QUARTERLY

OF

APPLIED MATHEMATICS

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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.

CONTENTS

Systems of Logic.   By Norman M. Martin. Cambridge University Press, 1989. xi+318 pp. $44.50 cloth, $15.95 paper.

The author stresses that this is not an introduction to logic, although it is a textbook on logic. Using Charles Morris' division of metalogic into syntactic, semantic, and pragmatic components, he stresses that his treatment is deliberately metalogical and primarily syntactic. That is, it is a book about, rather than of logic.

Almost Everywhere Convergence.   Edited by Gerald A. Edgar and Louis Suchestон. Academic Press, 1989. xv+416 pp., $49.95.

These are the proceedings of the International Conference on Almost Everywhere Convergence in Probability and Ergodic Theory, held in Columbus, Ohio, June 11–14, 1988. There are 25 papers.

Statistical and Scientific Database Management.   Edited by Z. Michalewicz. Springer-Verlag, 1990, iv+255, pp., $24.70.

This is volume 420 of Lectures in Computer Science. It contains 16 papers which have been selected for presentation at the Fifth International Conference on Statistical and Scientific Database Management, held in Charlotte, North Carolina, April 3–5, 1990. The papers cover subjects such as: object oriented database systems, semantic modeling, deductive mathematical databases, security of statistical databases, implementational issues for scientific databases, graphical and visual interfaces for statistical databases, query optimization, economic and geographic databases.

Game, Set and Math: Enigmas and Conundrums.   By Ian Stewart. Basil Blackwell, 1990. viii+191 pp., $19.95.

This is a collection of twelve edited and updated games and puzzles first published by the author (in French) as a regular column "Visions Mathematiques" in *Pour la Science*, the French translation of *Scientific American*.

Community Food Webs: Data and Theory.   By Joel E. Cohen, Frederic Briand, and Charles Newman. Springer-Verlag, 1990. x+308 pp., $79.00.

This is volume 20 in the series Biomathematics. Food webs hold a central place in the ecology. They describe which organisms feed on which others in natural habitats. This book describes some recently discovered empirical regularities in real food webs. It proposes a novel theory that unifies many of these regularities, and is intended for graduate students, teachers, and researchers primarily in ecology, especially community ecologists with a quantitative orientation. The first portion of the book, a general introduction, reviews the empirical and theoretical discoveries about food webs presented here. The second portion shows that community food webs obey several striking phenomenological regularities. The third portion, entitled A Stochastic Theory of Community Food Webs, presents a theoretical analysis of some of the unifying empirical regularities. Several simple models, based on random directed graphs, are considered. The fourth portion of the book presents 113 community food webs.

Multivariate Statistics and Probability: Essays in Memory of Paruchuri R. Krishnaiah.
Edited by C. R. Rao and M. M. Rao. Academic Press, 1989. xii+567 pp., $59.95.

This volume contains a biographical sketch of P. R. Krishnaiah by M. M. Rao, a complete publication list, and 35 contributions covering the main areas of multivariate statistical theory and its applications as well as aspects of probability and stochastic analysis. They cover both finite sampling and asymptotic results, including aspects of decision theory, Bayesian analysis, classical estimation, and regression, as well as time-series problems. The papers on probability include results on the vector central limit theory for dependent random variables, the rates of convergence and asymptotic expansions, Markov processes, and foundational problems.

Mathematics as a Service Subject. Edited by A. G. Howson, J.-P. Kahane, P. Lauginie, and E. de Turckheim. Cambridge University Press, 1988. iv+92 pp., $39.50 cloth, $14.95 paper.

This is a volume in the ICMI (International Commission on Mathematical Instruction) Study Series. It is based on the work of a symposium held in Udine, Italy, 6–10 April 1987, at the International Centre for Mechanical Sciences. There is an introduction by the editors and papers by J.-M. Bony, H. O. Pollak, F. Simons, R. R. Clements, J. H. van Lint, H. Murakami, E. Roubine, and M. J. Siegel.

A Methodology for Uncertainty in Knowledge-Based Systems. By Kurt Weichselberger and Sigrid Pöhlmann. Springer-Verlag, 1990. 132 pp.

This is volume 419 of Lecture Notes in Artificial Intelligence—a subseries of Lecture Notes in Computer Science. Being written by statisticians, it investigates the possibility of giving a systematic treatment of the characterization and combination of uncertain information in expert systems by using the classical theory of probability. It also takes into account that in many expert systems the available information is too weak to produce reliable point estimates for probability values. Therefore the handling of interval-valued probabilities is one of the main goals of this book.

