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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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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.

CONTENTS

Vol. LX, No. 4 **December 2002**

Singularity Theory and Gravitational Lensing. By A. O. Peters, H. Levine, and J. Wambsganss, Birkhäuser, 2001, xxiv + 603 pp., $74.95

Gravitational lensing is the deflection of light by a gravitational field, first observed by Sir Arthur Eddington in 1919, confirming Einstein's theory of gravitation. Recent discoveries of gravitationally lensed quasars and galaxies have revived interest in the subject. This book explores both its astrophysical and its mathematical aspects, in the context of thin-screen (deflecting mass distribution lies on a plane) and weak-field (deflector causes small bending angles) lensing. These approximations work extremely well for the vast majority of the currently observed gravitational lensing events. This book is the first to develop a mathematical theory of such events under these assumptions. Table of contents: Part I. Introduction. 1. Historical highlights; 2. Central problems. Part II. Astronomical aspects. 3. Basic physical concepts; 4. Physical applications; 5. Observations of gravitational lensing. Part III. Mathematical aspects. 6. Time delay and lensing maps; 7. Critical points and stability; 8. Classification and genericity of stable lense systems; 9. Local lensing geometry; 10. Morse inequalities; 11. Counting lensed images: single-plane case; 12. Counting lensed images: multiplane case; 13. Total magnification; 14. Computing the Euler characteristic; 15. Global geometry of caustics. There is a bibliography of approximately 400 items.

Random Matrix Models and Their Applications. Edited by Pavel M. Bleher and Alexander R. Its, Cambridge University Press, 2001, x + 438 pp., $64.95

This is volume 40 in the series Mathematical Sciences Research Institute Publications. It contains 17 papers, which are surveys and research results based largely on lectures given at a spring 1999 MSRI program. The main topics include: random matrix theory and combinatoric; scaling limits; universalities and phase transitions in matrix models; topologico-combinatorial aspects of the theory of random matrix models; scaling limits of correlations between zeros on complex and symplectic manifolds.

Modelling Extremal Events for Insurance and Finance. By Paul Embrechts, Claudia Klüppelberg, and Thomas Mikosch, Springer-Verlag, 1997, xv + 645 pp.

This is volume 33 in the series Applications of Mathematics—Stochastic Modelling and Applied Probability. It presents an introduction to the mathematical and statistical theory underlying Extreme Value Theory, with the main target group of readers being in the financial industry, which has been less exposed to EVT methodology than, say, hydrologists and reliability engineers. Table of Contents: 1. Risk theory; 2. Fluctuations of sums; 3. Fluctuations of maxima; 4. Fluctuations of upper order statistics; 5. An approach to extremes via point processes; 6. Statistical methods for extreme events; 7. Time series analysis for heavy-tailed processes; 8. Special topics. There are appendices on basic mathematical tools. The bibliography contains 646 items.

The Geometric Universe—Science, Geometry, and the Work of Roger Penrose. Edited by S. A. Huggett, L. J. Mason, K. P. Tod, S. T. Tsou, and N. M. J. Woodhouse, Oxford University Press, 1998, xviii + 431 pp.

This volume contains the texts of the 17 plenary lectures and 16 shorter lectures, delivered at the symposium "Geometric Issues in the Foundations of Science" held over 5 days in June 1996 at St. John's College, Oxford, in honour of Sir Roger Penrose in his 65th year. It begins with a "Laudation" by John A. Wheeler and the text of Sir Michael Atiyah's opening lecture, setting the scene for the symposium by giving an overview of the interaction between geometry and physics, and of him and Sir Roger, from which many important developments in mathematics and mathematical physics have emerged. There follow the texts of lectures in pure mathematics, including geometry, both classical differential geometry and non-commutative geometry, topology, including knot invariants, and the application of gauge theory and developments from string theory. Lectures on applied mathematics include integrable systems and general relativity. Lectures on theoretical physics include string theory, quantum gravity, and the foundations of quantum mechanics, and in experimental physics there are talks on quasi-crystals and astrophysics. There are also lectures on quantum computation, quantum cryptography, and the possible role of micro-tubules in a theory of consciousness. The volume ends with the text of Sir Roger's closing lecture, a review of twister theory, the problems currently confronting the theory, and prospects for their solution.

Theory and Applications of Partial Differential Equations. By Piero Bassanini and Alan R. Elcrat, Plenum Press, 1997, ix + 439 pp., $115.00

This is volume 46 in the series Mathematical Concepts and Methods in Science and Engineering. It introduces the basic ideas of the subject in the context of the pde's of mathematical physics, including more advanced subjects such as the De Giorgi-Nash-Moser theorem and Dirichlet problems for nonlinear elliptic equations. Table of Contents: 1. Introduction to partial differential equations; 2. Wave equation; 3. Heat equation; 4. Laplace equation; 5. Elliptic pde's of second order; 6. Abstract evolution equations; 7. Hyperbolic systems of conservation laws in one space variable; 8. Distributions and Sobolev spaces.

