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QUARTERLY OF APPLIED MATHEMATICS

The QUARTERLY 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.

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SUGGESTIONS CONCERNING THE PREPARATION OF MANUSCRIPTS FOR THE QUARTERLY OF APPLIED MATHEMATICS

The editors will appreciate the authors' cooperation in taking note of the following directions for the preparation of manuscripts. These directions have been drawn up with a view toward eliminating unnecessary correspondence, avoiding the return of papers for changes, and reducing the charges made for "author's corrections."

Manuscripts: Manuscripts should be typewritten double-spaced on one side only. Marginal instructions to the typesetter should be written in pencil to distinguish them clearly from the body of the text. The author should keep a complete copy.

The papers should be submitted in final form. Only typographical errors should be corrected in proof; composition charges for any major deviations from the manuscript will be passed on to the author.

Titles: The title should be brief but express adequately the subject of the paper. The name and initials of the author should be written as he/she prefers; all titles and degrees or honors will be omitted. The name of the organization with which the author is associated should be given in a separate line following his/her name.

Mathematical Work: As far as possible, formulas should be typewritten; Greek letters and other symbols not available on the average typewriter should be inserted using either instant lettering or by careful insertion in ink. Manuscripts containing pencilled material other than marginal instructions to the typesetter will not be accepted.

The difference between capital and lower-case letters should be clearly shown; care should be taken to avoid confusion between zero (0) and the letter O, between the numeral one (1), the letter l and the prime ($'$), between alpha and a, kappa and k, mu and u, nu and v, eta and n.

The level of subscripts, exponents, subscripts to subscripts, and exponents to exponents should be clearly indicated.

Single embellishments over individual letters are allowed; the only embellishment allowed above groups of letters is the overbar.

Double embellishments are not allowed. These may be replaced by superscripts following the symbols.

Complicated exponents and subscripts should be avoided. Any complicated expression that recurs frequently should be represented by a special symbol.

For exponentials with lengthy or complicated exponents the symbol exp should be used, particularly if such exponentials appear in the body of the text. Thus,

$$\exp[(a^2+b^2)^{1/2}] \text{ is preferable to } e^{[a^2+b^2]^{1/2}}.$$

Fractions in the body of the text and fractions occurring in the numerators or denominators of fractions should be written with the solidus. Thus,

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

In many instances the use of negative exponents permits saving of space. Thus,

$$\int u^{-1}\sin u\,du \text{ is preferable to } \int \frac{\sin u}{u}\,du.$$

Whereas the intended grouping of symbols in handwritten formulas can be made clear by slight variations in spacing, this procedure is not acceptable in typeset formulas. To avoid misunderstanding, the order of symbols should therefore be carefully considered. Thus,

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

Figures: Figures should be drawn in black ink with clean, unbroken lines; do not use ball point pen. The paper should be of a nonabsorbant quality so that the ink does not spread and produce fuzzy lines. If the figures are intended for reduction, they should be drawn with heavy enough lines so that they do not become flimsy at the desired reduction. The notation should be of professional quality and in proportion for the expected reduction size. Figures which are unsuitable for reproduction will be returned to the author for redrawing. Legends accompanying figures should be written on a separate sheet.

Bibliography: References should be grouped together in a Bibliography at the end of the manuscript. References in text to the Bibliography should be made by numerals between square brackets.

The following examples show the desired arrangements: (*for books*—S. Timoshenko, *Strength of materials*, vol. 2, Macmillan and Co., London, 1931, p. 237; *for periodicals*—Lord Rayleigh, *On the flow of viscous liquids, especially in three dimensions*, Phil. Mag. (5) 36, 354–372 (1893)). Note that the number of the series is not separated by commas from the name of the periodical or the number of the volume.

Authors' initials should precede their names rather than follow them.

In quoted titles of books or papers, capital letters should be used only where the language requires this. Thus, *On the flow of viscous fluids* is preferable to *On the Flow of Viscous Fluids*, but the corresponding German title would have to be rendered as *Über die Stromung zaher Flüssigkeiten*.

Titles of books or papers should be quoted in the original language (with an English translation added in parentheses, if this seems desirable), but only English abbreviations should be used for bibliographical details such as ed., vol., no., chap., p.

Footnotes: As far as possible, footnotes should be avoided. Footnotes containing mathematical formulas are not acceptable.

Abbreviations: Much space can be saved by the use of standard abbreviations such as Eq., Eqs., Fig., Sec., Art., etc. These should be used, however, only if they are followed by a reference number. Thus, "Eq. (25)" is acceptable but not "the preceding Eq." Moreover, if any one of these terms occurs as the first word of a sentence, it should be spelled out.

Special abbreviations should be avoided. Thus "boundary conditions" should always be spelled out and not be abbreviated as "b.c." even if this special abbreviation is defined somewhere in the text.

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Vol. XLVIII, No. 1 **March 1990**

Mathematics and the Unexpected. By Ivar Ekeland. The University of Chicago Press, Chicago, 1988. pp. xiii + 146. $19.95.