Variational and Finite Element Methods—A Symbolic Computation Approach. By A. I. Beltzer. Springer-Verlag, 1990. xi+254 pp., $59.50.

The aim of the authors is to show that it is easier for students to appreciate the variational approach in engineering analysis if they have the help of one of the available symbolic manipulation codes SMC: MACSYMA, REDUCE, SCRARCHPAD, MATHEMATICA, MAPLE, or DERIVE. They contend that the very process of programming with SMC encourages appreciation of the qualitative aspects of investigations. It has four chapters. Chapter 1 presents basic information on SMC and relevant exercises. Chapter 2 deals with basic concepts of variational calculus, Hamilton's principle and some of the optimization techniques, including an automatic derivation of the governing equations. The direct approach is given in Chapter 3, which presents the methods of weighted residual, Rayleigh–Ritz and others. The finite element method is given in Chapter 4. The presentation is confined to a linear theory and deals with the so-called displacement method.

Stability Analysis of Nonlinear Systems.   By V. Lakshmikantham, S. Leela, and A. A. Martynyuk. Marcel Dekker, 1989. 336 pp., $89.75.

This is volume 125 of Pure and Applied Mathematics: A Series of Monographs and Textbooks. Its aim is to present a systematic account of the recent developments in the field, describe the current state of the useful theory, show essential unity achieved by the wealth of applications, and provide a unified general structure applicable to a variety of nonlinear problems. Chapter headings: 1. Inequalities; 2. Variation of parameters and monotone technique; 3. Stability of motion in terms of two measures; 4. Stability of perturbed motion; 5. Models of real world phenomena.

Parabolic Equations on an Infinite Strip.   By N. A. Watson. Marcel Dekker, 1989. 256 pp., $99.75.

This is volume 127 of Pure and Applied Mathematics: A Series of Monographs and Textbooks. This book is concerned with solutions of second order, linear, parabolic partial differential equations on an infinite strip. Particular attention is paid to their integral representation, their initial values in several senses, and the relations between these. The main purpose is to provide a text that takes graduate students rapidly into an area of current research. The main body of the text deals only with the heat equation, but extensions to general parabolic equations are usually described. Chapter headings: 1. Fundamental solutions; 2. Non-negative solutions; 3. The semigroup property, Cauchy problem, and Gauss-Weierstrass representation; 4. Initial limits of Gauss-Weierstrass integrals; 5. Normal limits and representation theorems; 6. Hyperplane conditions and representation theorems; 7. The initial measure of a Gauss-Weierstrass integral; 8. Maximum principles and initial limits.

Introduction to the Mathematics of Operations Research.   By Kevin J. Hastings. Marcel Dekker, 1989. 424 pp., $99.75.

This is volume 128 of Pure and Applied Mathematics: A Series of Monographs and Textbooks. The unity underlying many mathematical models is stressed and the style of the text was designed to show the mathematics underlying the applied problems, and subsequently to exhibit real-world problems as examples of the application of the mathematical techniques. For example, instead of treating problems of queueing, reliability, and inventory as distinct subject areas, they are seen as examples of stochastic processes. Chapter headings: 1. Graph theory and network analysis; 2. Linear programming; 3. Further topics in linear programming; 4. Probability review; 5. Markov chains; 6. Continuous time processes; 7. Dynamic programming.

Continuous Mining Reliability: Design and Optimization of Mechanized Systems.   By V. Pavlovic. John Wiley & Sons, 1989. 137 pp., $79.75.

This is a volume in the Ellis Horwood Series in Mining and Mineral Resource Engineering. It is a text on the application of mathematical reliability theory to the analysis of mining systems. It defines the basic parameters of reliability and determines their application in the analysis of a mining system's capacity. It uses models based on Markov chains and Markov processes. There are two theoretical chapters: 1. Mathematical interpretation of the reliability characteristics of mining systems, 2. Calculation of mining system capacity on the basis of reliability parameters, and a third chapter giving the program for calculation of reliability characteristics and production capacities of continuous mining systems.

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Multivariate Approximation Theory IV. Edited by C. K. Chui, W. Schempp, and K. Zeller, Birkhäuser, Boston, 1989., ix+342 pp., $63.00.

