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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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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."

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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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0033-569X(199409)52:3;1-9

Probability in Banach Spaces. By Michel Ledoux and Michel Talagrand. Springer-Verlag, 1991. xii+480 pp., $129.00.

This is Band 23, 3.Folge, of the renowned series Ergebnisse der Mathematik und ihrer Grenzgebiete, A Series of Modern Surveys in Mathematics. Its aim is to present some of the main aspects of the theory of probability in Banach spaces, from the foundations of the topic to developments due to the intense activity during the past twenty years in the study of classical probability theory on infinite-dimensional spaces, vector-valued random variables, boundedness and continuity of random processes, with a fruitful interaction with classical Banach spaces and their geometry. The exposition is based on the modern point of view, using isoperimetric tools, concentration of measure phenomena and abstract random process techniques. The fifteen chapters are grouped into three parts: Part 0: Isoperimetric background and generalities (chapters 1–2); Part I: Banach space valued random variables and their strong limiting properties (chapters 3–8); Part II: Tightness of vector-valued random variables and regularity of random processes (chapters 9–15). The chapter headings are: 1. Isoperimetric inequalities and the concentration of measure phenomena; 2. Generalities on Banach space valued random variables and random processes; 3. Gaussian random variables; 4. Rademacher averages; 5. Stable random variables; 6. Sums of independent random variables; 7. The strong law of large numbers; 8. The law of the iterated logarithm; 9. Type and cotype of Banach spaces; 10. The central limit theorem; 11. Regularity of random processes; 12. Regularity of Gaussian and stable processes; 13. Stationary processes and random Fourier series; 14. Empirical process methods in probability in Banach spaces; 15. Applications of Banach space theory.

Time Series: Theory and Methods. Second Edition. By Peter J. Brockwell and Richard A. Davis. Springer-Verlag, 1991. xvi+577 pp., $49.50.

This is a volume in the series *Springer Texts in Statistics.* The second edition contains a large number of additions and corrections, including the incorporation of a new chapter on state-space models. The companion diskette for the IBM PC has expanded into the software package *ITSM: An Interactive Time Series Modelling Package for the PC*, which includes a manual and can be ordered from Springer-Verlag. The book's aim is to give a systematic account of linear time series models and their application to the modelling and prediction of data collected sequentially in time. The aim is to provide both specific techniques for handling data and also a thorough understanding of the mathematical basis for the techniques. Both time and frequency domain methods are discussed. Distinctive features are the extensive use of Hilbert space methods and recursive prediction techniques based on innovations, use of the exact Gaussian likelihood and AIC (an information criterion for model selection due to Akaike) for inference, a thorough treatment of the asymptotic behavior of the maximum likelihood estimators of the coefficients of univariate autoregressive moving-average (ARMA) models, extensive illustrations of the techniques by means of numerical examples, and a large number of problems for the reader.

Probabilistic Analysis of Packing and Partitioning Algorithms. By E. G. Coffman, Jr. and George S. Lüker. John Wiley & Sons, Inc., 1991. xiv+192 pp., $46.95.

This is a volume in the Wiley-Interscience Series in *Discrete Mathematics and Optimization.* It presents and illustrates a wide variety of probabilistic techniques for analyzing the typical or average-case properties of the solutions (packings, cuttings, or schedules) produced by heuristic algorithms. Approaches leading to exact results are rarely successful, especially for the better heuristics, with researchers turning to asymptotic methods, a secondary theme of this book. Chapter headings: 1. Introduction; 2. Analysis techniques; 3. Matching problems; 4. Scheduling and partitioning; 5. Bin packing: the optimum solution; 6. Bin packing: heuristics; 7. Packings in two dimensions.

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Differential Equations and Dynamical Systems. By Lawrence Perko. Springer-Verlag, 1991. xii+403 pages, $39.00.

