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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: Papers should be submitted in original typewriting on one side only of white paper sheets and be double or triple spaced with wide margins. Marginal instructions to the printer should be written in pencil to distinguish them clearly from the body of the text.

The papers should be submitted in final form. Only typographical errors may be corrected in proofs; composition charges for all 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 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 to follow his name.

Mathematical Work: As far as possible, formulas should be typewritten; Greek letters and other symbols not available on the typewriter should be carefully inserted in ink. Manuscripts containing pencilled material other than marginal instructions to the printer 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 in exponents should be clearly indicated.

Dots, bars, and other markings to be set *above* letters should be strictly avoided because they require costly hand-composition; in their stead markings (such as primes or indices) which *follow* the letter should be used.

Square roots should be written with the exponent $\frac{1}{2}$ rather than with the sign $\sqrt{\ }$.

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,

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

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 printed formulas. To avoid misunderstanding, the order of symbols should therefore be carefully considered. Thus,

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

In handwritten formulas the size of parentheses, brackets and braces can vary more widely than in print. Particular attention should therefore be paid to the proper use of parentheses, brackets and braces. Thus,

$$\{[a + (b + cx)^n] \cos ky\}^2 \text{ is preferable to } ((a + (b + cx)^n) \cos ky)^2.$$

Cuts: Drawings should be made with black India ink on white paper or tracing cloth. It is recommended to submit drawings of at least double the desired size of the cut. The width of the lines of such drawings and the size of the lettering must allow for the necessary reduction. Drawings which are unsuitable for reproduction will be returned to the author for redrawing. Legends accompanying the drawings should be written on a separate sheet.

Bibliography: References should be grouped together in a Bibliography at the end of the manuscript. References 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 it.

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 like 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 like 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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—BOOKS RECEIVED—

Stochastic models for social processes. 3rd edition. By D. J. Bartholomew. John Wiley & Sons, Chichester, New York, 1982. xii + 365 pp. $44.95.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is the third edition of a work first published in 1967 and differs substantially from its predecessors in giving a broader and more balanced account of the subject as it now exists, in making the book more suitable as a graduate text, and in giving a full bibliography. Chapter headings: 1. Stochastic modelling; 2. Models for mobility in closed social systems; 3. Markov models for open systems; 4. Continuous time models for closed social systems; 5. Continuous time models for open social systems; 6. Control theory for Markov models; 7. Models for duration and size; 8. Models for social systems with fixed class sizes; 9. The simple epidemic model for the diffusion of news, rumours and ideas; 10. General epidemic models for the diffusion of news, rumours, and ideas.

A history of computing in the twentieth century. Edited by N. Metropolis, J. Howlett, and Gian-Carlo Rota. Academic Press, New York, 1980. xiv + 659 pp. $29.50.

This book contains the edited versions of the papers presented at the International Research Conference on the History of Computing held at the Los Alamos Scientific Laboratory, 10–15 June 1976. It provides an account of the development of the first large-scale computers in the first half of the twentieth century. Each chapter describes one phase of the development and is written by either a participant in or a witness to these events. The treatment is narrative and factual and is meant to give a first exposition of the *res gestae.* The exposition is accessible to anyone interested in the subject and requires no technical background. There are five parts: 1. Introduction (R. W. Hamming, K. O. May); 2. The Human Side (Garrett Birkhoff, I. J. Good, B. Randell, S. M. Ulam, J. H. Wilkinson, H. S. Tropp); 3. The Languages (John Backus, A. P. Ershov and M. R. Shura-Buia, Donald Knuth and Luis Trabb Pardo, M. B. Wills); 4. The Machines (Julian Bigelow, Arthur W. Burks, J. C. Chu, James B. Robertson, Robert B. Everett, A. S. Householder, Cuthbert C. Hurd, Harry D. Huskey, S. H. Lavington, D. H. Lehmer, N. Metropolis, Jan Rajchman, Ralph J. Slutz, George R. Stibitz, Erwin Tomash, M. V. Wilkes), 5. The Places (Friedrich L. Bauer, J. Presper Eckert, Jr., John W. Mauchly, Andrew D. Booth, E. W. Dijkstra, Ryota Suekane, Antonia Swoboda, H. Zemanek, Konrad Zuse, B. Randell).

