

QUARTERLY
OF
APPLIED MATHEMATICS

EDITED BY

H. W. BODE
P. J. DAVIS
E. T. ONAT

J. L. SYNGE
G. F. CARRIER
D. C. DRUCKER

HIRSH COHEN
U. GRENANDER
P. S. SYMONDS

W. F. FREIBERGER, *Managing Editor*

EDITED WITH THE COLLABORATION OF

H. T. BANKS
M. A. BIOT
C. FERRARI
G. E. HAY
E. REISSNER
J. J. STOKER

J. M. BURGERS
P. GERMAIN
P. LE CORBEILLER
S. A. SCHELKUNOFF

H. W. EMMONS
J. A. GOFF
F. D. MURNAGHAN
W. R. SEARS

FOUNDER, AND
MANAGING EDITOR 1943-1965
W. PRAGER

VOLUME XXXV

JANUARY • 1978

NUMBER 4

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.

Manuscripts (two copies) submitted for publication in the QUARTERLY OF APPLIED MATHEMATICS should be sent to the Editorial Office, Box F, Brown University, Providence, R.I. 02912, either directly or through any one of the Editors or Collaborators. 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 proofs only. The authors' institution will be requested to pay a publication charge of \$25.00 per page which, if honored, entitles them to 100 free reprints. Instructions will be sent with galley proofs.

The 1977 subscription price for Volume 35 (April 1977-January 1978) is \$25.00. Single issues can be purchased, as far as they are available, at \$8.00 and back volumes at \$25.00 per volume. Subscriptions and orders for back volumes must be addressed to: American Mathematical Society, P.O. Box 1571, Providence, R. I. 02901. All orders must be accompanied by payment. Other subscription correspondence should be addressed to American Mathematical Society, P.O. Box 6248, Providence, R. I. 02940.

Second-class postage paid at Providence, Rhode Island, and at Richmond, Virginia
Publication number 808680

WILLIAM BYRD PRESS, INC., RICHMOND, VIRGINIA

QUARTERLY
OF
APPLIED MATHEMATICS

EDITED BY

H. W. BODE
P. J. DAVIS
E. T. ONAT

J. L. SYNGE
G. F. CARRIER
D. C. DRUCKER

HIRSH COHEN
U. GRENANDER
P. S. SYMONDS

W. F. FREIBERGER, *Managing Editor*

EDITED WITH THE COLLABORATION OF

H. T. BANKS
M. A. BIOT
C. FERRARI
G. E. HAY
E. REISSNER
J. J. STOKER

J. M. BURGERS
P. GERMAIN
P. LE CORBEILLER
S. A. SCHELKUNOFF

H. W. EMMONS
J. A. GOFF
F. D. MURNAGHAN
W. R. SEARS

FOUNDER, AND
MANAGING EDITOR 1943-1965
W. PRAGER

Printed by the
WILLIAM BYRD PRESS, INC.
Richmond, Virginia

CONTENTS

AIKAWA, K., T. HISAMOTO AND T. SUGANUMA: An electrostatic problem in bi-cyclide coordinates.....	297
ANDERSON, N. AND A. M. ARTHURS: Dual extremum principles for a nonlinear diffusion problem.....	188
ANDERSON, N. AND A. M. ARTHURS: Dual extremum principles for heat-transfer problems with variable thermal properties.....	337
ARTHURS, A. M. (<i>see</i> N. ANDERSON)	
BARUCH, MENAHEM (<i>see</i> DAVID DURBAN)	
C. E. BEEVERS: Continuous data-dependent results for a general theory of heat conduction in bounded and unbounded domains.....	111
T. T. BOWMAN (<i>see</i> L. CESARI)	
M. BRAUN AND J. HERSHENOV: Periodic solutions of finite difference equations.....	139
J. M. BURGERS: On some problems of homogenization	421
W. B. CASTELLAN AND E. F. INFANTE: On a functional equation arising in the stability theory of difference-differential equations.....	311
L. CESARI AND T. T. BOWMAN: Some error estimates in the alternative method.....	121
LIM CHEE-SENG: A radiation-condition Gaussian induced MGD cone field.....	321
P. K. CURRIE, M. A. HAYES AND P. M. O'LEARY: Viscoelastic Rayleigh waves	35
P. K. CURRIE AND P. M. O'LEARY: Viscoelastic Rayleigh waves II.....	445
DAVID DURBAN AND MENAHEM BARUCH: Natural Stress rate	55
J. S. FORSYTH (<i>see</i> Z. A. MELZAK)	
P. GATIGNOL: Two-timing procedure for higher-order modulations of near-linear dispersive wave trains with an application to plasma waves.....	357
NIMA GEFFEN: A variational formulation for constrained quasilinear vector systems.	375
M. HAYES (<i>see</i> P. K. CURRIE)	
J. HERSHENOV (<i>see</i> M. BRAUN)	
T. HISAMOTO (<i>see</i> K. AIKAWA)	
P. J. HOLMES AND D. A. RAND: Bifurcations of the forced van der Pol oscillator.....	495
CORNELIUS O. HORGAN AND LEWIS T. WHEELER: Isoperimetric inequalities for the Dirichlet eigenvalue problem.....	406
E. F. INFANTE (<i>see</i> W. B. CASTELAN)	
N. I. IOAKIMIDIS (<i>see</i> P. S. THEOCARIS)	
S. N. KARP AND M. MACHOVER: Curves along which plane waves can interfere.....	193
L. M. KEER AND K. S. PARIHAR: Singularity at the apex of pyramidal notches with three equal angles.....	401
NOBORU KIKUCHI: An analysis of the variational inequalities of seepage flow by finite-element methods	149
W. D. LAKIN AND A. NACHMAN: Unstable vibrations and buckling of rotating flexible rods.....	479
H. J. LANDAU: The notion of approximate eigenvalues applied to an integral equation of laser theory.....	165
R. W. LARDNER: Asymptotic solutions of nonlinear wave equations using the methods of averaging and two-timing	225
CHIH-BING LING: On Greenspan's transformation	185
C. D. LUNING AND W. L. PERRY: An iterative technique for solution of the Thomas-Fermi equation utilizing a nonlinear eigenvalue problem.....	257
R. C. MACCAMY: An integro-differential equation with application in heat flow.....	1