This is volume 7 in the series Texts in Applied Mathematics. It covers the topics necessary for a clear understanding of the qualitative or geometrical theory of ordinary differential equations, the major part of the book being devoted to nonlinear equations, and is written for upper-division or first-year graduate students. Linear systems are covered in Chapter 1. The local theory for nonlinear systems is developed in Chapter 2, which includes the fundamental local existence-uniqueness theorem, the Hartman-Grobman Theorem, and the Stable Manifold Theorem. The global theory in Chapter 3 includes a study of limit sets of trajectories and the behavior of trajectories at infinity. In Chapter 4 systems of differential equations depending on a parameter are studied, and it includes an introduction to bifurcation theory. It ends with a discussion of homoclinic loop bifurcations for planar systems, and with an introduction to tangential homoclinic bifurcations and the resulting chaotic dynamics that can occur in higher dimensions.

Mathematics in Industrial Problems, Part 3. By Avner Friedman, Springer-Verlag, 1990. xiii+187 pages, $24.00.

This is volume 31 of the IMA Volumes in Mathematics and Its Applications, and the third volume in the series *Mathematics in Industrial Problems.* It is based on questions raised in the IMA seminar on Industrial Problems at the University of Minnesota and subsequent discussions. Each chapter is devoted to one of the talks and is self-contained. Chapter headings: 1. Internal oxidation of binary alloys; 2. Fundamental problems in the theory of shaped-charged jets; 3. Mathematical modeling dielectric waveguides; 4. A diffusion problem from rock porosity measurements; 5. Applications and modeling of diffractive optical elements; 6. An approach to optimal classification; 7. Polymer-dispersed liquid crystal films for light control; 8. Singularity problems in the stress analysis of semiconductor packaging; 9. Pulse reflection from a randomly stratified medium; 10. Theory of polymer melt viscoelasticity; 11. The advection equation in air quality modeling; 12. Diffusion in swelling media: modeling and applications; 13. Mathematical modeling; 14. Conformation of random polymers; 15. Current-voltage relations for electrolytic solutions; 16. Scaling and optimization for list-matching; 17. Topics in tomography; 18. Solution to problems from part 2.

Adaptive Algorithms and Stochastic Approximations. By Albert Benveniste, Michel Mètivier and Pierre Priouret. Springer-Verlag, 1990. xi+365 pages, $59.00.

This is volume 22 in the series Applications of Mathematics, and is a translation, by Stephen S. Wilson, of the French original first published by Masson in 1987. Modifications in this English edition concern both applications and the presentation of the mathematical results. Two new applications, introduced through long exercises in which the reader is directed towards the solutions, concern machine learning using neural networks, and Gibbs fields or networks of random automata. For the mathematical results, a new appendix containing details of almost sure convergence theorems for stochastic approximations under Robbins-Monro type hypotheses has been added. Chapter headings: Part I (Adaptive Algorithms: Applications): 1. General adaptive algorithm form; 2. Convergence: the ODE method; 3. Rate of convergence; 4. Tracking non-stationary parameters; 5. Sequential detection; model validation; 6. Appendices to part I. Part II (Stochastic Approximation Theory): 1. ODE and convergence almost surely for an algorithm with locally bounded moments; 2. Application to the examples of part I; 3. Analysis of the algorithm in the general case; 4. Gaussian approximations to the algorithms; 5. Appendix to part II: A simple theorem in the Robbins-Monro case.

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Dynamics of Polyatomic Van der Waals Complexes. Edited by Nadine Halberstadt and Kenneth C. Janda. Plenum Press, 1990. ix+542 pp., $120.00.

This is volume 227 of Series B (Physics) in the NATO Advanced Science Institute Series. It is the Proceedings of the NATO Advanced Research Workshop on the Dynamics of Polyatomic Van der Waals Molecules held at the Château de Bonas, Castera-Verduzan, France, from August 21 through August 26, 1989. The workshop concentrated on the current questions and future prospects for extending our highly detailed knowledge of triatomic Van der Waals molecule dynamics to polyatomic molecules and clusters. Both experimental and theoretical studies were discussed, with particular emphasis on the dynamical behaviour of dissociation as observed in the distributions of quantum states of the dissociation product molecules. The discussion of theoretical approaches covered the range from complete *ab initio* studies with a rigorous quantum mechanical treatment of the dynamics to the empirical determination of potential energy surfaces and a classical mechanical treatment of the dynamics. Time dependent, time independent, and statistical approaches were considered. The 39 papers are divided into the following groups: Introduction; Dynamics of ground state molecules: mostly experiments; Small molecule theory; Experiments: small molecules, unpaired electrons; Diatomic dimers: theory; Dynamics: larger molecules, mostly experiments; More dynamics of larger molecules; Approximate treatments for polyatomic dimers; Dynamics of larger clusters; Posters.