This is a translation by the author (a professor at the University of Paris-Dauphine), of his Le Calcul l'Imprévu: Les figures du temps de Kepler à Thom, which received the Jean Rostand Prize for 1984. The subtitle of the French edition indicates that the author's themes are ideas about the mathematics of time which go back to Poincaré and which appear in the modern literature under names such as "nonlinear sciences" and "order and chaos". The modern heroes of the book are Arnold, Smale, and Thom. One controversial theme of the book is catastrophe theory. The chapter headings are: 1. The music of spheres (Kepler's laws, celestial mechanics); 2. The shattered crystal (dealing with Poincaré's contribution); 3. The comeback of geometry (dissipative systems, catastrophes), and 4. Back to the beginning.

The Method of Paired Comparisons. By H. A. David. Oxford University Press, New York, 1988. pp. 1 + 188. $39.95.

This is the second edition of volume 41 in the series Griffin's Statistical Monographs and Courses. It was first published in 1963. Although the subject now has many fields of application such as acoustics, animal ecology, choice behaviour, dentistry, economics, epidemiology, food science, politics, preference testing, psychometrics, sensory testing, sports, and others, the author contains himself largely to methodological issues, using applications only for illustration. The distinctive emphasis continues to be on simple nonparametric procedures and on the analogy between paired comparisons and tournaments. Chapter headings: 1. Probability models. 2. Combinatorial methods. 3. Nonparametric tests of significance. 4. The linear model. 5. Designs. 6. Selection and ranking. 7. A miscellany.

Oakland Conference on Partial Differential Equations and Applied Mathematics. Edited by L. R. Bragg and J. W. Dettman. Longman Scientific & Technical, and John Wiley & Sons, New York, 1986. pp. 1 + 117. $38.95.

This is volume 154 in the Pitman Research Notes in Mathematics Series. Five papers constitute the proceedings of the May 17, 1986 conference. The major focus was on the applications of recent developments in transmutations, functional analysis and function theoretic methods to inverse scattering, ocean acoustics, potential theory, and the partitioning of energy.

Contributions to Nonlinear Partial Differential Equations: Volume II. Edited by J. I. Díaz and P. L. Lions. Longman Scientific & Technical, and John Wiley & Sons, New York, 1986. pp. 1 + 308. $57.95.

This is volume 155 in the Pitman Research Notes in Mathematics Series. The 26 papers form the proceedings of the Second Franco-Spanish Colloquium on Nonlinear Partial Differential Equations held in Paris in December, 1985.

Semigroups of Linear Operators: An introduction. By A. C. McBride. Longman Scientific & Technical, and John Wiley & Sons, New York, 1986. pp. 1 + 134. $37.95.

This is volume 156 in the Pitman Research Notes in Mathematics Series. It is the author's aim to give a short introduction to the theory of semigroups of linear operators which would allow the nonexpert to cope with concepts if they turned up in a research paper. He developed the theory as far as the existence and uniqueness theorems for solutions of abstract Cauchy problems. Chapter headings: 0. Preliminaries. 1. Definitions and standard examples. 2. The infinitesimal generator of a C_0-semigroup. 3. Resolvants, Laplace transforms and the Hille–Yosida–Phillips theorem. 4. Exponential formulae. 5. New semigroups from old. 6. Abstract Cauchy problems for evolution equations.

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Autour de l'Approximation Semi-Classique. By Dider Robert. Birkhäuser, Boston, 1987. pp. ix + 328.

This is volume 68 of the series Progress in Mathematics. Nonrelativistic quantum mechanics was founded on the correspondence principle of Bohr: When the Planck constant h can be considered small in respect to the other parameters such as masses and distances, quantum theory approaches classical theory (Newtonian mechanics). This book gives a mathematical description of Bohr's principle that is based on modern ideas from partial differential equation theories: pseudodifferential and Fourier-integral operators, microlocal analysis, and functional analysis. The core of this work consists of an exposition of recent global results by B. Helffer and D. Robert. It is a precise study of quantum dynamics by the B. K. W. method with application to the semi-classical approximation of the discrete energy levels for the Schrödinger Hamiltonian.

Probabilistic Properties of Deterministic Systems. By Andrzej Lasota and Michael C. Mackey. Cambridge University Press, New York, 1985. pp. x + 358. $49.50.

To show how densities arise in simple deterministic systems, the authors give a unified treatment of a variety of mathematical systems generating densities, ranging from one-dimensional discrete time transformations through continuous time systems described by integro-partial-differential equations. The authors assume that the reader has a knowledge of advanced calculus and differential equations. Basic concepts from measure theory, ergodic theory, the geometry of manifolds, partial differential equations, probability theory and Markov processes, and stochastic integrals and differential equations are introduced as needed. Chapter headings: 1. Introduction. 2. The toolbox. 3. Markov and Frobenius–Perron operators. 4. Studying chaos with densities. 5. The asymptotic properties of denisties. 6. The behavior of transformations on intervals and manifolds. 7. Continuous time systems: an introduction. 8. Discrete time processes embedded in continuous time systems. 9. Entropy. 10. Stochastic perturbation of discrete time systems. 11. Stochastic perturbation of continuous time systems.