R. C. MACCAMY: A model for one-dimensional, nonlinear viscoelasticity	21
M. MACHOVER (<i>see</i> S. N. KARP)	
JOHN MALLET-PARET: Buckling of cylindrical shells with small curvature	383
G. T. McALLISTER (<i>see</i> S. M. ROHDE)	
P. J. MELVIN: On deviations from linear wave motion in inhomogeneous stars	75
Z. A. MELZAK AND J. S. FORSYTH: Polyconics I. Polyellipses and optimization	239
D. H. MICHAEL: Nonlinear effects in electrohydrodynamic surface wave propagation	345
A. NACHMAN (<i>see</i> W. D. LAKIN)	
P. M. O'LEARY (<i>see</i> P. K. CURRIE)	
K. S. PARIHAR (<i>see</i> L. M. KEER)	
FRANCO PASTRONE: On the dynamics of a second-order thin rod	
ROBERT G. PAYTON: Symmetry-axis elastic waves for transversely isotropic media	63
W. L. PERRY (<i>see</i> C. D. LUNING)	
GEORGE H. PIMBLEY, JR.: Wave solutions travelling along quadratic paths for the equation $(\partial u / \partial t) - (k(u)u_x)_x = 0$	129
A. C. PIPKIN: Energy changes in ideal fiber-reinforced composites	455
D. A. RAND (<i>see</i> P. J. HOLMES)	
WILLIAM T. REID: A result on the singularities of matrix functions	293
S. M. ROHDE AND G. T. McALLISTER: Optimization of elastohydrodynamic con- tacts	527
PHILIP W. SCHAEFER: Some maximum principles for nonlinear elliptic boundary- value problems	517
B. SHERMAN: Kinematic wave models for overland flow	435
D. A. SIMONS: Singular perturbation analysis of the scattering of Rayleigh waves by thin surface layers	203
ALFREDO S. SOMOLINOS: Periodic solutions of the sunflower equation: $\ddot{x} + (a/r)\dot{x} +$ $(b/r) \sin x(t - r) = 0$	465
R. P. SRIVASTAV: On dual integral equations with trigonometric kernels	524
T. SUGANUMA (<i>see</i> K. AIKAWA)	
P. S. THEOCARIS AND N. I. IOAKIMIDIS: Numerical integration methods for the solution of singular integral equations	173
YIH-O TU: A multi-phase Stefan problem describing the swelling and the dissolution of glassy polymer	269
HOMER F. WALKER: Strong ellipticity and Van Hove's lemma in inhomogeneous media	287
LEWIS T. WHEELER (<i>see</i> CORNELIUS O. HORGAN)	
M. H. WILLIAMS: The resolvent of singular integral equations	99
M. H. WILLIAMS: Generalized Theodorsen solution for singular integral equations of the airfoil class	213
WAN-LEE YIN: Zone estimates in the elastic-plastic torsion problem	410

BOOK REVIEWS

P. J. Davis: <i>Generalized inverses and applications</i> , edited by M. Z. Nashed	191
Ulf Grenander: <i>Stochastic processes: a survey of the mathematical theory</i> , by John Lamperti	531
Jack Hale: <i>Nonlinear operators and differential equations in a Banach space</i> , by R. H. Martin, Jr.	305
F. Kappel: <i>Nonlinear semigroups and differential equations in Banach spaces</i> , by Viorel Barbu	531
Alan L. Mackay: <i>Pattern synthesis: lectures in pattern theory, Vol. I</i> , by Ulf Grenander	191
A. C. Pipkin: <i>Viscoelasticity</i> , by Wilhelm Flügge	305
A. C. Pipkin: <i>Continuum mechanics—concise theory and problems</i> , by P. Chadwick....	305

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

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

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

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

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

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

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

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

Square roots should be written with the exponent $\frac{1}{2}$ rather than with the sign $\sqrt{\quad}$. Complicated exponents and subscripts should be avoided. Any complicated expression that recurs frequently should be represented by a special symbol.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONTENTS

J. M. BURGERS: On some problems of homogenization	421
B. SHERMAN: Kinematic wave models for overland flow	435
P. K. CURRIE AND P. M. O'LEARY: Viscoelastic Rayleigh waves II	445
A. C. PIPKIN: Energy changes in ideal fiber-reinforced composites	455
ALFREDO S. SOMOLINOS: Periodic solutions of the sunflower equation: $\ddot{x} + (a/r)\dot{x} + (b/r) \sin x(t-r) = 0$	465
W. D. LAKIN AND A. NACHMAN: Unstable vibrations and buckling of rotating flexible rods	479
P. J. HOLMES AND D. A. RAND: Bifurcations of the forced van der Pol oscillator	495
FRANCO PASTRONE: On the dynamics of a second-order thin rod	511

NOTES:

PHILIP W. SCHAEFER: Some maximum principles for nonlinear elliptic boundary-value problems	517
R. P. SRIVASTAV: On dual integral equations with trigonometric kernels	524
S. M. ROHDE AND G. T. MCALLISTER: Optimization of elastohydrodynamic contacts	527

BOOK REVIEWS:

VIOREL BARBU: <i>Nonlinear semigroups and differential equation in Banach spaces</i>	F. KAPPEL 531
JOHN LAMPERTI: <i>Stochastic processes: a survey of the mathematical theory</i>	ULF GRENANDER 531

BOOKS RECEIVED	464, 494, 510, 532-540
----------------------	------------------------

—BOOK REVIEW SECTION—

Nonlinear semigroups and differential equations in Banach spaces. By Viorel Barbu. Noordhoff International Publishing, Leyden, Netherlands, 1976. 353 pages. \$24.00

This book deals systematically with the existence theory for nonlinear differential equations in Banach spaces which are associated with dissipative operators. Most of the results are concerned with autonomous equations. The general approach is by nonlinear semigroup theory. Chapter I provides relevant results of functional analysis and a short introduction to linear semigroup theory. In Chapter II, the author gives a systematic presentation of the theory of maximal monotone and dissipative operators. Chapter III deals with nonlinear semigroups of contractions and with differential equations in Banach spaces. Aspects of the more complete theory of nonlinear differential equations in Hilbert space together with results on nonlinear semigroups in Hilbert space are presented in Chapter IV. Finally, Chapter V gives some results on second-order equations.