Vortex Element Methods for Fluid Dynamic Analysis of Engineering Systems. By R. I. Lewis. Cambridge University Press, 1991. xxi+565 pp., $125.00.

This is volume 1 of the *Cambridge Engine Technology Series.* It is its aim to lay out a systematic treatment of the surface vorticity method in relation primarily to the author's special field of interest of turbomachinery fluid dynamics. The strategy of the book is to present an unfolding methodology designed to lead easily into computing schemes, beginning with potential flow modelling in Part I (chapters 1–6) and progressing right through to full vortex cloud modelling in Part II (chapters 7–12). Chapter headings: 1. The basis of surface singularity modelling; 2. Lifting bodies, two-dimensional aerofoils and cascades; 3. Mixed-flow and radial cascades; 4. Bodies of revolution, ducts and annuli; 5. Ducted propellers and fans; 6. Three-dimensional and meridional flows in turbomachines; 7. Free vorticity shear layers and inverse methods; 8. Vortex dynamics in inviscid flows; 9. Simulation of viscous diffusion in discrete vortex modelling; 10. Vortex cloud modelling by the boundary integral method; 11. Further development and applications of vortex cloud modelling to lifting bodies and cascades; 12. Use of grid systems in vortex dynamics and meridional flows. There is an appendix with listings of useful computer programs.

Uses of Randomness in Algorithms and Protocols. By Joe Kilian. The MIT Press, 1990. 235 pages, $39.95.

This is a volume in the series ACM Distinguished Dissertations, being one of the two 1989 winners in the ACM-MIT competition. Three areas are considered in this thesis, in each of which randomness plays a pivotol role: 1. Randomness is used to generate large prime numbers which have short, easily verified certificates of primality; 2. Scenarios are considered in which two parties wish to compute some function on their private information, neither wishing for the other to learn more about his private data than is absolutely necessary ("oblivious transfer"); 3. The connection is investigated between information and belief afforded by a randomized generalization of the usual notion of proof. Chapter headings: 1. Introduction; 2. New techniques in primality testing; 3. Committing bits using oblivious transfer; 4. Circuit evaluation using oblivious transfer: the NC^1 circuit case; 5. Oblivious evaluation of arbitrary circuits; 6. Interactive proof systems with multiple provers.

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Glory and Failure: The Difference Engines of Johann Müller, Charles Babbage and Georg and Edvard Scheutz. By Michael Lindgren, translated by Craig G. McKay. The MIT Press, 1990. 414 pages, $45.00.

The author, Curator at the National Museum of Science and Technology in Stockholm, analyzes the first attempts to mechanize the production of numerical tables, viz. the difference engines of Müller and Babbage, and the mathematical principles on which they are based. He also tells the story of how Georg and Edvard Scheutz learned about Babbage's engine, discusses the design and operation of the Scheutzes' machine, and explains why Babbage failed technically and the Scheutzes failed commercially. The book is divided into two parts; Part I, History and Technology: Chapter 1–Babbage, Müller, and the first difference engines; Chapter 2–Scheutz and the Swedish difference engines; Part II, Analysis: The machines, the men, and the market.

Biostatistics: A Foundation for Analysis in the Health Sciences. Fifth edition. By Wayne W. Daniel. John Wiley, 1991. xii+740 pages, $49.95.

This edition of a well-known text, a volume in the Wiley Series in Probability and Mathematical Statistics, contains a greater emphasis on computer applications. For most of the statistical techniques covered, the MINITAB commands by which they can be applied are given. Also, stem-and-leaf displays and box-and-whisker plots are used to introduce exploratory data analysis. A diskette containing the large data sets in the text and a solutions manual are available free to adopters of the text. Discussion of the chi-square statistic has been expanded; the Wilcoxon signed-rank text and a discussion of nonparametric regression have been added.