The theory of Eisenstein systems. By M. Scott Osborne and G. Warner. Academic Press, New York, 1981. xiii + 385 pp. $55.00.

This is volume 99 in the series Pure and Applied Mathematics. Let G be a reductive Lie group, Γ a lattice in G—then, some twenty-five years ago, Selberg associated with the pair (G, Γ), when Γ was in addition uniform, his celebrated trace formula, a noncommutative analog of the Poisson summation formula. Selberg's trace formula is now an important and well-established tool in harmonic analysis. Apart from a few examples, Selberg never did give a trace formula in the nonuniform situation, remarking only on the great difficulties inherent in the attempt to obtain such. At the present time, for general G and Γ, the Selberg trace formula does not yet exist. On the other hand, it is generally agreed that its development is crucial, leading, as will eventually be the case, to significant applications in automorphic forms and number theory. Simply put, the purpose of this monograph is to lay the foundations upon which the theory rests, concluding with some preliminaries on the trace formula itself.

Quantum mechanics in Hilbert space. 2nd edition. By Eduard Prugovecki. Academic Press, New York, 1981. xxi + 685 pp. $39.50.

This book, volume 92 in the series Pure and Applied Mathematics, is the second edition of a work first published in 1971. It is intended to provide a critical presentation of the basic mathematics of nonrelativistic quantum mechanics at a level which "meets the present standard of mathematical rigor". It should also be of interest to mathematicians working in functional analysis of related areas. The author has attempted to make the book self-contained. There are five parts: 1. Basic ideas of Hilbert space theory; 2. Measure theory and Hilbert space theory of functions; 3. Theory of linear operators in Hilbert spaces; 4. The axiomatic structure of quantum mechanics; 5. Quantum mechanical scattering theory. Most changes since the first edition deal with the part treating quantum scattering theory.

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Pathways to solutions, fixed points, and equilibria. By W. I. Zangwill and C. B. Garcis. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1981. xv + 479 pp. $32.00.

The principal concept and motive in this book is path-following, in its two common forms: differentiable paths and piecewise-linear paths. It commences with differentiable paths, since this produces elegant mathematical proofs. Piecewise-linear paths are introduced after the key ideas are well established—the subject is more complicated. The 22 chapters are divided into four parts: basic theory, applications (to nonlinear programming, economic equilibria, game theory, networks, elasticity and catastrophe theory), algorithms and solution procedures, and, lastly, fundamental concepts and extensions. There are appendices giving background theorems, and an extensive bibliography.

Computer methods for partial differential equations. Vol. 1. By Robert Vichnevetsky. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1981. $28.00.

This book is about the theories on which numerical solutions of partial differential equations are based, and about the corresponding computer methods. It is addressed to graduate students as a textbook, and to scientists and engineers as a reference. The book is intended to appeal to both mathematicians and engineers. The first seven chapters are a self-contained introduction to the tools and techniques for the numerical approximation of elliptic equations with finite differences. The finite-element method starts with chapter 8, beginning with a review of the calculus of variations, followed by the Rayleigh-Ritz and the Galerkin and collocation methods. Chapter headings: I. Fundamentals; 1. Introduction, 2. Fourier series, 3. Finite-difference approximations; II. Elliptic equations; 4. Two-point boundary-value problems I, 5. Finite-difference approximation of elliptic equations, 6. Numerical solution of algebraic equations, 7. Special tools; III. The finite-element method, 8. Rayleigh-Ritz and Galerkin methods, 9. Two-point boundary-value problems II, 10. Poisson's equation, 11. Theory and geometry, 12. Geometric transformations and isoparametric elements.

Digital computer treatment of partial differential equations. By V. Vemuri and W. J. Karplus. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1981. xiv + 449 pp. $28.95.

This book aims to provide the reader with a comprehensive view of digital computer methods for the solution of field problems characterized by partial differential equations, as well as insight into the underlying mathematical issues and physical concepts. It is organized into three major parts: formulations, a discussion of the origin of mathematical models; transformations, the task of changing the partial differential equations derived in part I into algebraic equations; and computations, the solution of these algebraic equations by digital computers.