This is volume 90 in the International Series of Numerical Mathematics. It is the Proceedings of the Conference at the Mathematical Research Institute at Oberwolfach, Black Forest, February 12–18, 1989. The reason for the current interest in multivariate approximation theory lies in its impact on computer aided design, image processing, pattern recognition, and multidimensional signal processing, subjects represented in this volume.

Control and Estimation of Distributed Parameter Systems. Edited by F. Kappel, K. Kunisch, and W. Schappacher. Birkhäuser, Boston, 1989. xiii+434 pp., $82.50.

This is volume 91 in the International Series of Numerical Mathematics. It is the Proceedings of the 4th International Conference on Control of Distributed Parameter Systems, Chorherrenstift Vorau in Steiern, Austria, July 10–16, 1988. The main purpose of this conference was to provide up-to-date information on important directions of research in the field of control theory for infinite dimensional systems. The 29 papers include the following topics: well-posedness and representation, aspects of controllability, optimal control, stabilisations, sensitivity and shape design, identification.

Continuation Techniques and Bifurcation Problems. Edited by H. D. Mittelman and D. Roose. Birkhäuser, Boston, 1990. 218 pp., $52.00.

This is volume 92 in the International Series of Numerical Mathematics. The fourteen papers in this volume are reprinted from the Journal of Computational and Applied Mathematics, Vol. 26, numbers 1 + 2, June 1989 and are devoted to aspects of the title subject; they were all solicited by the editors and refereed.

Function Spaces, Differential Operators and Nonlinear Analysis. Edited by L. Päivärinta. John Wiley & Sons, 1989. 292 pp., $42.00.

This is volume 211 in the Pitman Research Notes in Mathematics Series. This book is based on invited lectures given in the summer school in Sodankylä in Finnish Lapland in August 1988. The lectures describe new results in the fields of function spaces, singular boundary value problems, and nonlinear analysis. Topics like atomic decomposition, continuity of pseudodifferential operators, interpolation, and functional inequalities are examined in several function spaces. Also, singular boundary value problems including those with corners and wedges are discussed. Applications deal with subjects such as electromagnetic fields near corners, transport equations for semiconductors and exact controllability of hyperbolic problems.

Critical Points at Infinity in Some Variational Problems. By A. Bahri. John Wiley & Sons, 1989. 307 pp.

This is volume 182 in the Pitman Research Notes in Mathematics Series. It displays new phenomena in chosen variational problems of nonlinear analysis and geometry. The author develops further his ideas which first appeared in volume 173 of this series, entitled *Pseudo-orbits of Contact Form.*

Semicontinuity, Relaxation and Integral Representation in the Calculus of Variations.
By Giuseppe Buttazzo. John Wiley & Sons, 1989. 222 pp., $52.95.

This is volume 207 in the Pitman Research Notes in Mathematics Series. The author presents a
unified account of the various results obtained in recent years in semicontinuity, relaxation, and integral
representation for functionals of the calculus of variation. An overview is given on functionals defined
on L^p spaces, Sobolev spaces, and the spaces of measures. The last chapter is devoted to the application
of the relaxation method in optimal control theory.

Recent Advances in Nonlinear Elliptic and Parabolic Problems.   Edited by P. Benilan,
M. Chipot, L. C. Evans, and M. Pierre. John Wiley & Sons, 1989. 340 pp., $44.00.

This is volume 208 in the Pitman Research Notes in Mathematics Series. These proceedings of an
international conference held in Nancy, France, in March 1988, present many recent advances regard-
ing nonlinear equations and systems of elliptic and parabolic type. Among the problems investigated
are the classical issue of existence, uniqueness, and smoothness of solutions, as well as blow-up, asymp-
totic behaviour, localisation of support, free boundaries and periodic behaviour. Applications include
flow through porous media, chemical reaction-diffusion, phase transitions, population dynamics, image
segmentation, electromagnetic casting, and internal waves.

Mathematical Modelling and Simulation of Electrical Circuits and Semiconductor De-
vices.   Edited by R. E. Bank, R. Bulirsch, and K. Merten, Birkhäuser, Boston, 1990.
xv+297 pp., $59.00.

This is volume 93 in the International Series of Numerical Mathematics. It is the Proceedings of
a Conference held at Oberwolfach, October 30–November 5, 1988. There are eight papers on circuit
simulation and thirteen papers on device simulation. In the semiconductor area special lectures were
given on mixed finite element methods and iterative procedures for the solution of large linear systems.
For three-dimensional models new discretization procedures including software packages were presented.
Connections between semiconductor equations and the Boltzmann equation were shown as well as relations
to the quantum transport equation.