Wave Packets and Their Bifurcations in Geophysical Fluid Dynamics. By Huijun Yang. Springer-Verlag, 1990. vii+247 pages, $39.00.

This monograph, volume 85 in the series Applied Mathematical Sciences, is based predominantly on the author's recent work. Necessary basic knowledge is provided to make the book more readable for graduate students and non-specialists. There are eight chapters: 1. Introduction; 2. The wave packet theory; 3. Evolution of the wave packet in barotropic flow; 4. Global behavior: the wave packet structural vacillation; 5. Change in global behavior: bifurcation; 6. Secondary bifurcation; 7. Evolution of wave packets in stratified baroclinic basic flow; 8. Wave packets and teleconnections.

Chaotic Dynamics—An Introduction. By G. L. Baker and J. P. Gollub. Cambridge University Press, 1990. ix+182 pages, (cloth) $49.50, (paper) $17.95.

This book is written as a short text, at a level accessible to sophomore/junior level undergraduate students of mathematics, engineering or physics, the subject being introduced through the study of the driven pendulum. It assumes elementary multivariable calculus, linear differential equations, and introductory physics. Listings, in BASIC, of useful programs are included. A menu-driven runtime package is available on a diskette. Chapter headings; 1. Introduction; 2. Some helpful tools; 3. Visualization of the pendulum's dynamics; 4. Toward an understanding of chaos; 5. The characterization of chaotic attractors; 6. Concluding remarks.

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Colloidal Dispersions. By W. B. Russel, D. A. Saville, and W. R. Schowalter. Cambridge University Press, 1990. xvii+525 pages, $99.50.

This book addresses the physical side of colloid science: the subjects range from the individual forces acting between submicron particles suspended in a liquid through the equilibrium and dynamic properties of the dispersion. The relevant forces include Brownian motion, electrostatic repulsion, attraction due to dispersion forces, attraction and repulsion caused by soluble polymers, and viscous forces arising from relative motion between the particles and the liquid. The authors' aim is to impart a quantitative understanding grounded in basic theory and coupled to experiments on well-characterized model systems. Chapter headings: 1. A survey of colloidal dispersions; 2. Hydrodynamics; 3. Brownian motion; 4. Electrostatics; 5. Dispersion forces; 6. Forces due to soluble polymer; 7. Electrokinetic phenomena; 8. Electrostatic stabilization; 9. Polymeric stabilization; 10. Equilibrium phase behavior; 11. Particle capture; 12. Sedimentation; 13. Diffusion; 14. Rheology.

Lattices, Semigroups, and Universal Algebras. Edited by Jorge Almeida, Gabriela Bordalo, and Philip Dwinger. Plenum Press, 1990. ix+336 pages, $75.00.

This volume contains papers which are based on talks given at an international conference held June 20–24, 1988, in Lisbon, Portugal, in memory of Professor Antònio Almeida Costa, whose research interests are reflected in the themes of the conference.

An Introduction to Dynamical Systems. By D. K. Arrowsmith and C. M. Place. Cambridge University Press, 1990. 423 pages, (cloth) $79.50, (paper) $29.95.

This book is aimed at the interface between undergraduate and postgraduate studies. A major feature is a set of over 300 exercises, which not only illustrate the topics in the text but also guide the reader in the completion of technical details omitted from the main discussion. Chapter headings: 1. Diffeomorphisms and flows; 2. Local properties of flows and diffeomorphisms; 3. Structural stability; 4. Local bifurcations I: planar vector fields and diffeomorphisms on $\mathbb{R}$; 5. Local bifurcations II: diffeomorphisms on $\mathbb{R}^2$; 6. Area-preserving maps and their perturbations.

Probability Metrics and the Stability of Stochastic Models. By Svetlozar T. Rachev. John Wiley & Sons, Inc., 1991. xiv+494 pp., $75.00.