Aspects of multivariate statistical theory. By Robb J. Muirhead. John Wiley & Sons, 1982. xix + 673 pp. $39.95.

This book is designed as a text for graduate-level courses in multivariate statistical analysis, building on the foundations laid by T. W. Anderson in his classic work of 1958. It is intended in large part to describe some of the developments that have taken place since then, in particular the introduction of zonal polynomials and hypergeometric functions of matrix argument by A. J. James and A. G. Constantine, which made possible a unified study of the noncentral distributions that arise in multivariate analysis under the standard assumptions of normal sampling. Chapter headings: 1. The multivariate normal and related distributions; 2. Jacobians, exterior products, Kronecker products, and related topics; 3. Samples from a multivariate normal distribution, and the Wishart and multivariate beta distributions; 4. Some results concerning decision-theoretic estimation of the parameters of a multivariate normal distribution; 5. Correlation coefficients; 6. Invariant tests and some applications; 7. Zonal polynomials and some functions of matrix argument; 8. Some standard tests on covariance matrices and mean vectors; 9. Principal components and related topics; 10. The multivariate linear model, 11. Testing independence between k sets of variables and canonical correlation analysis.

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Angular momentum in quantum physics: theory and applications. By L. C. Biedenharn and J. D. Louck. Vol. 8 of *Encyclopedia of mathematics and its applications*, edited by Gian-Carlo Rota. Addison-Wesley, Reading, MA, 1981. xxxii + 716 pp. $54.50.

This is a volume in the section Mathematics of Physics (Peter A. Carruthers, section editor). Its companion volume, *The Racah-Wigner algebra in quantum theory*, is noted below. This volume develops the theory of angular momentum from the viewpoint of a fundamental symmetry in nature and shows how this concept relates to applied areas of research in modern quantum physics. The companion volume deals in depth with the fundamental concepts of the subject and the interrelations of angular momentum theory with other areas of mathematics. Table of contents: 1. Introduction, 2. The kinematics of rotations, 3. Standard treatment of angular momentum in quantum mechanics; the theory of turns adapted from Hamilton, 5. The boson calculus applied to the theory of turns, 6. Orbital angular momentum and angular functions on the sphere, 7. Some applications to physical problems: (i) Introductory remarks, (ii) Basic principles underlying the applications, (iii) The Zeeman effect, (iv) The nonrelativistic hydrogen atom, (v) Atomic spectroscopy, (vi) Electromagnetic processes, (vii) Angular momentum techniques in the density matrix formulation of quantum mechanics, (viii) Angular correlations and angular distributions of reactions, (ix) Some applications to nuclear structure, (x) Body-fixed frames: spectra of spherical top molecules.

The Racah-Wigner algebra in quantum theory. By L. C. Biedenharn and J. D. Louck, with a foreword by Peter A. Carruthers and an introduction by George W. Mackey. Vol. 9 of *Encyclopedia of mathematics and its applications*, edited by Gian-Carlo Rota. Addison-Wesley, Reading, MA, 1981. xxxviii + 534 pp. $54.50.

This is a volume in the section Mathematics of Physics (Peter A. Carruthers, section editor). Its companion volume is noted above. In this volume, the development of the algebraic aspects of angular momentum theory and the relationship between angular momentum theory and special topics in physics and mathematics are covered. Table of contents: 1. Introduction, 2. Algebraic structures associated with Wigner and Racah operations, 3. Null space properties and structure theorems for RW-algebra, 4. W-algebra: an algebra of invariant operators, 5. Special topics: (i) fundamental symmetry considerations, (ii) monopolar harmonics, (iii) a minimal realization of angular momentum states: the symplecton, (iv) algebraic aspects of physical tensor operators, (v) complex angular momenta, Regge trajectories, and Regge poles, (vi) radial integrals and the Lie algebra of SU (1, 1), (vii) uncertainty relations for angular momentum, (viii) interrelations between angular momentum theory and projective geometry, (ix) physical interpretation and asymptotic (classical) limits of the angular momentum functions, (x) nontrivial zeros of the 3-*j* and 6-*j* symbols, (ix) the relationship between generalized hypergeometric functions and the Racah-Wigner coefficients, (xii) coupling of N angular momenta: recoupling theory.