Statistical Methods for Speech Recognition. By Frederick Jelinek, The MIT Press, 1998, xxi + 283 pp., $35.00

This is a volume in the series Language, Speech and Communication. It is not a textbook of speech recognition, but only of its statistical aspects, in particular those that have proven so fruitful in the field: hidden Markov models, data clustering, smoothing of probability distributions, the decision tree method of equivalence classification, the use of information measures as goodness criteria, and maximum entropy probability estimation. Table of Contents: 1. The speech recognition problem; 2. Hidden Markov models; 3. The acoustic model; 4. Basic language modeling; 5. The Viterby search; 6. Hypothesis search on a tree and the fast match; 7. Elements of information theory; 8. The complexity of tasks—the quality of language models; 9. The expectation-maximization algorithm and its consequences; 10. Decision trees and tree language models; 11. Phonetics from orthography: spelling-to-base form mappings; 12. Triphones and allophones; 13. Maximum entropy probability estimation and language models; 14. Three applications of maximum entropy estimation to language modeling; 15. Estimation of probabilities from counts and the back-off method.

Statistics on the Table—The History of Statistical Concepts and Methods. By Stephen M. Stigler, Harvard University Press, 1999, viii + 488 pp., $45.00

This is a collection of 22 essays, arranged in five groups: 1. Statistics and social science, 2. Galtonian ideas, 3. Some seventeenth-century explorers, 4. Questions of discovery, 5. Questions of standards. Topics include seventeenth-century medicine and the circulation of the blood, the cause of the Great Depression, the effect of the Californian gold discoveries of 1848 upon price levels, determinations of the shape of the earth and the speed of light, the meter of Virgil's poetry, the prediction of the Second Coming of Christ. The title essay tells how Karl Pearson came to issue the challenge to put "statistics on the table" to the economists Marshall, Keynes, and Pigou in 1911. Several of the essays are entirely non-technical; all examine statistical ideas with an eye for their essence and what their history can tell us for current disputes.

Theoretical Astrophysics Volume II: Stars and Stellar Systems. By T. Padmanabhan, Cambridge University Press, 2001, xvii + 575 pp., $120.00 (hardback), $44.95 (paperback)

The key physical concepts required in volumes II and III of this work (e.g., radiative processes, fluid mechanics, plasma physics, etc.) are presented in volume I (Astrophysical Processes), from a unified perspective, and applied in the later volumes to different astrophysical situations (volume III will be entitled Galaxies and Cosmology). In this volume, the fundamentals of stellar structure, stellar evolution, and stellar remnants—treated as isolated systems—are covered in chapters 2–6, the behaviour of binary stellar systems in chapter 7, and Chapters 8–10 treat special topics. The three-volume work is written so as to be understandable by 1st-year graduate students in theoretical physics, astronomy, astrophysics, and cosmology. Chapter headings: 1. Overview: stars and stellar systems; 2. Stellar structure; 3. Stellar evolution; 4. Supernova (type II); 5. White dwarfs, neutron stars, and black holes; 6. Pulsars; 7. Binary stars and accretion; 8. The sun and the solar system; 9. The interstellar medium; 10. Globular clusters.

Structure and Interpretation of Classical Mechanics. By Gerald Jay Sussman and Jack Wisdom, with Meinhard E. Meyer, The MIT Press, 2001, xxi + 534 pp., $60.00

From the preface: "This book presents classical mechanics from an unusual perspective. It focuses on understanding motion rather than deriving equations of motion. It weaves recent discoveries in nonlinear dynamics throughout the presentation, rather than presenting them as an afterthought. It uses fundamental mathematical notation that allows precise understanding of fundamental properties of classical mechanics. It uses computation to constrain notation, to capture and formalize methods, for simulation, and for symbolic analysis." To achieve their aim, tested in several years of teaching at MIT, the authors introduce a notation (outlined in an appendix) which avoids the ambiguities in the classical notation, and use computational algorithms to communicate precisely some of the methods employed in the analysis of dynamical phenomena. They express computational algorithms in Scheme, a dialect of the Lisp family which is used in introductory computer science courses at MIT and which they outline in an appendix. Chapter headings: 1. Lagrangian mechanics; 2. Rigid bodies; 3. Hamiltonian mechanics; 4. Phase space structure; 5. Canonical transformations; 6. Canonical perturbation theory; 7. Appendix: Scheme; 8. Appendix: Our notation.