The book provides an excellent treatment of those parts of the theory of nonlinear differential equations in Banach spaces as indicated above. In principle, it is self-contained, but assumes a good working knowledge of relevant topics in functional analysis; a beginner in the field certainly has to struggle hard since at various places the proofs are kept short by referring to standard arguments which may be nonstandard to a nonspecialist. It is sometimes advisable to make use of the literature cited in the bibliographical notes at the end of each chapter except the first one. All together, the book is not intended to be a textbook for someone who has no previous knowledge of the field, but is an excellent and systematic treatment for those who have some familiarity with the topics presented.

F. KAPPEL (GRAZ, AUSTRIA)

Stochastic processes: a survey of the mathematical theory. By John Lamperti. Applied Mathematical Sciences 23, Springer-Verlag, New York-Heidelberg-Berlin, 1977. 266 pages. \$9.80

This is an elegant introduction to stochastic processes, written in a personal style and with a careful selection of material. It does not attempt to cover this theory, which would be impossible in a book of this size, but presents some of the fundamental ideas and mathematical techniques of this fascinating chapter in modern probability theory.

The first hundred pages or so deal with second-order processes and the stationary case. Much of this can profitably be viewed from the perspective of Hilbert space following Kolmogorov, Karhunen and others. In this way the reader will learn about the geometry of stochastic processes and how it can be used for representing stationary processes, as well as for solving certain extrapolation and interpolation problems. The strictly stationary case and the related measure-preserving transformations are also studied and lead up to an attractive proof of the individual ergodic theorem.

The rest of the book deals with Markov processes and martingales. In the Markov case the main tool is semigroup theory, which the author employs in a concrete manner that should be accessible to most readers. Although measure-theoretic questions are not neglected, the emphasis is on the analytical aspects. The many examples in the text will help the reader to understand an area that is not easy to penetrate. The last chapter, on martingales, is less analytical and includes some results on the continuity of paths.

It is characteristic of this book that the author has selected the material in such a way that mathematical substance has been aimed for rather than generality. In this it resembles Lamperti's earlier book *Probability: a survey of the mathematical theory*. Written in this classical spirit, it is highly concentrated; the presentation is lucid, resulting in a very readable introduction to stochastic processes.

The preface contains a discussion of the controversial question of the responsibility of the scientist to society. It is controversial and challenging, and is recommended for those readers who still believe that scientific work belongs to the ivory tower isolated from the rest of the universe.

ULF GRENANDER (*Providence*)

—BOOKS RECEIVED—

Notice in this section does not preclude later full review in the Book Review Section.

The analysis of contingency tables. By B. S. Everitt. Halsted Press, New York, 1977. xii + 128 pages. \$8.50

This book is designed primarily for those who need to find possible relationships between qualitative variables. The early chapters are essentially a revision of A. E. Maxwell's *Analyzing qualitative data*, which included basic information such as the analysis of 2×2 tables and methods of analysis for the general two-dimensional contingency table. Since this book was first published in 1961, a great deal of new and interesting work on the analysis of contingency tables has been developed. Later chapters of the present book discuss these new methods, the most important of which concerns the analysis of multidimensional tables. The book emphasizes the scope of application of such methods, and in particular looks at the development of methods for fitting log-linear models to multidimensional frequency data, and the description of these data in parametric terms.

Sampling inspection and quality control. 2nd edition. By G. Barrie Wetherill. Halsted Press, New York, 1977. viii + 146 pages. \$7.50

This is the second edition of the book first published by Methuen & Co. in 1969. It gives a broad coverage of the field, with some emphasis on the principles upon which various plans are constructed, including important background theory. For this new edition, tables, nomograms and explanations have been added so that numerical exercises can be set, and the sections on acceptance sampling have been rewritten. Also, the text has been brought up to date with current work in numerous places.

Adaptive information processing: an introductory survey. By Jeffrey R. Sampson. Springer-Verlag, New York, 1976. x + 214 pages. \$14.80

This volume in the series "Texts and Monographs in Computer Science" consists of three self-contained parts of five chapters each: 1. Information and automata; 2. Biological information processing; 3. Artificial intelligence. It is designed as a one-semester course for undergraduate computer science majors, introducing them to aspects of the theory and application of computation, giving them a background in automata theory, biological information processing and artificial intelligence sufficient for future graduate study, and presenting a personal, unifying viewpoint. Prerequisites are set theory, elementary discrete probability, and logic.

Discrete multivariate analysis: theory and practice. By Y.M.M. Bishop, S. E. Fienberg, and P. W. Holland with the collaboration of R. J. Light and F. Mosteller. The MIT Press, 1975. x + 557 pages. \$27.50

This book—which, the authors state, owes its inspiration and guidance to Frederick Mosteller—brings together the literature on discrete multivariate analysis (and especially the analysis of cross-classified data) in an organized way, to be useful to both theoretical and practical workers in the field and so as to emphasize the salient ideas. It presents parametric models, sampling schemes, basic theory, practical examples and advice on computation. The chapters are arranged into three logical groups: the first (of nine chapters) introduces the log-linear model, presents the statistical theory underlying its use in the analysis of contingency-table data, and illustrates the application of the theory to a wide variety of substantive problems. The second group (of three chapters) deals with approaches and methods not relying directly on the log-linear model. The final pair of chapters contains basic statistical results and theory used throughout the book.

(continued on page 494)

(continued from page 464)

Introduction to crystal geometry, By M. J. Buerger. Robert E. Krieger Co., New York, 1977. xii + 204 pages. \$12.50

This is a reprint of the original edition published by McGraw-Hill in 1971. It is at the same time a textbook requiring no college-level background and thus suitable for the early years of undergraduate study, and also an introduction to space groups for maturer readers wishing to understand the niceties of this part of crystallography. There are eleven chapters, entitled: introduction, order in patterns, translational order, rotational order, the point groups, lattice types and coordinate systems, application of point-groups, lattice types and coordinate systems, application of point-group symmetries to crystals, characteristics of space groups, the space groups, equipoints, and the development of crystal geometry.

This work by an eminent crystallographer will be welcome by all interested in a beautiful field of applied mathematics.