Padé approximations, Part I: Basic theory; Part II: Extensions and applications. By George A. Baker, Jr. and Peter Graves-Morris, with a foreword by Peter A. Carruthers. Vols. 13 and 14 of *Encyclopedia of mathematics and its applications*, edited by Gian-Carlo Rota. vol. 13: xx + 325 pp, $32.50; vol. 14: x + 215 pp., $29.50. Addison-Wesley, Reading, MA, 1981.

These are volumes in the section Mathematics of Physics (Peter A. Carruthers, section edition). They describe in a comprehensive manner the topic of Padé approximation and some of its generalizations. The subjects are special topics in mathematical approximation theory and complex analysis. Relations are developed to numerical methods, orthogonal polynomials, and continued fractions. Applications are made to integral equations, quantum mechanics, scattering theory, field theory and statistical mechanics. Table of contents: Part I: 1. Introduction and definitions, 2. Direct application, 3. Padé approximants and numerical methods, 4. Connection with continued fractions, 5. Stieljes series and Polya series, 6. Convergence theory, Part II: 1. Extensions of Padé approximants, 2. Connection with integral equations and quantum mechanics; 3. Connection with numerical analysis; 4. Connection with quantum field theory.

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Finite elements, vol. 1: an introduction. By E. G. Becker, G. F. Carey and J. T. Iden. Prentice-hall, Inc., Englewood Cliffs, N. J., 1981. xii + 258 pp. $24.95.

This is the first volume in a projected six-volume series on finite elements, written by members of the Texas Institute for Computational Mechanics at the University of Texas at Austin (Volume 2: a second course, 3: computational aspects, 4: mathematical aspects, 5: special problems in solid mechanics, 6: fluid mechanics). The purpose of this introductory volume is to provide the undergraduate student of engineering and science with a concise introduction to the finite-element method—one that will give a reader, equipped with little more than calculus, some matrix algebra, and ordinary differential equations, a clear idea of what the finite element method is, how it works, why it makes sense, and how to use it to solve problems of interest to him. Chapter headings: 1. A model problem. 2. One-dimensional problems. 3. Development of a finite-element program. 4. Two-dimensional problems. 5. Two-dimensional element calculations. 6. Extension.

Realization theory of continuous-time dynamical systems. By Tsuyoshi Matsuo. Springer-Verlag, Berlin, Heidelberg, New York, 1981. vi + 320 pp. $17.40.

This is volume 32 of Lecture Notes in Control and Information Science. The realization problem consists in determining an intrinsic mathematical model (canonical dynamical system) from the input-output relations of a given causal black box, i.e., to understand fully the internal behavior of the black box from the experimental data to which it gives rise. There are four chapters: 1. Introduction. 2. Realization theory of (general) dynamical systems. 3. Realization theory of linear representation systems. 4. Realization theory of (algebraic) linear (time-constant) systems.

Mathematical modeling in epidemiology. By J. C. Frauenthal. Springer-Verlag, Berlin, 1980. viii + 118 pp. $14.80.

This is a volume in the series Universitext. It is derived from courses taught by the author to fourth-year undergraduate students majoring in the mathematical sciences. Chapter headings: 1. Deterministic epidemic models. 2. Rumors and mousetraps. 3. Stochastic epidemic models. 4. Chain binomial models. 5. Branching process model. 6. Smallpox vaccination discontinuation. 7. Schistosomiasis eradication. 8. Gonorrhea. 9. Sickle-cell anemia.

Numerical solution of partial differential equations. By Theodor Meis and Ulrich Marcowitz. Springer-Verlag, New York, 1981. viii + 541 pp. $24.00.

This book—volume 32 in Applied Mathematical Sciences—is the result of two courses of lectures given at the University of Cologne in Germany in 1974/75. The majority of the students were not familiar with partial differential equations and functional analysis, which explains why the book contains some basic material and results from these areas. The three parts of the book are largely independent of each other and can be read separately. Their topics are: initial-value problems, boundary-value problems, solutions of systems of equations. There is much emphasis on theoretical considerations and they are discussed as thoroughly as the algorithms which are presented in full detail, together with FORTRAN programs.

