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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: 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 $\sqrt{}$.

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,

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

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.

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—BOOKS RECEIVED—

Theoretical approaches to complex systems (Lecture Notes in Biomathematics, volume 21). Edited by R. Heim and G. Palm. Springer-Verlag, Berlin, Heidelberg, New York, 1978. 244 pp. $11.00.

These are the proceedings of a symposium held in Tübingen in June 1977, dedicated to Ernst Pfaffelhuber. The papers present some mathematical tools which may be helpful in analyzing complex systems (H. Hahn, G. Palm, O. Rössler, P. J. Ortoleva), discuss concrete biological systems exhibiting cooperative complexity (W. U. van der Heiden, T. Poggio and V. Torre, W. Reichardt, M. Conrad, V. Braitenberg, D. Varji), or develop optimality criteria applicable to biological systems (R. Heim, M. Dal Cin).

Prediction and improved estimation in linear models. By John Bibby and Helge Toutenburg. John Wiley & Sons, Inc., 1978. xiii + 188 pp. $18.50.

This book is a revised and updated version of the book "Vorhersage in linearen Modellen" by H. Toutenburg. Its main aim is to bring to the attention of the English-speaking public some recent work in mathematical statistics from the German Democratic Republic, in particular biased methods for estimation and prediction which are often better than unbiased ones in a least-square sense. Topics such as ridge regression, Stein estimation, Bayesian methods and Box-Jenkins methods are discussed, and there are chapters on practical applications. Much of the material has never before appeared in English.

Discrete discriminant analysis. By Matthew Goldstein and William R. Dillon. John Wiley & Sons, Inc., 1978. x + 186 pp. $16.95.

This volume in the Wiley Series in Probability and Mathematical Statistics is the first monograph to deal exclusively with the issues of discriminant analysis when the observations are discrete-valued. Chapter 1 deals with problems that can arise when the standard linear discriminant function is applied to discrete data. Chapter 2—the main chapter of the book—is a survey of models in discrete discriminant analysis, with examples drawn from several different fields. Chapter 3 deals with problems of error rates of bias and chapter 4 with those of variable selection. Chapter 5 deals with several special topics (e.g., classification procedures for mixed continuous and discrete observations, methods of comparing two competing procedures, and simulation experiments), and chapter 6 is devoted to a discussion of existing computer programs implementing the techniques discussed.

Problems and theorems in analysis II. By G. Pólya and G. Szegö. Springer-Verlag, New York, Heidelberg, Berlin, 1976. xi + 391 pp. $14.80.

This the Springer Study Edition of the revised and enlarged translation of the famous *Aufgaben und Lehrsätze aus der Analysis, Volume II.*

Extreme eigenvalues of Toeplitz operators (Lecture Notes in Mathematics, Volume 618). By I. I. Hirschman, Jr. and Daniel E. Highes. Springer-Verlag, Berlin, Heidelberg, New York, 1977. iv + 145 pp. $8.30.

The asymptotic distribution of the eigenvalues of finite section Toeplitz operators as the section parameter increases to ∞ has been known ever since the fundamental 1915 paper of Szegö. In the last fifteen years interest has been focused on the asymptotic behavior as the section parameter increases to ∞ of the very large and the very small eigenvalues. The object of the present exposition is to give a systematic account of one major portion of this subject, incorporating recent advances and discoveries.

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Stability theory by Liapunov's direct method. Edited by N. Rouche, P. Habets and M. Laloy. Springer-Verlag, New York, Heidelberg, Berlin, 1977. xii + 396 pp. $14.80.

This is volume 22 of the "Applied Mathematical Sciences" series. This monograph is a collective work. The names appearing on the front cover are those of the people who worked on every chapter; other contributors were: C. Risito, K. Pfeiffer, R. J. Ballieu, Dang Chau Phien, J. L. Corne. The aim of the book is twofold: to describe the present state of the most useful parts of the theory, and to appeal to practically-inclined readers with a wealth of applications taken from many varied fields. The chapter headings are: 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; Appendix I. Dini-derivatives and monotonic functions; Appendix II. The equations of mechanical systems; Appendix III. Limit sets.

Pattern analysis: lectures in pattern theory, vol. II. By Ulf Grenander. Springer-Verlag, New York, Heidelberg, Berlin, 1978. viii + 605 pp. $14.80.

This is volume 24 in the "Applied Mathematical Sciences" series. This book continues the mathematical study of regular structures begun in volume I, *Pattern Synthesis*. With the help of the concepts there introduced, the inverse problem, pattern analysis, is now tackled. The material presented in this (as well as the previous) volume is due to the author and his coworkers and represents a further step in the development of a comprehensive and general mathematical theory of patterns on which particular pattern recognition methods can be based. In addition to further development of the general theory, the book also contains discussions of many particular examples from diverse fields of application. The chapter headings are: 1. Ends and means in pattern analysis; 2. Analysis of abstract patterns; 3. Analysis of certain temporal patterns; 4. Point patterns; 5. Set patterns and statistical geometry; 6. Network pattern processors; 7. Pattern processors for language abduction.

Integral transforms and their applications. By B. Davies. Springer-Verlag, New York, Heidelberg, Berlin, 1978. xii + 411 pp. $14.80.

This book (Volume 25 in the "Applied Mathematical Sciences" series) is intended to serve as introductory and reference material for the application of integral transforms to a range of common mathematical problems. It is based on lectures given at the Australian National University, Canberra. The book has 21 chapters, divided into four parts: 1. The Laplace transform; 2. The Fourier transform; 3. Other important transforms (e.g., Mellin, Hankel); 4. Special techniques (e.g. Wiener-Hopf).