Population System Controls.   By Jian Song and Jingyuan Yu. Springer-Verlag, 1988.
xi+286 pp., $49.50.

This book aims to give an account of the latest results of investigations undertaken primarily by Chinese
systems analysts over the past few years on population system control theory and its application, many of
which were published only recently. After an introductory first chapter, Chapter 2 explains the classical
definitions and theories from a new standpoint, starting with the population systems equation. Chapter 3
redefines the classical descriptions of demographic indices and establishes new formulae for calculation.
Chapter 4 studies comprehensively the dynamic characteristics of the population system. In the fifth
chapter, the central instability theorem of population systems is proved in various forms and a decisive
parameter of critical fertility rate is derived in explicit form. Chapter 6 summarizes the basis and methods
of population control policy evaluation. A recent important conclusion reached in these population studies
is that inevitably man will see the emergence of societies with zero growth rate. Analysis of the population
structure of this kind of society is given in Chapter 7. Finally, Chapter 8 presents in detail optimization
theory of birth control policy and its applications. The data and examples in this book are taken mainly
from statistics and censuses in China.

Functional Analysis with Applications.   By B. Choudhary and Sudarsan Nanda. John Wiley & Sons, 1989. xii+344 pp., $34.95.

This text consists of eleven chapters and three appendices. Chapters 1–5 include the essentials of functional analysis, Chapter 6–9 deal with advanced topics in the field (operators in Banach and Hilbert spaces, spectral and fixed point theory), Chapter 10 is devoted to nonlinear operators, and Chapter 11 is for the reader specializing in sequence spaces and matrix transformations.

Fibonacci and Lucas Numbers, and the Golden Section: Theory and Applications.   By S. Vajda. John Wiley & Sons, 1989. 189 pp., $64.95.

This is a volume in the Ellis Horwood series in Mathematics and its Applications. It begins with an overview of problems in which Fibonacci numbers arise and then begins to develop their properties. The Lucas numbers are close relatives. Fibonacci numbers first arose in a model for the growth of a rabbit population and in plant morphology. They occur in efficient search procedures in computer science, and Fibonacci-type mechanisms are often used for pseudo-random number generation in computer simulation and Monte Carlo methods. The Golden Section, studied in antiquity, is a principle expressing aesthetic harmony. In this book, a discussion of Meta-Fibonacci numbers, an extension of Fibonacci numbers, precedes a look at the Golden Section in the plane and in space. Platonic solids are described and some of their less familiar features are exhibited. The theoretical context of this book fits into algebra, geometry, probability theory, computational aspects of the combinatorial side of number theory.

A General Theory of Equilibrium Selection in Games.   By John C. Harsanyi and Reinhard Selten. The MIT Press, 1988. xiii+378 pp., $32.50.

The purpose of this monograph is to propose a new solution concept, primarily defined for noncooperative games but applicable also to cooperative games, because every cooperative game can be remodeled as a bargaining game having the structure of a noncooperative game. For any noncooperative game, including noncooperative bargaining games, the authors' theory always selects *one* equilibrium point as the solution. By reducing cooperative games to noncooperative bargaining games, this approach unifies the theories of cooperative and noncooperative games into one general theory. The book applies this theory to a number of specific game classes, such as unanimity games; bargaining with transaction costs; trade involving one seller and several buyers; two-person bargaining with incomplete information on one side, and on both sides. The last chapter discusses the relationship of the authors' theory to other recently proposed solution concepts, particularly the Kohberg–Mertens stability theory.

Smooth Tests and Goodness of Fit.   By J. C. W. Rayner and D. J. Best.   Oxford University Press, 1989. xiv+162 pp., $39.95.

Goodness of Fit is concerned with assessing the validity of models involving statistical distributions, a subject pioneered by Karl Pearson in 1900 and his X^2 test. The *smooth* tests are a class of goodness of fit tests that are informative, easy to apply, and generally applicable. Typically they can be derived as score tests. The book is complementary to D'Agostino and Stephens' 1986 monograph. The chapter headings are: 1. Introduction; 2. Pearson's X^2 test; 3. Asymptotically optimal tests; 8. Conclusion; and Chapters 4–7 deal with Neyman smooth tests for null hypotheses which are, respectively, simple, categorized simple, uncategorized composite, and categorized composite.

Complex Variables, Second Edition. By Stephen D. Fisher. Wadsworth & Brooks/ Cole, 1990. x+427 pp.