Lectures on the theory of functions of a complex variable. By George W. Mackey. Robert E. Krieger Co., New York, 1977. iii + 266 pp. \$12.50

This book, a reprint with corrections of the original van Nostrand edition of 1967, is based on lecture notes for Mathematics 213 at Harvard. It develops the subject axiomatically and requires, in principle, no background of mathematics at all. In practice, of course, only readers with considerable mathematical maturity will appreciate the masterly presentation. The chapter headings are: the real and continuous number fields, elementary point set topology, continuous functions, differentiation of complex-valued functions of a complex variable, complex integration, entire and meromorphic functions, conformal mapping, analytic continuation and Riemann surfaces, and algebraic functions and their integrals (resumé of results).

Encounters with mathematics. By Lars Gårding. Springer-Verlag, New York, 1977. ix + 270 pages. \$9.80

This is a book for readers with at least a high-school, but better some early college, background in mathematics who wish to acquire a knowledge of the historical, scientific and cultural aspects of the subject. It will, however, be appreciated also by mature mathematicians. Each of the nine chapters (ranging from number theory to applications) starts with a historical introduction, continues with a concise but complete account of some basic facts and proceeds to look at the present state of the art including, if possible, some recent piece of research. Most of the chapters end with one or two passages from historical mathematical papers, translated into English. It is an original and unusual book, looking at mathematics from the vista of an accomplished practitioner.

Quasilinear hyperbolic systems and waves. By A. Jeffrey. Pitman Publishing Co., London, 1976. vii + 230 pages. \$6.90

These notes aim to gather together in a compact form the basic ideas of nonlinear wave propagation, with particular attention to first-order quasilinear systems in one space dimension and time, although some information is also included about systems in many dimensions. The unifying theme among the topics treated is the effect nonlinearity has in leading to the breakdown of classical differentiable solutions and the way in which, for conservative systems, these solutions may be extended by the introduction of discontinuous solutions (shocks). Closely related is the analysis of the transport of Lipschitz discontinuities in the initial data that characterize wavefronts, and the manner in which they lead to shock formation and interact with established shocks. The chapter headings are: nonlinear equations and quasilinear systems, hyperbolic systems and characteristics, Riemann invariants and simple waves, shock waves, and development of shocks from Lipschitz continuous data. There is a bibliography of 142 items.

(continued on page 510)

(continued from page 494)

Application-oriented algebra: an introduction to discrete mathematics. By James L. Fisher. Harper & Row, New York, 1977. xviii + 362 pages. \$16.50

The need for algebra courses designed for students interested in the applications of mathematics has been increasingly felt in recent years and several textbooks have appeared designed to fill this need. The present book is one of them. It offers applications not usually found in algebra texts and will appeal particularly to computer science students. Congruences and homomorphisms of groups, rings and universal algebras are covered because of the importance of congruence in the theory of machines and its natural extension to congruences of universal algebras. The chapter headings are: basic concepts, partially ordered sets, graphs, Boolean algebra, finite machines, languages, groups, modular arithmetic, coding theory, finite fields, and universal algebra.

Adventures of a mathematician. By S. M. Ulam. Charles Scribner's Sons, New York, 1977. xi + 317 pages. \$4.95

An account of the author's life, in four parts: 1. Becoming a mathematician in Poland; 2. A working mathematician in America; 3. Life among the physicists (his Los Alamos experience); 4. The past fifteen years.

The universe: its beginning and end. By Lloyd Motz. Charles Scribner's Sons, New York, 1977. xiv + 343 pages. \$4.95

The author—a professor of astronomy at Columbia—gives a non-technical account of current theories on the origin, the evolution and the ultimate collapse of the universe. The ideas of relativity and quantum theory are woven into the fabric of the text to emphasize their impact on our understanding of the universe.

First course in rings, fields and vector spaces. By P. B. Bhattacharya and S. K. Jain. Halsted Press, New York, 1977. x + 238 pages. \$6.95

This is a companion volume to the same authors' *First course in group theory*. Chapter 1 to 7 deal with theory of rings, modules and linear mappings, chapters 8-11 with the theory of fields, and chapter 12 deals with the eigenvalue problem. Each chapter contains several examples to illustrate the concepts, as well as numerous solved and unsolved problems.

Waves in water of variable depth. Edited by D. G. Provis and R. Radok. Lecture Notes in Physics, vol. 64. Springer-Verlag, Berlin, 1976. 231 pages. \$22.50

These are the proceedings of a symposium held under the auspices of the International Union of Theoretical and Applied Mechanics (IUTAM) and the Australian Academy of Science, in Canberra, 20-23 July 1976. The lectures are organized in six parts: 1. Wave propagation in water of variable depth (4 lectures); 2. Tsunami generation and propagation (4 lectures); 3. Waves on beaches (5 lectures); 4. Waves and currents (3 lectures); 5. Waves in a rotating stratified fluid (3 lectures); 6. Long period barotropic waves (7 lectures). Each part is preceded by a summary and references.

(continued on page 532)

(continued from page 510)

The following three books are volumes in the series *Lecture Notes in Economics and Mathematical Systems*, published by Springer-Verlag, Berlin-Heidelberg-New York, 1977.

Vol. 144: *Convex analysis and its applications*. Proceedings of a conference held at Murat-la-Quaire, March 1976. Edited by A. Auslender. \$11.00

The text of thirteen lectures, two in French and the others in English, giving an account of recent research done in French universities in the field.

Vol. 145: *Extreme games and their solutions*. By Joachim Rosenmüller. \$8.00

Chapters: 0. Preliminaries; 1. Convex games; 2. Super-additive games; 3. Examples.

Vol. 146: *In search of economic indicators: essays on business surveys*. Edited by Werner H. Strigel. \$11.40

A collection of ten essays, arising out of the work on business cycle surveys of the IFO Institute for Economic Research, Munich.

Design and analysis of experiments. By Douglas C. Montgomery. John Wiley & Sons, New York, 1976. xiv + 418 pages. \$10.95

This book is intended for readers who have completed a first course in statistical methods, and requires some calculus and matrix algebra as prerequisites. It is suitable as a second undergraduate statistics course or a first-year graduate course.

The book contains 15 chapters. Chapter 1 presents the basic philosophy of the statistical approach to experimental design. Chapter 2 reviews elementary statistical methods, and introduces terminology and notation used in subsequent chapters.