This is a volume in the Wiley Series in *Probability and Mathematical Statistics.* It is a comprehensive account of the theory of probability metrics, allowing a unified approach to various topics in probability theory. Such metrics are defined either on sets of probability distributions, or on sets of random elements. The author first applies the method to the problem of transportation of masses on infinite-dimensional spaces, to the finding of precise bounds for the speed of convergence in limit theorems for random variables on Banach spaces and to the quantitative analysis of the stability of various stochastic models. Applications include limit theorems for sums and maxima of random variables, empirical measures, the invariance principle, problems of stability for queueing models, and insurance mathematics. The nineteen chapters are grouped into four parts: I. Main directions in the theory of probability metrics; II. Relations between compound, simple and primary distances; III. Applications of minimal primary distances; IV. Ideal metrics.

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Theory of Heart: Biomechanics, Biophysics, and Nonlinear Dynamics of Cardiac Function. Edited by Leon Glass, Peter Hunter, and Andrew McCulloch. Springer-Verlag, 1991. xvii+611 pp., $59.00.

These are the proceedings of a conference held under the auspices of the Institute for Nonlinear Science at the University of California, San Diego, July 10–18, 1989. The first nine chapters are concerned with the mechanism of the heart wall. The emphasis is not on lumped parameter models but on a continuum approach, in which regional mechanics are described by continuous distributions of stress and strain in the heart wall. A mathematical model must, thus, describe the material properties of the heart muscle, the geometry and structure of the wall, and the boundary conditions, and yield, together with the conservation laws of mass, energy, and momentum, a predictive tool with clinical applications. Another group of papers is concerned with the electrical activity of the heart, caused by the opening and closing of ionic channels in the cardiac membrane. Other topics include an introduction to the physiology of the spread of excitation in the heart and the onset of ventricular fibrillation. A chapter addresses the interrelationships between mechanical and electrical activity, and the final chapters give clinical perspectives on the theory of the heart. The editors regret that they could not include work on the hydrodynamic aspects of cardiac function.

Statistical Methods: The Geometric Approach. By David J. Saville and Graham R. Wood. Springer-Verlag, 1991. xv+560 pp., $49.50.

This is a volume in the series *Springer Texts in Statistics.* The authors present in this text a systematic geometric approach to the presentation of the theory of basic statistical methods—analysis of variance and regression. It provides an elementary but at the same time rigorous view of the subject. Moreover, problem-solving methods used by the practicing statistician, such as the use of transformations or techniques for handling missing values, are introduced throughout the text. Real-life datasets are used where possible, and any assumptions made are carefully checked. Class exercises as well as general exercises are provided; the latter are mainly agricultural or biological in origin, though a few medical and industrial examples are also included. The Minitab package serves as the computing tool. The 18 chapters are divided into five groups: I. Basic ideas (chapters 1–4: motivation, reference chapters on the geometric approach and an overview of the basic geometric method employed throughout the text); II. Introduction to analysis of variance (chapters 5–7: questions about the means of a single, of two, and of several populations); III. Orthogonal contrasts (chapters 8–11: methods for capturing some of the variation between treatment means of several populations, phrased in terms of class comparisons, and of factorial, polynomial and pairwise contrasts); IV. Introducing blocking (chapters 12–14: methods to capture some of the variation between the experimental units—randomized block, latin square and split block designs); V. Fundamentals of regression (chapters 15–18: simple and polynomial regression, and analysis of covariance).

Seismology and Plate Tectonics. By David Gubbins. Cambridge University Press, 1990. vii+339 pages, (cloth) $59.50, (paper) $27.95.

This text grew from an undergraduate course at Cambridge; it concentrates on the development of seismology since the introduction of the World Wide Standardised Seismic Network in about 1960 and its role in the development of plate tectonic theory. Since reading seismograms is an excellent way to learn about the earth, several examples of seismograms have been included in the book, together with practical exercises for locating earthquakes, identifying different seismic phases and the free oscillations, and determining the nature of the earthquake source. Chapter headings: 1. Introduction; 2. Mechanics of elastic media; 3. Elastic waves in simple media; 4. Earth structure and earthquake location; 5. Free oscillations; 6. The seismic source; 7. Plate tectonic theory.