The first edition of this text was published in 1986. For the second edition, the author has made several changes, e.g., in the presentation of Cauchy's theorem, and in the discussion of flows. It remains a first course in complex variables, requiring as prerequisites three semesters of calculus. Chapter headings: 1. The complex plane; 2. Basic properties of analytic functions; 3. Analytic functions as mappings; 4. Analytic and harmonic functions in applications; 5. Transform methods.

Nonlinear Control Systems, Second Edition.   By Alberto Isidori. Springer-Verlag, 1989. ix+479 pp.

This is a volume in the Communications and Control Engineering Series. The first edition was published in 1985 under the same title as volume 72 in Lecture Notes in Control and Information Sciences. In addition to a major rearrangement of the last two chapters of the first version, this new edition incorporates two additional chapters at a more elementary level and some new results. The purpose of the volume remains to present a self-contained description of the fundamentals of the theory of nonlinear control systems, with special emphasis on the differential geometric approach. Chapter headings: 1. Local decomposition of control systems; 2. Global decompositions of control systems; 3. Input-output maps and realization theory; 4. Elementary theory of nonlinear feedback for single-input single-output systems; 5. Elementary theory of nonlinear feedback for multi-input multi-output systems; 6. Geometric theory of state feedback: tools; 7. Geometric theory of state feedback: applications.

Finite Element Methods for Viscous Incompressible Flows: *A Guide to Theory, Practice, and Algorithms.*   By Max D. Gunzburger. Academic Press, 1989. xi+269, pp., $44.50.

The central subject of this book is finite element discretization algorithms for mathematical models of various aspects of incompressible viscous flows. Results are given concerning the stability of the algorithms and the accuracy of approximate solutions obtained through their use. In addition, questions related to the implementation of these algorithms, including methods for the solution of the discrete equations, are also addressed. The 21 chapters are divided into 10 parts: 1. Discretizations of the primitive variable formulation; 2. Solution of the discrete equations; 3. Time-dependent problems; 4. The streamfunction-vorticity formulation; 5. The streamfunction formulation; 6. Eigenvalue problems connected with stability studies for viscous flows; 7. Exterior problems; 8. Nonlinear constitutive relations; 9. Electromagnetically or thermally coupled flows; 10. Remarks on some topics that have not been considered.

Analytic Function Theory on One Complex Variable.   Edited by Yusaku Komatu, Kiyoshi Niino, and Chung-chun Yang. John Wiley & Sons, 1989. 392 pp., $49.00.

This is volume 212 in the Pitman Research Notes in Mathematics Series. The articles presented in this volume include a representative cross section of current research trends and recent contributions of Japanese mathematicians working in complex analysis. The contents consist of expository surveys, surveys with new results, as well as original research papers on topics such as univalent functions, meromorphic functions, Kleinian groups, and Riemann surfaces.

The Collected Economics Articles of Harold Hotelling. Edited and with an introduction by Adrian C. Darnell. Springer-Verlag, 1990. vii+178 pp., $49.80.

There are eleven papers in this volume, dating from the years 1925–1943. They deal, for instance, with Hotelling's Law (the observation that spatial competition may lead to a clustering of competitors), Hotelling's Lemma (which refers to Hotelling's work on integrability and duality in the context of the theory of the producer), and Hotelling's Rule (that the optimal production schedule of an irreplaceable resource is such that it generates a rate of increase of its price which is identical to society's discount rate).

Ordinary Differential Equations with Applications, Second Edition. By Bernard J. Rice and Jerry D. Strange. Brooks/Cole Publishing Company 1989. ix+465 pp., $41.25.

The major change in this edition is the inclusion in Chapter 9 of four new sections on the use of matrix methods in the solution of systems of differential equations.

Discrete Mathematics with Algorithms. By Michael O. Albertson and Joan P. Hutchison. John Wiley & Sons, 1988. xii+546 pp., $41.00.

This text is intended for a one-semester course at the freshman-sophomore level. Chapter headings: 1. Sets and algorithms; an introduction; 2. Arithmetic; 3. Arithmetic of sets; 4. Number theory; 5. Graph theory; 6. Searching and sorting; 7. Recurrence relations; 8. More graph theory.

Program Translation Fundamentals: Methods and Issues. By Peter Calingaert. Computer Science Press, 1988. xi+366 pp., $36.95.