Fuzzy automata and decision processes. Edited by Maddan M. Gupta, George N. Saridis and Brian R. Gaines. Elsevier North Holland, Inc., New York, 1977. xiv + 496 pp. $37.50.

Fuzzy set theory originated in the work of Lofti A. Zadeh in 1965. The papers appearing in this volume were contributed in part by participants in a round table discussion on fuzzy automata and decision processes held at the Sixth IFAC World Congress at M.I.T. in August 1975, and in part by other workers in the field. The volume presents a review of fuzzy set theory, including expositions of fuzzy algebra, fuzzy measures and fuzzy integrals; surveys applications of the theory to decision processes, control systems, fuzzy reasoning, fuzzy algorithms, medical diagnosis and related fields; and provides an up-to-date annotated bibliography covering the period 1965 to the present. It is divided into three parts: introduction (six papers), theory (eleven papers) and applications (seven papers).

Real and functional analysis (Mathematical Concepts and Methods in Science and Engineering, volume 6). By A. Mukherjea and K. Pothoven. Plenum Press, New York and London, 1978. x + 529 pp. $25.00.

This textbook for first-year graduate students who have some prior knowledge of mathematical analysis is an introduction to the theory of measure and integration, and to the theory of Banach and Hilbert spaces. Its chapter headings are: 1. Preliminaries on set theory and topology; 2. Measure; 3. Integration; 4. Differentiation; 5. Banach spaces; 6. Hilbert spaces; 7. Measure and topology. There are many illustrations and applications of the major theorems to emphasize their relevance in diverse areas of mathematics and science. There are also numerous recent results appearing for the first time in book form.

A course in differential geometry (Graduate Texts in Mathematics, volume 51). By Wilhelm Klingenberg. Springer-Verlag, New York, Heidelberg, Berlin, 1978. xii + 178 pp. $14.80.

This book has its origins in a course given at Göttingen, Mainz and Bonn. It offers an introduction to the classical differential geometry of curves and surfaces, assuming only basic analysis, real linear algebra and euclidean geometry (only the last chapter is such that a familiarity with the topology of compact surfaces may be useful). The table of contents—which conveys a summary of these lectures—is as follows: 0. Calculus in Euclidean space; 1. Curves; 2. Plane curves: global theory; 3. Surfaces: local theory; 4. Intrinsic geometry of surfaces: local theory; 5. Two-dimensional Riemannian geometry; 6. The global geometry of surfaces.

Computing in systems described by equations (Lecture Notes in Computer Science, volume 58). By Michael J. O'Donnell. Springer-Verlag, Berlin, Heidelberg, New York, 1977. 191 pp. $8.30.

This monograph is an attempt to provide some useful mathematical foundations for the design of interpreters for functional programming languages, such as LISP, which are often described by sets of equations. The problem of interpreting is attacked by studying ways of using equations to compute simple output expressions from input expressions. Such computations are studied here in terms of an abstract formalism called a subtree replacement system.

A comparative study of very large data bases (Lecture Notes in Computer Science, volume 59). By Edward Hill, Jr. Springer-Verlag, Berlin, Heidelberg, New York, 1978. 140 pp. $9.00.

This monograph presents a comparison of methods for organizing very large amounts of stored data to facilitate fast retrieval of desired information on direct-access storage devices.

Introduction to ordinary differential equations. By Rodney D. Driver. Harper & Row Publishers, New York, 1978. xi + 340 pp. $12.95.

This text is designed for a first course in ordinary differential equations. What makes the book unusual is inclusion of a chapter on delay differential equations. Emphasis is on the solution of applied problems, without

sacrifice of rigor. The chapter headings are: 1. Elementary methods for ordinary differential equations; 2. Uniqueness for ordinary differential equations; 3. Linear ordinary differential equations of order n; 4. Linear ordinary differential systems; 5. Existence and computations; 6. Delay differential equations; 7. Power series solution of linear ordinary equations; 8. The Laplace transform method and linear ordinary equations.

A first course in numerical analysis, 2nd edition. By Anthony Ralston and Philip Rabinowitz. McGraw-Hill Book Co., New York, 1978. xix + 556 pp. $19.50.

This is an extensively revised second edition of a book first published in 1965. It treats numerical analysis with mathematical rigor, but presents relatively few theorems and proofs. Oriented towards solving problems on a digital computer, it stresses errors in methods and computational efficiency, and compares different solutions to the same problem. Many methods are illustrated by worked numerical examples, and numerous problems—some strictly mathematical, others requiring a computer for solution—are included with each chapter. The second edition is thoroughly updated, and includes new discussions of spline interpolation, adaptive integration, the fast Fourier transform, the simplex method of linear programming, and simple and double QR algorithms.

The chapter headings are: 1. Introduction and preliminaries; 2. Approximation and algorithms; 3. Interpolation; 4. Numerical differentiation, numerical quadrature, and summation; 5. The numerical solution of ordinary differential equations; 6. Functional approximation: least-squares techniques; 7. Functional approximation: minimum maximum error techniques; 8. The solution of nonlinear equations; 9. The solution of simultaneous linear equations; 10. The calculation of eigenvalues and eigenvectors or matrices. There is a bibliography, with bibliographic notes, at the end of each chapter.

Degree theory (Cambridge Tracts in Mathematics, volume 73). By N. G. Lloyd. Cambridge University Press, 1978. x + 172 pp. $21.00.

Many problems in analysis and in the application of analysis can be reduced to a study of the set of solutions of nonlinear equations. Degree theory is a means of obtaining information about the solutions of such equations—their existence, their number and their nature. The theory is widely used in the study of differential equations and of more general functional equations. The book is designed as a guide to the theory for analysts and applied mathematicians. The approach is entirely analytic and does not use the methods of algebraic topology. No specialized knowledge on the part of the reader is assumed. The uses of degree theory are emphasized throughout.