Chapter 3 begins the study of designs for experiments with a single factor. The analysis of variance is introduced as the appropriate method of statistical analysis. Chapters 4 and 5 continue the development of single-factor experiments, with randomized blocks, Latin squares, and related designs discussed in chapter 4. Chapter 5 introduces incomplete block designs and chapter 6 factorial designs. Chapter 7 presents a set of rules for deriving computing formulas for sums of squares and expected mean squares for any balanced multifactor design.

The 2^k and 3^k factorial designs are introduced in chapter 8; they may be run in incomplete blocks by sacrificing information on certain interactions. Procedures for constructing and analyzing these designs are given in chapter 9. The relatively high cost of industrial experimentation has led to the extensive use of fractional 2^k and 3^k factorial designs, which are discussed in chapter 10. The basic presentation of multifactor designs is continued in chapter 11, which discusses nested arrangements. These are nonfactorial designs in which the levels of one factor are contained entirely within the levels of another factor. Chapter 12 illustrates how randomization restrictions are employed in multifactor experiments. An example of such design would be running a factorial experiment in a randomized block.

Regression analysis is introduced in chapter 13 as a methodology for the analysis of unplanned experiments. Chapter 14 discusses response surface methodology, a collection of mathematical and statistical techniques for determining the optimum operating conditions for industrial processes. This chapter concludes with a section on evolutionary operations, a process control method developed initially for chemical plants. The final chapter treats the analysis of covariance, which, like blocking, is a methodology for improving the precision of comparisons between treatments.

There are problem sets at the end of each substantive chapter.

Self-organization in nonequilibrium systems: from dissipative structures to order through fluctuations. By G. Nicolis and I. Prigogine. John Wiley & Sons, 1977. xii + 491 pages. \$27.50

The aim of this monograph is the study of self-organization in nonequilibrium systems, characterized by the appearance of dissipative structures through the amplification of appropriate fluctuations. It encompasses problems from chemistry to biology and population dynamics. The work is organized in five parts and eighteen chapters, as follows. Part I is devoted to the thermodynamic background, giving a concise but self-contained presentation of the basic principles of non-equilibrium thermodynamics, with special emphasis on chemical reactions coupled to transport processes such as diffusion. The time evolution of systems involving chemical reactions and diffusion is described by a set of coupled nonlinear partial differential equations. In general, there exist more than one solution for given initial and boundary conditions; here, thermodynamics singles out a special solution, the "thermodynamic branch", which is defined as that corresponding to equilibrium conditions. When the system is permitted to deviate from equilibrium, new solutions may or may not replace the "thermodynamics branch", and the main problem discussed in Part II is how to construct solutions that occur when the thermodynamic branch becomes unstable. The concept of stability is first discussed. Then, an introduction is presented to the field of bifurcation theory, which gives the natural approach to the problem of the emergence of new patterns. Techniques other than bifurcation theory suitable to studying the appearance of new structures are also surveyed. Part II deals with deterministic methods. The role of fluctuations is studied in Part III: it consists of three chapters: general comments, birth-and-death descriptions of fluctuations, effect of diffusion (phase-space description and multivariate master equation), a "mean-field" description of fluctuations (non-linear master equation). Parts IV and V discuss specific examples of selforganization, chosen in various fields of interest from chemistry to sociobiology. It includes, for instance, an account of Turing's remarkable 1952 paper on the chemical basis of morphogenesis, and Turing's instability is shown to be one of the most striking phenomena associated with the breakdown of the thermodynamic branch. In Part V, evolution is viewed as a problem in structural stability.

In addition to the direct utility of mathematical models in the analysis of complex systems, the monograph stresses the universality of the concepts and mechanisms underlying self-organization.

Linear representations of finite groups. By J. P. Serre. Graduate Texts in Mathematics No. 42. Springer-Verlag, New York, 1977. x + 170 pages. \$12.80

This book consists of three parts, rather different in level and purpose. The first part, Representations and Characters, was originally written for quantum chemists. It describes the correspondence, due to Frobenius, between linear representations and characters. Only the definition of a group and the rudiments of linear algebra are used, and the examples should be useful to chemists.

The second part, Representations in Characteristic Zero, completes the first on the following points: degrees of representations and integrality properties of characters; induced representations, theorems of Artin and Brauer, and applications; rationality questions.

The third part is an introduction to Brauer theory: passage from characteristic 0 to characteristic p , and conversely.

Extensions of linear-quadratic control, optimization and matrix theory. By David H. Jacobson. Academic Press, London, 1977. x + 217 pages. \$12.95

This monograph seeks to extend, develop and strengthen the link between control, optimization and matrix theory by presenting a number of extensions of the well-known linear-quadratic theories. There are seven chapters: introduction; nonlinear-quadratic control problems; copositive matrices, non-convex quadratic forms and quadratic differential equations; non-negativity conditions for constrained and non-quadratic functionals; controllability of constrained linear autonomous systems; new approaches to function minimization; conclusion.

Multicriteria decision making. Edited by G. Leitmann and A. Marzollo. International Centre for Mechanical Sciences, Courses and Lectures No. 211. Springer-Verlag, Wien-New York, 1975. 387 pages. \$22.50

This series of papers is directed towards general and rigorous formulations in order to reduce multicriteria decision problems conceptually to clearly defined classes of optimization problems for which definite solution algorithms are sought. Contents: cooperative and non-cooperative differential games (G. Leitmann), vector-valued optimization in multi-player quantitative games (A. Blaquiere), minimax Pareto optimal solutions with application to linear quadratic problems (J. Medanic), preference optimality and applications of Pareto optimality (W. Stadler), domination structures and non-dominated solutions (P. L. Yu), on some broad classes of vector optimal decisions and their characterization (A. Marzollo, W. Ukovich), estimating the common cost of a good when the local costs are known in the countries of a community (M. Volpato), explicit solution for a class of allocation problems (G. Castellani).

The finite element method in partial differential equations. By A. R. Mitchell and R. Wait. John Wiley & Sons, 1977. x + 198 pages. \$14.95

This book is intended to bridge the gap between expositions of the finite-element method addressed to engineers (such as that by Zienkiewicz) and to mathematicians (such as that by Strang and Fix). Except for the chapter on convergence of approximations, the book is accessible to readers with a mathematical background no more specialized than vector spaces and advanced calculus. Hilbert space and functional-analytic concepts are introduced throughout, mainly from the point of view of unifying material. Only a working knowledge of partial differential equations is assumed. A chapter on variational principles is included since these, rather than partial differential equations, are often the starting point. Ritz, Galerkin, least-squares and collocation methods are covered and a large selection of possible basis functions is given.