Design Theory. By D. R. Hughes and F. C. Piper. Cambridge University Press, New York, 1985. pp. viii + 240. $39.50.

The subject of design theory has grown out of several branches of mathematics, and has been increasingly influenced in recent years by developments in other areas. Its statistical origins are still evident in some of its standard terminology. Today it has very fruitful connections with group theory, graph theory, coding theory, and geometry; these ties have been two-way, by and large. The authors have attempted in this book to lay the groundwork for an understanding of designs, with advanced undergraduate or graduate students in mind. Finite projective and affine geometries are central to design theory, and are introduced early in the book. The subject of symmetric designs is also introduced early, and its important aspects (the Bruck–Ryser–Chowla Theorem, Singer groups and difference sets, Hadamard 2-design, etc.) are developed. The first four chapters, covering basic definitions, geometry and symmetric designs, are designed to be part of any course based on the book. Chapter 5 covers resolvable and affine designs; Chapter 6 introduces 2-designs other than those met already; Chapter 7 deals with 1-designs and an introduction to generalized quadrangles; finally, Chapter 8 studies the large Mathieu designs and groups.

Continuum Models of Discrete Systems. Edited by A. J. M. Spencer. A. A. Balkema, Boston, 1987. pp. vii + 240. $46.00.

This volume contains the texts of most of the lectures presented at the International Symposium on Continuum Models of Discrete Systems held at the University of Nottingham, 14–20 July, 1985. This series began in Poland in 1975. There are twenty-nine lectures and abstracts of another three.

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Numerical Analysis for Applied Mathematics, Science, and Engineering. By Donald Greenspan and Vincenzo Casulli. Addison-Wesley Publishing Company, New York, 1988. pp. ix + 341. $43.25.

This book is designed for a first course in numerical analysis. The authors aimed for a text that would differ considerably from other such texts in its choice of topics. Their concern has been with the needs of science, engineering, and applied mathematics students. Thus, they aimed at a presentation of a broad spectrum of topics of applied interest, which would bring the reader to various frontiers of the subject. They were able to do this by purging the traditional curriculum of many topics which are not likely to be encountered in either science or technology. Chapter headings: 1. Algebraic and transcendental systems. 2. Approximation. 3. Approximate integration and differentiation. 4. Approximate solution of initial value problems for ordinary differential equations. 5. Approximate solutions of boundary value problems for ordinary differential equations. 6. Elliptic equations. 7. Parabolic equations. 8. Hyperbolic equations. 9. The Navier–Stokes equation.

Inequalities. By G. Hardy, J. E. Littlewood, and G. Pólya. Cambridge University Press, New York, 1988. pp. xii + 324. $19.95.

This is the first paperback edition of the famous classic, first published in 1934. The second, 1952, edition is a reprint with a few minor changes and three new appendices.

Applied Linear Algebra. By Riaz A. Usmani. Marcel Dekker, New York, 1987. pp. vi + 258. $39.75.

This is volume 105 in the series Pure and Applied Mathematics. This text is designed for a course in linear algebra and some of its applications for beginning students of science and engineering. Chapter headings: 1. Vector spaces. 2. Matrices. 3. Generalized inverses. 4. Linear transformations. 5. The eigenvalue problem. 6. Functions of a matrix. 7. Irreducible and monotone matrices.

Modeling in Urban Regional Economies. By Alex Anas. Harwood Academic Publishers, New York, 1987. pp. xiii + 133. $36.00.

This book provides a comprehensive, critical coverage of the progress and development of mathematical modeling within urban and regional economies over the last four decades. It spans a wide range of modeling styles, from land use models of monocentric cities to regional and interregional models of less developed countries. The author evaluates the achievements of these modeling efforts in testing theory, in formulating and resolving questions of policy interest and in stimulating the further growth of theoretical reasoning. He argues that the sophisticated use of microeconomic theory in urban economics has positively affected the development of policy-oriented and empirically-testable models with a progressive interaction between theory and modeling, and shows how, conversely, in regional and interregional economics the lack of a well-developed theoretical microeconomic base has been reflected in the continuing use of input-output and econometric models.

Discrete Groups in Geometry and Analysis: Papers in Honor of G. D. Mostow on his Sixtieth Birthday. Edited by Roger Howe. Birkhäuser, Boston, 1987. pp. x + 210. $27.00.

This is volume 67 in the series Progress in Mathematics. It is the proceedings of a conference at Yale University, March 23–25, 1984, at which the speakers were: P. Deligne, Jun-ichi Igusa, Dennis Johnson and John Millson, Mark Alan Mostow, Yum-Tong Siu, and Robert J. Zimmer.