This book is a successor to the author's *Assemblers, Compilers, and Program Translation.* It is intended primarily for use as a one-semester text in a first course on translators, but is also suitable for self-study. teh of of compiler construction being the focus, the book presents a unified treatment of principles, methods, and issues of translation. These are discussed in the context of many different types of translators, not only compilers. Readers are expected to have some experience in programming both in assembler language and in a machine-independent language. Chapter headings: 1. Introduction; 2. Assembly; 3. Program modules; 4. Macro processing; 5. Interpretation and generation; 6. Source program analysis; 7. Data structures; 8. Compilation; 9. Linking and loading; 10. General issues.

Seminar on Stochastic Processes, 1988. Edited by E. Cinlar, K. L. Chung, and R. K. Getoor. Birkhäuser, Boston, 1989. vii+247 pp.

This is volume 17 in the series Progress in Probability. The 1988 Seminar on Stochastic Processes was held at the University of Florida, Gainesville, March 3–5, 1988. It was the eighth seminar in the series. There are 17 papers, including an expository paper by D. Bakry on the Riesz transform and reminiscences of some of Paul Levy's ideas in Brownian motion and in Markov chains by K. L. Chung.

Numerical Methods in Transient and Coupled Problems. Edited by R. W. Lewis, E. Hinton, P. Bettess, and B. A. Schrefler. John Wiley & Sons, 1987. xvi+350 pp., $95.00.

This volume had its origin in an international conference held in Venice at the Giorgio Cini Foundation on the Island of San Giorgio Maggiore in July 1984, and contains invited papers by some who attended the conference and by some who did not. There is a state-of-the-art survey paper by W. L. Wood, in addition to 13 other contributions on subjects such as adaptive mesh refinement, groundwater flow, elliptic and hyperbolic problems, contact problems, rain effects on aircraft, instability analysis, transient flows, two-dimensional Navier Stokes equations, free-surface flows, parallel computations, etc.

Computation and Control. Edited by K. Bowers and J. Lund. Birkhäuser, Boston, 1989. 400 pp., $49.00.

This is volume 1 in the series Progress in Systems and Control Theory. It is a collection of papers presented at the first Bozeman Conference, held at Bozeman, Montana, August 1–11, 1988. It contains both applications of computation and control, and the description of new trends and techniques. There are 30 papers, including plenary lectures by W. Gautschi (Orthogonality—conventional and unconventional—in numerical analysis), C. I. Byrnes and A. Isidori (Feedback design from the zero dynamics point of view), C. F. Martin (Observability, interpolation and related topics), and F. Stenger (Explicit approximate methods for computational control theory).

Estimation Techniques for Distributed Parameter Systems. By H. T. Banks and K. Kunisch. Birkhäuser, Boston, 1989. xiii+315 pp., $42.00.

This is volume 1 in the series Systems and Control: Foundations and Applications. The research reported in this monograph was originally motivated by the authors' interest in control problems involving partial and delay equations, but the focus is on approximation and computational aspects of inverse problems for infinite-dimensional systems. The monograph is principally about approximation methods for least squares inverse problems governed by partial differential equations. Chapter headings: 1. Examples of inverse problems arising in applications; 2. Operator theory preliminaries; 3. Parameter estimation: basic concepts and examples; 4. Identifiability and stability; 5. Parabolic equations; 6. Approximation of unknown coefficients in linear elliptic equations; 7. An annotated bibliography.

Mathematical Models for Scientists and Engineers: Linear and Nonlinear Systems. By Peter B. Kahn. John Wiley & Sons, 1990. xix+469 pp., $54.95.

This modern and somewhat unorthodox text for a book with its title is divided into two parts: Linear systems (Chapters 1–6), with particular emphasis on asymptotic methods, and Nonlinear systems (Chapters 7–16) where (using the material of Part I) the focus is on weakly nonlinear oscillatory systems and nonlinear difference equations. Chapter headings: 0. Miscellaneous resources; 1. Matrix theory; 2. The gamma and related functions; 3. Elements of asymptotics; 4. Evaluation of sums: the Euler-MacLaurin sum expansion; 5. Evaluation of integrals: the Laplace method; 6. Differential equations; 7. The simple harmonic oscillator and the logistic equation; 8. Aspects of harmonic motion and the concept of secular terms; 9. Equilibrium points and the phase plane; 10. Conservative systems; 11. Non-conservative systems; 12. The method of averaging; 13. The method of multiple time scales; 14. Higher-order calculations; 15. Error analysis; 16. One-dimensional iterative maps and the onset of chaos.