Time series analysis, forecasting and control. By G. E. P. Box and G. M. Jenkins. Holden-Day, Inc., San Francisco, 1976. xxi + 575 pages. \$32.95

This is a revised edition of the well-known work first published in 1970. Material has been updated and a new section with exercises and problems has been added.

Differential topology with a view to applications. By D. R. J. Chillingworth. Pitman Publishing, San Francisco, 1976. viii + 291 pages. \$17.00

This volume (Research Notes in Mathematics 9) gives an overall view of the new techniques in differential topology and the qualitative theory of dynamical systems with emphasis on their applicability in physics, engineering, economics, chemistry and biology, and introduces catastrophe theory and the ways in which it can be used. Only a knowledge of elementary calculus is assumed and technical proofs are omitted. There is a bibliography of 151 items.

Finite free resolutions. By D. G. Northcott. Cambridge University Press, New York, 1976. xii + 271 pages. \$29.50

This volume (Cambridge Tracts in Mathematics 71) gives a self-contained and elementary presentation of the basic theory of that part of homological algebra which deals with modules possessing projective resolutions of finite length, a subject going back to Hilbert's theorem on syzygies.

Markov chains: theory and applications. By Dean L. Osacsson and R. W. Madsen. John Wiley & Sons, 1976. x + 265 pages. \$18.95

This volume in the Wiley Series in Probability and Mathematical Statistics is rigorous mathematically but emphasises the practical use of Markov chains. It deals principally with discrete time chains. Chapter headings: 1. Introduction; 2. Fundamental concepts of Markov chains; 3. The classical approach to Markov chains; 4. The algebraic approach to Markov chains; 5. Nonstationary Markov chains and the ergodic coefficient; 6. Analysis of a Markov chain on a computer; 7. Continuous-time Markov chains.

Using computers. By B. L. Meek and S. Fairthorne. Halsted Press, New York, 1977. 208 pages. \$16.50

This is a general introduction to computers, principally their use in various fields. The eight chapters discuss, respectively, the computer as a concept, machine, problem-solver, number-cruncher, data-handler, watchdog, social force, and as an entertainment.

The complexity of computing. By John E. Savage. John Wiley & Sons, 1976. xiii + 391 pages. \$22.95

This book investigates the interaction of programs and machines from an efficiency point of view, specifically in terms of space-time tradeoffs. Chapter headings: 1. Introduction; 2. Combinational complexity of functions; 3. Combinational complexity and formula size; 4. Sequential machines; 5. Turing machines; 6. General-purpose computers; 7. Storage-time tradeoffs; 8. Combinatorial and algebraic problems.

Taylor expansions and catastrophes. By T. Poston and I. N. Stewart. Pitman Publishing, San Francisco, 1976. 168 pages. \$13.90

This volume (Research Notes in Mathematics 7) consists of five parts, all concerned with various aspects of Taylor series expansions in relation to catastrophe theory: 1. A sketch of the topologist's calculus; 2. Thom's classification theorem—an intuitive approach; 3. Rules for determinacy and unfolding computations; 4. The geometry of binary quartic forms; 5. Gravitational catastrophe machines.

Methods of accelerated convergence in nonlinear mechanics. By N. N. Bogoljubov, J. A. Mitropoliskii, A. M. Samoilenko. Springer-Verlag, Berlin, 1976. viii + 291 pages. \$27.90

This is an English translation by V. Kuman, edited by I. N. Sneddon, of the original Russian monograph. The authors have contributed several short appendices to this translation which bring the work up to date. The monograph deals with results in nonlinear mechanics obtained in recent years by means of a modern version of Bogoljubov's method of successive changes of variables which ensures rapid convergence. The method was conceived by Krylov and Bogoljubov in 1934 and recently modernized by Bogoljubov, using results by Kolmogorov and Arnold. The chapter headings are: 1. Quasi-periodic solutions in problems of nonlinear mechanics; 2. General solutions of nonlinear differential equations in the neighborhood of quasi-periodic solutions; 3. A smoothing technique; 4. Trajectories on a torus; 5. Linear systems with quasi-periodic coefficients; 6. Neighbourhood of an invariant smooth toroidal manifold; 7. Neighbourhood of a compact invariant manifold of a non-autonomous system.

Introduction to statistical time series. By W. A. Fuller. John Wiley & Sons, 1976. ix + 470 pages. \$24.95

This volume in the Wiley Series in Probability and Mathematical Statistics provides an introduction to representations for statistical time series and to the estimation of time series models. Both the time domain and frequency domain approaches are developed, but emphasis is on estimation in the time domain. Chapter headings: 1. Introduction; 2. Moving average and autoregressive processes; 3. Introduction to Fourier analysis; 4. Spectral theory of time series; 5. Some large sample theory; 6. Estimation of the mean and autocorrelations; 7. The periodogram; estimated spectrum; 8. Estimation for autoregressive and moving average time series; 9. Regression, trend, and seasonality.

Innovation processes. By Y. A. Rozanov. Halsted Press, New York, 1977. vii + 136 pages. \$14.50

This volume in the Scripta Series in Mathematics is a translation from the Russian, edited by A. V. Balakrishnan. The problem of constructing innovation processes—important in filtering theory—is examined in a very general setting, and much of the work represents the author's own research. Using innovation processes as the basic theme, he develops some of the fundamental aspects of Gaussian processes, such as regularity and multiplicity (including the infinite-dimensional case), Wold decomposition and factorization, equivalence and orthogonality.

Solutions of ill-posed problems. By A. N. Tikhonov and V. Y. Arsenin. Halsted Press, New York, 1977. xiii + 258 pages. \$19.75

This volume in the Scripta Series in Mathematics is a translation from the Russian, edited by Fritz John. The monograph gives a general theory of ill-posed problems and introduces the reader to a wide variety of applications, ranging from heat flow to the design of optical systems and the automatic processing of observational data. The chapter headings are: 1. The selection method. Quasi-solutions; 2. The regularization method; 3. Solution of singular and ill-conditioned systems of linear algebraic equations; 4. Approximate solutions of integral equations of the first kind of the convolution type; 5. Certain optimal regularizing operators for integral equations of the convolution type; 6. Stable methods of summing Fourier series with coefficients that are approximate in the l_2 metric; 7. Stable methods of minimizing functionals and solving optimal control problems; 8. Stable methods of solving optimal-planning (linear programming) problems.