The definition and properties of degree in finite-dimensional spaces are first established; then the same is done in the context of a BVanach space. Later chapters are concerned with defining the degree of progressively wider classes of mappings. An axiomatic scheme is presented in chapter 5, and this is used subsequently. The final chapter is devoted to a number of the applications of degree theory, mainly in the study of differential equations.

Principles of optimal control theory (Mathematical Concepts and Methods in Science and Engineering, volume 7). By R. V. Gamkrelidze; translated from the Russian by Karol Makowski, translation edited by Leonard D. Berkovitz. Plenum Press, New York and London, 1978. xii + 175 pp. $24.50.

This monograph presents the principles of general control theory as well as proofs of the maximum principle and basic existence theorems of optimal control theory, with emphasis on the time-optimal problem with fixed endpoints.

Mathematical methods in the physical sciences. By Merle C. Potter. Prentice-Hall, Inc. New Jersey, 1978. xii + 466 pp. $18.95.

The purpose of this textbook is to provide an additional mathematics course after differential equations for undergraduate students in the physical sciences. After a review of ordinary differential equations in the first chapter, there follow chapters on power series, Laplace transforms, matrices and determinants, vector analysis, partial differential equations, numerical methods and complex variables. There are many problems with answers to selected ones.

Unidirectional wave motions. By H. Levine. North-Holland Publishing Co., Amsterdam, New York and Oxford, 1977. xvi + 494 pp. $69.75.

This book aims at providing an up-to-date survey of efficient and generally applicable techniques of analysis of wave motion, without the particular emphasis binding it to special wave types or settings. With a list of some 87 separate sections, the book covers such topics as Green's functions, matched expansions, the Doppler effect, scattering matrices, dispersion relations, variational principles, periodic and random configurations, and stability. The author's approach is designed to show the substantive nature of individual topics through direct and explicit application. The book, which is reasonably self-contained, assumes a familiarity with only the rudiments of complex variable theory and partial differential equations.

Semisimple Lie algebras (Lecture Notes in Pure and Applied Mathematics, volume 38). By Morikuni Goto and Frank D. Grosshans. Marcel Dekker, Inc., 1978. 496 pp. $37.50.

Providing a systematic exposition of Lie algebras, this book stresses their connection with Lie groups and algebraic groups. The book begins with the basic theory of Lie algebras. An entire chapter is devoted to various discrete groups connected with root systems. Then group theory is introduced, beginning with a self -contained exposition of Lie groups. Many important results proved for Lie algebras are translated to the group setting. The book concludes with discussions of representation theory (which is developed from the analytic and algebraic standpoint discovered by Hermann Weyl) and the classification of real simple Lie algebras. Here the interplay between Lie groups and Lie algebras plays an important role. The presentation includes all the standard topics in the theory of Lie algebras: the classification of complex semisimple Lie algebras; the existence of faithful representations; the Levi decomposition; and cohomology theory. Also, many important topics in the theory of real semisimple Lie algebras (such as the Cartan and Iwasawa decompositions, the theory of compact real forms, the theory of real irreducible representations, and the classification theory of real simple Lie algebras) are covered. The book includes many exercises, and there is an appendix which provides a brief review of some basic results in linear algebra as well as statements of proofs of several important results. The book presumes only an understanding of linear algebra.

Foundations of applied mathematics. By Michael D. Greenberg. Prentice-Hall, Inc., New Jersey, 1978. xvii + 636 pp. $18.95.

This is a text for first-year graduate students or seniors in engineering. The applications (fluid mechanics, heat conduction and Newtonian mechanics) are developed from first principles and these physical concepts weave through the mathematics and act as a unifying element. There are 29 chapters grouped into 5 parts: real variable theory, complex variables, linear analysis, ordinary differential equations, partial differential equations.

Handbook of hypergeometric integrals: theory, applications, tables, computer programs. By Harold Exton. Ellis Horwood Publishers, Chichester, 1978. 316 pp.

This book has been designed with the object of providing tables of integrals of hypergeometric functions of many different types. A number of the integrals included have not previously appeared explicitly in the literature. Also, a number of FORTRAN IV programs to evaluate numerically some of the hypergeometric integrals concerned are given. These programs have been set up in such a way that they may be extended to cover wider results with a minimum of essential modification. The first part of the book consists of seven chapters on the general theory of hypergeometric integrals. There is an extensive bibliography.

Mathematics for operations research. By W. H. Marlow. John Wiley and Sons, Inc., New York, 1978. xv + 483 pp. $19.95.

This book is devoted to parts of mathematics that are used in operations research, except for probability and statistics. The chapter headings are: Elementary results, 2. Linear algebra, 3. Column vectors, 4. Rectangular matrices in Euclidean space, 5. Square matrices in unitary space, 6. Differential calculus on $\mathcal{R}^n$, 7. Optimization theory on $\mathcal{R}^n$, 8. Complex variables, 9. Linear differential equations, 10. Linear difference equations.

A course of mathematical analysis, Volumes I and II. By S. M. Nikolsky. MIR Publishers, Moscow, 1977 (available from Imported Publications, Inc., 320 West Ohio Street, Chicago, Ill. 60610). 901 pp. $14.50 the set.

This is a textbook by a member of the USSR Academy of Sciences and Chebyshev prizewinner, based on the author's course in mathematical analysis at the Moscow Physico-Techhical Institute. Volume I treats differential calculus of functions of one and several variables, series, and integral calculus for functions of one variable. Volume II treats multiple integrals, field theory, Fourier series and integrals, differential manifolds and differential forms, and the Lebesgue integral.