Electrodynamics and classicial theory of fields and particles. By A. O. Barut. Dover Publications, New York, 1980. xv + 235 pp. $4.50.

This is a corrected reprint of the original 1964 edition.

Duality for crossed products of von Neumann algebras. By Yoshiomi Nakagami and Masamichi Takesaki. Springer-Verlag, Berlin, 1979. ix + 139 pp. $9.00.

This is volume 731 of Lecture Notes in Mathematics.

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Mathematical programming for operations researchers and computer scientists. Edited by Albert G. Holzman. Marcel Dekker, Inc. New York, 1981. 392 pp. $45.00.

This text consists of eleven chapters: 1. Linear programming. 2. Integer programming. 3. Game theory. 4. Goal programming. 5. Multicriteria decision making. 6. Quadratic programming. 7. Complementarity problems. 8. Geometric programming. 9. Fixed-point computing methods. 10. Classical optimization. 11. Nonlinear programming.

Theory and applications of some new classes of integral equations. By A. G. Ramm. Springer-Verlag, New York, 1980. xiii + 343 pp.

This book is intended for students, research engineers, and mathematicians interested in applications of numerical analysis. Pure analysts will also find some new problems to tackle. Most of the material can be understood by a reader with a relatively modest knowledge of differential and integral equations and functional analysis. There are five chapters, eleven appendices and an extensive bibliography.

Finite rotations and Lagrangean description in the non-linear theory of shells. By Wojchiech Pietraszkiewicz. Polish Scientific Publishers, Warszawa, Poland, 1979. 102 pp.

Chapter headings: 1. Introduction. 2. Introductory relations. 3. Deformation. 4. Theory of finite rotations. 5. Basic shell equations. 6. Small strain theory. 7. Theory of moderate rotations. 8. Concluding remarks.

Geometric quantization. By Nicholas Woodhouse. Oxford University Press, New York, 1981. xi + 316 pp. $74.00.

This systematic account of geometric quantization theory and its applications to theoretical physics is intended as a work of applied mathematics, suitable for graduate students and established workers in mathematical physics. The basic aim of the theory is to identify the structures that are needed for the reconstruction of a quantum system from its classical limit and to determine the extent to which these are singled out by the symplectic geometry of the classical phase space. The geometric method is developed not as a substitute for the analytic method of quantum theory, but to illuminate the relationship between classical and quantum mechanics. The book also clarifies the connection with twistor theory. Chapter headings: 1. Symplectic geometry. 2. Lagrangian and Hamiltonian mechanics. 3. Symmetry. 4. Polarizations and Hamilton-Jacobi theory. 5. Quantization. 6. The metaplectic correction. 7. Spinors and relativistic systems. There is also an appendix on useful background material.

Intermediate statistical methods. By G. Barrie Wetherill. Methuen, Inc., New York, 1981. (Chapman & Hall, London). xvi + 390 pp. $25.00.

Chapter headings: 1. Some properties of basic statistical procedures. 2. Regression and the linear model. 3. Statistical models and statistical inference. 4. Properties of the method of maximum likelihood. 5. The method of least squares. 6. Multiple regression: further analysis and interpretation. 7. Polynomial regression. 8. The use of transformations. 9. Correlation. 10. The analysis of variance. 11. Designs with regressions in the treatment effects. 12. An analysis of data on trees. 13. The analysis of variance: subsidiary analyses. 14. Components of variance. 15. Crossed classifications. 16. Further analysis of variance. 17. The generalized linear model.

Intermediate mathematical statistics. By G. P. Beaumont. Chapman & Hall, London and Methuen, Inc., New York, 1980. 248 pp. $10.95.

Chapter headings: 1. Sufficiency. 2. Unbiased point estimators. 3. Elementary decision theory and Bayesian methods. 4. Methods of estimation. 5. Hypothesis testing I. 6. Hypothesis testing II. 7. Interval estimation. Appendix 1. Functions of random variables. Appendix 2. The regular exponential family of distributions.

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