Revised report on the algorithmic language Algol 68. Edited by A. van Wijngaarden, B. J. Mailloux, J. E. L. Peck, C. H. A. Koster, M. Sintzoff, C. H. Lindsey, L. G. L. T. Meertens and R. G. Fisker. Springer-Verlag, Berlin, 1976. 236 pages. \$9.90

The report is in five parts: 1. Preliminary definitions; 2. Fundamental constructions; 3. Context dependence; 4. Elaboration-independent construction; 5. Environment and examples. It has been accepted and approved for publication by the General Assembly of the International Federation for Information Processing.

Stability theory of Liapunov's direct method. By N. Rouche, P. Habets and M. Laloy. Springer-Verlag, New York, 1977. xii + 396 pages. \$14.80

This is volume 22 in the Springer series "Applied Mathematical Sciences". It is a collective work by the authors cited and C. Risito, K. Peiffer, R. J. Ballieu, Dang Chau Phien and J. L. Corae, and originated in a seminar held at the University of Louvain during 1971/72. The subject matter is stability theory in the general setting of ordinary differential equations using Liapunov's direct or second method. Chapter headings: 1. Elements of stability theory; 2. Simple topics in stability theory; 3. Stability of a mechanical equilibrium; 4. Stability in the presence of first integrals; 5. Instability; 6. A survey of qualitative concepts; 7. Attractivity for autonomous equations; 8. Attractivity for non-autonomous equations; 9. The comparison method. There are three appendices, on Dini derivatives and monotonic functions, the equations of mechanical systems, and limit sets, respectively. The bibliography contains approximately 250 items.

Linear algebra. By Ichiro Satake. Pure and Applied Mathematics, Volume 29. Marcel Dekker, Inc., New York, 1975. xi + 375 pages. \$13.75

Contents: Vector and matrix operations; determinants; vector spaces; normalization of matrices; tensor algebra; geometric interpretation. This textbook provides the student with a self-contained introduction to the basic theories of matrices and determinants in addition to the underlying concepts of vector spaces and linear mappings.

To explain the concept of vectors, the axioms of a vector space are introduced after concrete numerical vectors are discussed. The author supplies numerous examples in related subjects such as quadratic forms, classical groups, analytic geometry, and linear differential equations to clarify and illustrate how the concepts of linear algebra are applied to other branches of mathematics. A chapter on multilinear algebra is also included.

Linear algebra with geometric applications. By Larry E. Mansfield. Pure and Applied Mathematics, Volume 34. Marcel Dekker, Inc., New York, 1976. ix + 495 pages. \$14.50

This is an undergraduate-level introductory textbook in linear algebra. It includes an introductory chapter detailing the connection between analytic geometry and linear algebra, while later sections examine topics such as real vector spaces, linear transformations, second-degree curves and surfaces, and canonical forms under similarity.

Matrix theory and its applications. By N. J. Pullman. Pure and Applied Mathematics, Volume 35. Marcel Dekker, Inc., New York, 1976. xi + 240 pages. \$21.75

The volume covers algebraic and analytic preliminaries, non-negative matrices, differential equations, and location and estimation of eigenvalues. By dealing with a limited number of selected topics, it gives detailed exposure to matrix-theoretic ideas. It is addressed to advanced undergraduates and beginning graduate students.

Aspects of topology. By Charles O. Christenson and William L. Voxman. Pure and Applied Mathematics, Volume 39. Marcel Dekker, Inc., New York, 1977. xi + 517 pages. \$19.75

This volume provides coverage of the standard topics of general topology, as well as an introduction to continua, inverse systems, homotopy theory, covering spaces, triangulation and classification of 2-manifolds, and the topology of n -manifolds. It includes Brown's proof of the Schoenflies Theorem and the algorithm for computing the fundamental group of the complement of a graph (in E^3). There are sections devoted to direct limits, plane topology, and upper-semi-continuous decompositions. It also offers many exercises and problems, as well as an appendix providing background material, and an index. It is addressed to seniors and graduate students.

Optimization. By Lucien W. Neustadt. Princeton University Press, New Jersey, 1977. xiii + 424 pages. \$22.50

The purpose of this book is to give a comprehensive development of necessary conditions for optimization problems. This is done in the context of a general theory for extremal problems in a topological vector space setting. Chapter headings: I. Mathematical preliminaries; II. A basic optimization problem in simplified form; III. A general multiplier rule; IV. Optimization with operator equation restrictions; V. Optimal control problems with ordinary differential equation constraints; VI. Optimal control problems with parameters and related problems; VII. Miscellaneous optimal control problems.

The manuscript of the book was unfinished at the time of Professor Neustadt's death in 1972; it was edited and prepared for the press by Professor H. T. Banks of Brown University, who also added notes, historical comments and a bibliography.

Techniques of program structure and design. By Edward Yourdon. Princeton-Hall, Inc., New Jersey, 1975. xv + 364 pages. \$16.95

This book discusses modern computer program design philosophies and methods. It includes chapters on the characteristics of a "good" computer program, top-down program design, modular programming, structured programming, programming style, "antibugging", program testing methods, debugging concepts and techniques, and appendices on four major example problems.

The following six books are volumes in the series *Lecture Notes in Pure and Applied Mathematics*, published by Marcel Dekker, Inc., New York.

Topology: proceedings of the Memphis State University Conference. Vol. 24. Edited by S. P. Franklin and Barbara V. Smith Thomas. 1976. xii + 312 pages. \$24.50

This volume presents the proceedings of the ninth annual Spring Topology Conference held at Memphis State University. It contains the text of invited addresses surveying recent contributions to the theory of generalized metric spaces, categorical topology, zero-dimensional spaces, and differential categories of locally convex spaces. It also contains texts or abstracts of contributed papers on Baire spaces, continua, metrization theorems, Stone-Ćech compactifications, topological algebra, and other topics.