Random allocations. By Valentin F. Kolchin, Boris A. Sevast'yanov, and Vladimir P. Chistyakov. W. H. Winston & Sons, Washington, D. C., 1978. xi + 262 pp.

This is a translation, by A. V. Balakrishnan, of a work by senior research associates of the Steklov Institute of Mathematical Sciences of the USSR Academy of Sciences. It deals with a class of combinatorial problems in the theory of probability, viz. problems of allocations of particles to cells. Among these, the classical problem of shots is best known: let n shots be thrown independently into N cells. What is the distribution of the random variable $X(n, N)$ denoting the number of empty cells? The table of contents indicates the other problems and methods treated in this book: 1. The classical shot problem; 2. Equiprobable allocations; 3. Multinomial allocations; 4. Convergence to random processes; 5. The empty cell test and its generalizations; 6. Allocations with the number of particles randomized; 7. Allocation of particles by complexes; 8. Generalization of the problem of allocation and cycles of random permutations.

Numerical methods in offshore engineering. Edited by O. C. Zienkiewicz, R W. Lewis, and K. G. Staff. John Wiley & Sons, New Jersey, 1978. xii + 582 pp. $48.00.

These are the proceedings of a symposium held at Swansea in January 1977. The seventeen chapters fall into three major sections. After the basic review of chapter 1, the first section (chapters 2-5) deals with problems of fluid loading, the second (chapters 6-11) with general methods of computing dynamic response and the third (chapters 12-17) with foundations and sea bed problems.

Waves in fluids. By Sir James Lighthill. Cambridge University Press, 1978. xv + 504 pp. $37.50.

In this comprehensive textbook Professor Lighthill describes the science of waves in liquids and gases. Drawing on a subject of enormous extent and variety, he provides his readers with a thorough analysis of the most important and representative types of waves including sound waves, shock waves, water waves of all kinds, and the so-called internal waves (inside atmospheres and oceans) due to density stratification. Emphasis throughout is on the most generally useful fundamental ideas of wave science, which are developed at length, one after another. These include the principles of how waves interact with flows.

Four main chapters on sound waves, one-dimensional waves in fluids, water waves and internal waves form the body of the book. Each ends with a set of problems. A substantial amount of additional material on other types of waves in fluids, together with some more advanced general ideas, is sketched in an epilogue. Designed as a "comprehensive introduction" (the author's phrase), the book provides the reader with the grounding in wave generation, propagation, scattering, resonance, attenuation, nonlinearity, dispersion, anisotrophy, etc., necessary for an insight into the subject as a whole and for the understanding of more specialized literature. While the approach is quantitative, all the mathematical analyses have to the maximum extent possible been given physical interpretations. Illustrative practical applications include problems in noise-abatement, circulatory physiology, hydraulics, oceanography and meteorology. An extensive annotated bibliography indicates where to find further reading on each topic treated in the book.

Outliers in statistical data. By Vic Barnett and Toby Lewis. John Wiley & Sons, New York, 1978. xi + 365 pp. $39.95.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. The chapter headings are: 1. Introduction; 2. What should one do about outlying observations?; 3. Discordancy tests for outliers in univariate samples; 4. Accommodations of outliers in univariate samples: robust estimation and testing; 5. Outlying sub-samples: slippage tests; 6. Outliers in multivariate data; 7. Outliers in designed experiments, regression and in time-series; 8. Bayesian and non-parametric approaches; 9. Perspective.

Differential equations and their applications. Short version. By Martin Braun. Springer-Verlag, New York, 1978. viii + 319 pages.

This is a short version of the text listed above. The items left out of this edition are: numerical methods for first-order d.e.s, much of the chapter on qualitative theory, the chapter on separation of variables and Fourier series, and the introduction to APL.

Quantitative ethology. Edited by Patrick W. Colgan. John Wiley & Sons, Inc., 1978. xiv + 364 pp. $25.00.

The idea for the present book grew from a symposium on "The Quantitative Methods in Ethology" at the 1975 annual meeting of the Animal Behavior Society. It considers the basic issue of data collection (Peter J. B. Slater); treats the problem of estimating the total number of response types in the behavioral repertory of an animal (Robert M. Fagen); discusses the measurement of the amount of information transferred in communicative arts (George S. Losey, Jr.); examines the problems associated with the quantitative study of durations, intervals, latencies, and sequences of stimuli and responses (Robert M. Fagen and Donald Y. Young); explores the uses of cluster analysis to estimate the similarities of response types and to group these types objectively (Victor J. De Ghett); describes techniques for analyzing multidimensional contingency tables (Patrick W. Colgan and J. Terry Smith); outlines multidimensional scaling for searching for structure in data (Ian Spence); and provides information on the major aspects of multivariante analysis based on multinormal populations (Dennis F. Frey and Richard A. Pimentel on principal component, factor and discriminant analysis, and on multidimensional ANOVA); there are also chapters on systems diagrams (Dennis Sustare) and modelling (Patrick W. Colgan).

Fifth conference on probability and statistics in atmospheric sciences. American Meteorological Society, 1977. x + 363 pages. $20.00.

These proceedings contain the papers presented in the eleven sessions of the conference: 1. Statistical and probabilistic forecasting; 2. statistical forecasting and decision models; 3. statistical analysis I; 4. application of statistics to air-pollution; 5. statistical analysis II; 6. application of statistics to weather modification; 7. invited society session: American Statistical Association; 8. application of statistics to environmental phenomena; 9. spectral analysis; 10. application of statistics to satellite meteorology; 11. verification theory and results.

Statistics for experimenters. An introduction to design, data analysis and model building. By George E. P. Box, William G. Hunter and J. Stuart Hunter. John Wiley & Sons, Inc., 1978. xviii + 653 pp. $23.95.

