games. 24. Stability of pay-off configurations. 25. A bargaining model of cooperative games. 26. The solution concept of Nash for n-person cooperative games. 27. Examples of cooperative games. 28. Game-theoretical treatment of multicriteria decision making. 29. Games with incomplete information.

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