Ring theory. Vol. 25. Edited by S. K. Jain. 1977. viii + 256 pages. \$24.50

This volume is a collection of the invited papers presented at the Ohio University Ring Theory Conference in May, 1976. The contributors include Amitsur, Martindale, Passman, Rowen, and others. The volume is of interest to graduate students and research mathematicians in ring theory. It is also a reference source for mathematicians in the fields of algebraic geometry and topological algebra.

Ring theory II: proceedings of the second Oklahoma conference. Vol. 26. Edited by B. R. McDonald and R. A. Morris. 1977. v + 320 pages. \$25.00

This volume, a sequel to *Ring Theory: Proceedings of the Oklahoma Conference* (Marcel Dekker, Inc., 1974), presents the proceedings of the second Ring Theory Conference held at the University of Oklahoma. The papers were written to inform mathematicians about current trends in ring theory. Expository in nature, they represent a cross-section of topics from both commutative and non-commutative ring theory. The three principal speakers at the conference were Maurice Auslander, Moss Sweedler, and Daniel Zelinsky; their respective topics of discussion were existence theorems for almost split sequences, noncommutative inseparable extensions and commutative descent theory, and Brauer groups.

Orderable groups. Vol. 27. By Roberto Botto Mura and Akbar Rhemtulla. 1977. iii + 176 pages. \$19.75

This book focuses primarily upon the interplay between orderability properties and group-theoretical conditions, such as nilpotency, solvability, and finiteness of rank. The opening chapters of the volume deal with basic properties of orderable groups. Classes related to orderable groups are then discussed, and embedding theorems, including some results obtained by Philip Hall, are given. Separate chapters are devoted to the number of orders on a group and to right-orderable groups. In addition, a detailed appendix and a table of results on closure operations have been included.

Stability of dynamical system: theory and applications. Vol. 28. Edited by John R. Graef. 1977. xi + 232 pages. \$19.75

This volume contains the invited addresses and contributed papers presented at an NSF-CBMS Regional Conference on the stability of dynamical systems. The conference, held at Mississippi State University, featured J. P. LaSalle of Brown University as the Principal Lecturer, whose talk is, however, not included but is rather published as Volume 25 in the SIAM Regional Conference Series in Applied Mathematics. The book covers a broad range of topics, including control theory, nonlinear oscillations, stability criteria, and various applications.

Homogeneous Banach algebras. Vol. 29. By Hwai-chiuan Wang. 1977. vii + 216 pages. \$19.75

This volume investigates aspects of homogeneous Banach algebras and related topics, and illustrates various methods used in several classes of group theory. Included in the volume is a survey of modern harmonic analysis, from its inception in 1950 to date. Areas of current interest, such as problems of factorizations, homomorphisms, multipliers, and closed subalgebras, are covered. A table of group algebras is also given, as well as a collection of open problems and an exhaustive bibliography.

Applied mathematical demography. By Nathan Keyfitz. John Wiley and Sons, New York, 1977. xxiv + 388 pages. \$19.95

Chapter headings: 1. Introduction: population with age; 2. The life table; 3. Mortality comparison: the male female ratio; 4. Fixed regime of mortality and fertility: the uses of stable theory; 5. Birth and the intrinsic rate of natural increase; 6. Reproductive value, with applications to migration, contraception, and zero population growth; 7. Understanding population characteristics; 8. Projection and forecasting; 9. Some types of instability; 10. The demographic theory of kinship; 11. Microdemography; 12. Epilogue: how do we know the facts of demography?

The author's earlier book *Introduction to the mathematics of population* developed the theory, whereas this book is devoted entirely to applications—to finding answers that will be serviceable to those working on population and related matters. It requires only beginning calculus as mathematical background.

Mathematical theory of economic dynamics and equilibria. By V. L. Makarov and A. M. Rubinov. Springer-Verlag, New York, Heidelberg, Berlin, 1977. vx + 252 pages. \$29.80

This is a translation, by Mohamed El-Hodiri, of a Russian monograph. The chapter headings are: 1. Theory of point-set maps; 2. The Neumann-Gale model; 3. Optimal trajectories and their characteristics; 4. Asymptotes of optimal trajectories; 5. Models of economic equilibria; 6. Models of economic dynamics with explicit consumption. There is an appendix with historical comments and comments about the literature and an 8-page bibliography.

Models of economic dynamics describe the motion of an economy through time. Of all possible trajectories in phase that describe possible developments of the economy, those which are optimal in terms of certain criteria are selected. The topological aspects of point-set maps (especially the Kakutani fixed-point theorem) are used to study equilibrium models as well as n-person games.

Risk theory, second edition: the stochastic basis of insurance. By R. E. Beard, T. Pentikäinen and E. Pesonen. Halsted Press, New York, 1977. xvi + 195 pages. \$12.95

This is the second edition of the Methuen Monograph first published in 1969; numerous misprints have been corrected and the chapter on application of risk theory to business planning has been rewritten. The chapter headings are: 1. Definitions and notations; 2. Process with constant size of one claim; 3. Generalized Poisson distribution; 4. Normal approximation and Edgeworth series for $F(x)$; 5. Applications of the normal approximation; 6. The Esscher approximation; 7. Monte Carlo method; 8. Other methods of calculating the generalized Poisson function; 9. Variance as a measure of stability; 10. Varying basic probabilities; 11. The ruin probability during a finite time period; 12. The ruin probability during an infinite time period; 13. Application of risk theory of business planning.

Epidemics of plant diseases: mathematical analysis and modeling. Edited by Jurgen Kranz. Springer-Verlag, New York, Heidelberg, Berlin, 1975. x + 170 pages. \$24.60

This is volume 13 in the series "Ecological Studies—Analysis and Synthesis". This book contains expanded versions of lectures given at the Symposium on the Role of Mathematics and Modelling in the Analysis of Epidemics held in conjunction with the 2nd International Congress of Plant Pathology, Minneapolis, September 1973: The role and scope of mathematical analysis and modeling in epidemiology (J. Kranz); automatic data processing in analyses of epidemics (M. Mogk); multiple regression analysis in the epidemiology of plant diseases (D. J. Butt and D. J. Royle); nonlinear disease progress curves (D. Jowett, J. A. Browning and Blanche Cournoyer Haning); simulation of epidemics (P. E. Waggoner).