This approach to statistics focuses on applications in the physical, engineering, biological, and social sciences. It requires only elementary mathematics as background.

Material is presented with the nonstatistician in mind. After a problem is stated, appropriate statistical methods of design and analysis are discussed. And frequently examples are presented for which standard mathematical assumptions are wrong, thus forcing the reader's attention onto the essential precautions necessary in the conduct of the experiment to ensure valid conclusions.

In addition to many worked examples in the text, there are frequent exercises (with answers) throughout the book. There are also questions at the end of each chapter (for purposes of preview and review) and numerous problems at the end of each part of the book.

The book is in four parts (after a chapter on the relation between statistics and the scientific method): 1. Comparing two treatments (four chapters); 2. Comparing more than two treatments (three chapters); 3. Measuring the effects of variables (five chapters); 4. Building models and using them (five chapters). The authors, in addition to being professors of statistics, all have a great deal of experience in industrial consulting and thus bring to bear both academic excellence and practical insight in their treatment of the subject.

The book is a volume in the Wiley Series in Probability and Mathematical Statistics.

Differential equations and their applications, 2nd ed. By Martin Braun. Springer-Verlag, New York, 1978. xiii + 518 pages.

This book, volume 15 in the Springer Series "Applied Mathematical Sciences", is the second edition of the text first published in 1975.

Stochastic approximation methods for constrained and unconstrained systems. By Harold J. Kushner and Dean S. Clark. Springer-Verlag, New York, 1978. x + 261 pp. $9.80.

This is volume 26 of the series "Applied Mathematical Sciences". It deals with a powerful and convenient approach to a great variety of problems of the recursive Monte-Carlo or stochastic approximation type. Typically, a sequence $\{x_n\}$ of estimates of a parameter is obtained by means of some recursive statistical procedure. The nth estimate is some function of the $(n\text{-}1)$st estimate and of some new observational data, and the aim is to study the convergence, rate of convergence, and the parametric dependence and other qualitative properties of the algorithms. In this sense, the theory is a statistical version of recursive numerical analysis. There are seven chapters: 1. Introduction; 2. Convergence w.p. 1 for unconstrained systems; 3. Weak convergence of probability measures; 4. Weak convergence for unconstrained systems; 5. Convergence w.p. 1 for constrained systems; 6. Weak convergence: Constrained systems; 7. Rates of convergence.

Statistical methods for engineers and scientists: a students' course book. By A. C. Bajapi, I. M. Calus and J. A. Fairley. John Wiley & Sons, 1978. xii + 444 pp. $14.50.

This volume comprises three units: 1. Probability distributions—elementary ideas and standard models; 2. The deduction of information from samples; 3. Various analysis, correlation and regression. It uses the programmed method of presentation throughout, developing the subject in carefully sequenced steps. Each program is divided up into a number of "frames" which are to be worked in the order given. For instance, unit 1 comprises the following programs: descriptive methods (76 frames), probability (61 frames), discrete random variates (29 frames), continuous variates (62 frames). The emphasis is on the practical side of the subject, but there is sufficient information about the basis of the various methods for the student to be able to use them sensibly and appropriately.

Differential forms in mathematical physics. By C. von Westenholz. North-Holland Pub. Co., 1978. xv + 487 pp. $65.25.

This monograph is aimed primarily at making available to physical scientists the mathematical machinery related to differentiable manifold ideas relevant to physics. The author's concern is with a straightforward exposition of vector analysis on manifolds which is designed as a comprehensive introduction to Cartan's and de Rham's work. The calculus of differential forms is developed systematically and used in formulating integration theory. Many physical applications are interspersed in the presentation throughout the book. There are six parts and thirteen chapters: I. Basic concepts: 1. Topological preliminaries, 2. Differential calculus on R^n. II. Manifolds: 3. Differentiable manifolds, 4. Differential calculus on manifolds, 5. Lie groups, 6. Fiber bundles. III. Differential forms: 7. Basic concepts of differential forms, 8. The Frobenius theory. IV. Integration theory on manifolds: 9. Integration of differential forms; 10. the de Rham cohomology. V. Theory of connections: 11. Connections on fibre bundles. VI. Intrinsic mathematical physics: 12. Hamiltonian mechanics and geometry, 13. General theory of relativity.

Cyclotomic fields. By Serge Lang. Springer-Verlag, New York, 1978. xi + 253 pp. $19.80.

This is volume 59 of Graduate Texts in Mathematics. It is intended to be a systematic introduction to cyclotomic theory and is kept as elementary as possible. The chapter headings are: 1. Character sum; 2. Stickelberger ideals and Bernoulli distributions; 3. Complex analytic class number formulas; 4. The p-adic L-function; 5. Iwasawa theory and ideal class groups; 6. Kummer theory over cyclotomic Z_p-extensions; 7. Iwasawa theory of local units; 8. Lubin-Tate theory; 9. Explicit reciprocity laws.

Globally optimal design. By Douglass J. Wilde. John Wiley & Sons, New York, 1978. xii + 288 pp. $25.00.

Numerical optimization procedures for finding least-cost engineering designs have been widely applied over the last decade. This book offers new analytic techniques effective in cases where numerical methods either take too long or do not provide correct answers. The very nonlinearities of design which make mathematical programming methods unreliable can also make them unnecessary. Simpler procedures are often more appropriate. Using these new techniques, a designer will know when a satisfactory design has been attained and when further improvement is not worth pursuing.

Written for engineers, this book uses mathematics sparingly and only to prove results generated by examples. Its goal is to find simple design methods guaranteed to give the global, rather than any local, optimum through computations easy enough to be done on a manual calculator.

Introduction to Lie algebras and representation theory. 2nd printing, revised. By James E. Humphreys. Springer-Verlag, New York, 1972. xii + 171 pp. $16.90.

This is the second edition of volume 9 of Graduate Texts in Mathematics. It is designed to introduce the reader to the theory of semisimple Lie algebras over an algebraically closed field of characteristic 0, with emphasis on representations. A good knowledge of linear algebra (including eigenvalues, bilinear forms, euclidean spaces, and tensor products of vector spaces) is presupposed, as well as some acquaintance with the methods of abstract algebra. The first four chapters might well be read by a bright undergraduate; however, the remaining three chapters are a little more demanding. There are seven chapters: 1. Basic concepts; 2. Semisimple Lie algebras; 3. Root systems; 4. Isomorphism and conjugacy theorys; 5. Existence theorem; 6. Representation theory; 7. Chevalley algebras and groups.

Many degrees of freedom in field theory. Edited by L. Streit. Plenum Publishing Corp., New York, 1978. vii + 248 pp. $27.50.

This book constitutes volume 30 of series B (Physics) of the NATO Advanced Study Institutes Series. It contains the proceedings of the 1976 International Summer Institute of Theoretical Physics, held at the University of Bielefeld from August 24 to September 4, 1976.

The theories of systems with many degrees of freedom and collective phenomena play a critical role in describing the nature of elementary particles. This volume, together with its companion volume, *Many degrees of freedom in particle theory* (volume 31), provides a review of this field of study. In this volume, the contributors examine the occurrence of these theories in numerous recent developments in mathematical physics. The chapters provide discussions on topics ranging from classical nonlinear field theory, through classical soliton models and constructive quantum field theory with soliton solutions and gauge models, to the recent unified description of renormalization group techniques in probabilistic language and quantum statistical dynamics in terms of derivations.

The authors are: J. Fröhlich; M. Cassandro and G. Jona-Lasinio; K. Pohlmeyer; L. O'Raifeartaigh; M. Reed; D. W. Robinson; R. F. Streater; J. Tarski.

Introduction to the Laplace transform. By Peter K. F. Kuhfittig. Plenum Press, New York, 1978. x + 205 pp. $19.50.

This is volume 8 in the series Mathematical Concepts and Methods in Science and Engineering. Written for use as a one-semester undergraduate text for engineering and applied mathematics students, this book provides a comprehensive introduction to the theoretical concepts and uses of the Laplace transform. The author begins with basic concepts, and gradually proceeds to more complex levels, assuming no previous knowledge of complex variable theory. Numerous exercises are placed at the end of each section, with answers provided at the end of the book. There are seven chapters: 1. Basic properties and applications; 2. Further properties and applications; 3. Sketch of complex variable theory; 4. The complex inversion formula; 5. Convolutions; 6. Transforms with infinitely many singularities; 7. Applications to partial differential equations.

Nonlinear equations in abstract spaces. Edited by V. Lakshmikantham. Academic Press, New York, 1978. ix + 483 pp. $24.00.

This volume consists of the proceedings of an international symposium held at The University of Texas at Arlington, June 8–10, 1977. The purpose of the symposium was to highlight some of the

recent advances in abstract nonlinear equations. Its theme was the solvability of nonlinear equations, such as Volterra integral equations, ordinary differential equations, and differential equations with retarded arguments, in Banach spaces.

There is a group of papers dealing with boundary value problems using such techniques as nonlinear superposition, alternative methods, and fixed points of monotone mappings in ordered Banach spaces. Another group of papers is concerned with the application of nonlinear semigroup theory in solving Volterra integral equations and semilinear partial differential equations. A third group of papers deals with existence theorems for nonlinear evolution equations in Banach spaces. There are also some applications of the previous results to problems arising in nonlinear elasticity, turbulence in Newtonian fluids, classical mechanics, and mathematical models in social phenomena.

Crystallographic groups of four-dimensional space. By Harold Brown, Rolf Bülow, Joachim Neubüser, Hans Wondratschek and Hans Zassenhaur. John Wiley & Sons, New York, 1978. xiv + 443 pp. $38.50.

This book describes two-, three-, and four-dimensional crystallographic groups, primarily by the use of tables. Complete tables of four-dimensional groups are presented for the first time.

The variety and complexity of crystallographic groups are much greater in four dimensions than in lower dimensions. Therefore the authors hope that this description of the four-dimensional crystallographic groups provides a clearer insight into dimension-independent crystallographic properties and thus also a deeper understanding of crystallography in two and three dimensions.

The book has three main sections: Chapter 1 gives a concise dimension-independent description of crystallographic concepts and classifications; Chapters 2 and 3 offer, for the first time, complete tables of crystallographic objects for dimensions 2 and 4, particularly space groups and lattices hierarchically ordered according to crystal classes, Bravais flocks, crystal systems and crystal families. Additional lists provide, for example, character tables and normalizers in $GL(n, Z)$ of the point groups (finite unimodular groups) involved. The Appendix discusses the relevance of crystallographic groups in the general theory of symmetry groups.

A first look at numerical functional analysis. By W. W. Sawyer. Clarendon Press, Oxford, England, 1978. xi + 186 pp. $0.00.

The aim of this book is to provide an intelligible introduction to functional analysis by giving samples of its applications to numerical analysis. Chapter headings are: 1. A first course in functional analysis; 2. Old ideas in new contexts; 3. Iteration and contraction mappings; 4. Minkowski spaces; 5. Linear operators and their norms; 6. Differentiation and integration; 7. Further developments; 8. Euclidean space; 9. Some tools of the trade; 10. Some bridgeheads.

Hilbert's third problem. By Vladimir G. Boltianskii. John Wiley & Sons, New York, 1978. x + 228. $19.95.

Among the famous problems posed by Hilbert, the third problem occupies a special position in that it is the only one which deals with more or less elementary mathematics. Hilbert asks whether one can derive the formula for the volume of a tetrahedron without a limiting process. He foresaw that this problem might lead to the creation of a mathematically interesting and fruitful theory of

equidecomposability of polyhedra. Hilbert's foresight, which proved completely correct, has thus led to a fascinating interplay between special cases and general theories, each in the service of each other.

This book provides a completely self-contained account of this solution. In addition to the theorems and their proofs, there are many digressions, orienting remarks and historical discussions. The book is in three chapters: 1. The measurement of area and volume; 2. Equidecomposability of polygons; 3. Equidecomposability of polyhedra.

Fundamentals of decision analysis. By Irving H. LaValle. Holt, Rinehart and Winston, 1978. xiii + 626 pp.

The objectives of this text are to emphasize the generality and applicability of the basic decision-analytic model, to emphasize principles by showing that all the basic ideas arise in cases with finite numbers of states and acts, to show that many topics such as stochastic simulation and "classical" inference can be brought within the purview of the author's philosophy, and to do these things in a standard text format, with theorems, definitions, proofs, examples and exercises set apart from the body of the text.

There are twelve chapters divided into four parts: I. Fundamentals of decision analysis in extensive form (introduction and preview; problem formulation: decisions in extensive form; foundations of decision analysis; analysis of decisions in extensive form); II. More on preference and judgment quantifications (quantification of preferences; quantification of judgments) III. Further topics in individual decision-making (decisions in formal form and sensitivity analysis; monetary evolutions of opportunities and information; approaches to statistical inference; introduction to Markovian decision processes); IV. Several-person decision (monetary group decision; a glimpse at game theory).

Automata-theoretic aspects of formal power series. By A. Salomaa and M. Soittola. Springer-Verlag, New York, 1978. x + 171 pp. $16.50.

This is the first book devoted entirely to formal power series. It develops the theory for series in non-commuting variables, with particular emphasis on results applicable to automata and formal language theory. That formal power series constitute a useful and powerful tool in automata and language theory is demonstrated by the fact that they lead, in a certain sense, to the arithmetization of these theories. This monograph contains several examples of specific new results in language theory which are difficult, if not impossible, to obtain by other means.

The level is suitable for advanced undergraduate or beginning graduate work. The presentation is self-contained for the most part, and the reader is assumed to have only some background in algebra and analysis, as well as in automata and formal language theory. The required preliminaries from these areas are reviewed in the introduction.

Applied time series analysis, volume I: basic techniques. by Robert K. Otnes and Loren Enochson. John Wiley & Sons, New York, 1978. xiv + 449 pp. $25.00.

The thrust of this book is well indicated by the list of chapter headings: 1. Preliminary concepts; 2. Probability and statistical concepts; 3. Collecting and preprocessing data; 4. Design of digital filters; 5. Practical aspects of digital filtering; 6. Fourier transforms; 7. Covariance and convolution functions; 8. Power and cross spectral densities; 9. Transfer functions and coherence function; Appendix A: computer subroutines for time series analysis; Appendix B: Blackman-Tukey computational procedure for power spectral densities. The emphasis is thus on computational techniques for computer applications and the necessary software, expressed in Fortran code.

Modern formulas for statics and dynamics: a stress-and-strain approach. By Walter D. Pilkey and Pin Yu Chang. McGraw-Hill, 1978. 418 pp. $18.50.

This is a collection of simple, accurate extensions of handbook formulas to encompass more complicated computer programs, intended for engineers concerned with the analysis and design of shafts, beams, plates, and shells.

Lectures in semigroups. By M. Petrich. John Wiley & Sons, Inc., 1978. viii + 168 pp. $17.95.

The contents of this monograph are: 1. Preliminary; 2. Bands; 3. Matrix decompositions; 4. Normal band decompositions; 5. Lattices of subsemigroups.

Model building in mathematical programming. by H. P. Williams. John Wiley & Sons, 1978. xiv + 330 pp.

This book is divided into four parts. Part 1 discusses the general principles of model building in mathematical programming. In part 2 twenty practical problems are presented to which mathematical programming can be applied. In parts 3 and 4 suggested formulations and solutions to the problems are given. The algorithmic side is given less attention in this book and the concentration is more on the building and interpreting of models rather than on the solution process (which is well covered in other texts and largely automated by the use of the commercial packages programs discussed in one of the chapters). There is new material, particularly on integer programming, and there are many references. The chapter headings are: 1. Introduction; 2. Solving mathematical programming models; 3. Building linear programming models; 4. Structured linear programming models; 5. Applications and special types of mathematical programming model; 6. Interpreting and using the solution of a linear programming model; 7. Non-linear models; 8. Integer programming; Building integer programming models I; Building integer programming models II; The implementation of a mathematical programming system of planning; 12. The problems; 13. Formulation and discussion of problems; 14. Solutions to problems.

Specification searches: ad hoc inference with nonexperimental data. By Edward E. Leamer. John Wiley and Sons, 1978. xiii + 370 pp. $24.95.

This book, a volume in the Wiley series in Probability and Mathematical Statistics, is classified by the author as "metastatistics"—the theory of inferences actually drawn from data, rather than ideally drawn from data (which is "statistics"). It analyzes how the researcher's motives and opinions influence his choice of model and his choice of data. It includes the study of memory and computing failures, and the social mechanism by which information is transmitted. Specification searches is a special topic in metastatistics: it describes the process by which a researcher is led to choose one specification of a model rather than another, and attempts to identify the inferences that may be properly drawn from a set of data when the data-generating mechanism is ambiguous.

The book is logically divided into three parts. The core consists of chapters 4 through 9 which analyze six different kinds of specification searches. The first three chapters are introductory and the last chapter "constitutes a footnote describing the inability of anyone actually to behave as described in the first nine chapters". The chapter headings are: 1. Introduction; 2. An introduction to Bayesian inference; 3. The linear-regression model; 4. Hypotheses-testing searches; 5. Interpretive searches; 6. Simplification searches; 7. Proxy searches; 8. Data-selection searches; 9. Data-instigated models; 10. Systematic judgmental errors.

Information and exponential families in statistical theory. By Ole Barndorff-Nielsen. John Wiley & Sons, 1978. ix + 238 pp. $33.00.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It brings together results on aspects of statistical information, notably concerning likelihood functions, plausibility functions, ancillarity, and sufficiency, and on exponential families of probability distributions. Much of the material is of fairly recent origin and some of it is new. The roots of the book lie in the writings of R. A. Fisher both as concerns results and the general stance to statistical inference, which has been a determining factor in the selection of topics. The ten chapters are divided into three parts and an introduction: I. Lods functions and inferential separation (likelihood and plausibility; sample-hypothesis duality and Lods functions; logic of inferential separation. Ancillarity and sufficiency); II. Convex analysis, unimodality, and Laplace transforms (convex analysis; Log-concavity and unimodality; Laplace transforms); III. Exponential families (introductory theory of exponential families; duality and exponential families; inferential separation and exponential families).

The asymptotic theory of extreme order statistics. By Janos Galambos. John Wiley & Sons, 1978. xiii + 352 pp.

This is a book in the Wiley Series in Probability and Mathematical Statistics. The asymptotic theory of extreme order statistics provides in some cases exact but in most cases approximate probabilistic models for random quantities when the extremes govern the laws of interest (strength of materials, floods, droughts, air pollution, failure of equipment, effects of food additives, etc.). The book describes all known asymptotic models. In addition to finding the asymptotic distributions, both univariate and multivariate, it also includes results on the almost sure behavior of the extremes. Finally, random sample sizes are treated and a special random size, the so-called record times, is discussed in more detail. Although the book is mathematically rigorous, the applied scientist has been kept in mind and the only prerequisites are calclulus and basic probability theory. The chapter headings are: 1. Introduction: estimates in the univariate case; 2. Weak convergence for independent and identically-distributed variables; 3. Weak convergence of extremes in the general case; 4. Degenerate limit laws: almost sure results; 5. Multivariate extreme value distributions; 6. Miscellaneous results.

Unsolved problems concerning lattice points (Research Notes in Mathematics, No. 15). By J. Hammer. Fearon-Pitman Publishers 1977. 101 pp. $9.00.

The material in this book is so organized that a student of mathematics can obtain an insight into the field of lattice points, but not in the conventional way. The problems are accompanied by background material and a description of related known results. Several of these results and problems appear here the first time. In general proofs are not given. Instead, where possible there are referrals to the original sources.

The book is divided into three parts, each consisting of several sections. In any one section, problems on the same topic have been given. Part I deals with problems of a geometric nature. Many of them are closely connected with classical theorems of Minkowski's, like the "convex body theorem" and the "theorem of successive minima" which are the backbone of the so-called geometry of numbers, founded by Minkowski himself.

The problems in Part 2 relate to combinatorics. There are problems of a combinatorial nature in the previous part, too, but here they are of a more set-theoretical or a topological nature. Many of them are related to fundamental theorems of combinatorics, like Euler's topological theorem on nets, or Ramsey's theorem.

Part 3 is concerned mostly with sets of lattices and not with lattice points of a single lattice, as in the first two parts. The main feature of this part is Mahler's compactness theorem, and the development of an abstract theory of geometry of numbers.

Explicit a priori inequalities with applications to boundary value problems (Research Notes in Mathematics, No. 13). By V. G. Sigillito. Fearon-Pitman Publishers, 1977. 112 pp. $10.00.

This monograph presents explicit *a priori* inequalities which are useful in computing approximate solutions, with error bounds, to many of the boundary-value problems in physics and engineering. The numerical calculations illustrating the use of the inequalities deal with second- and fourth-order elliptic problems, second-order parabolic problems and third-order pseudoparabolic problems. Also included is recent work on the application of *a priori* inequalities in eigenvalue estimation.

Nonlinear diffusion (Research Notes in Mathematics, No. 14). Edited by W. E. Fitzgibbon and H. F. Walker. Fearon-Pitman Publishers, 1977. 232 pp. $13.50.

This volume contains texts of most of the invited and contributed talks delivered at an NSF-CBMS regional conference held at the University of Houston in June 1976; the ten one-hour lectures delivered by D. G. Aronson will be published separately. The lectures covered applications in fields such as population dynamics, population genetics, epidemiology, nerve impulse studies, electrical transmission line analysis, chemical reactor theory, neutron transport theory and the study of gas flow in porous media.

Edge-colourings of graphs (Research Notes in Mathematics, No. 16). By S. Fiorini and R. J. Wilson. Fearon-Pitman Publishers, 1977. 154 pp. $12.50.

This book surveys the literature of the subject of edge-colorings, and describes some more recent results. Special features include: a lengthy introductory section outlining the history of the subject and summarizing the background material to be assumed in the rest of the book; a set of exercises at the end of each chapter, to test the reader's understanding and to introduce further results; a chapter describing some applications of the material in the natural and social sciences; an extended bibliography comprising more than 200 items; a very full index; and almost 150 diagrams. The text is divided into four parts: 1. Introduction (3 chapters); 2. The chromatic index (6 chapters); 3. Critical graphs (6 chapters); 4. Further topics (4 chapters).

Nonlinear analysis and mechanics, volume I (Research Notes in Mathematics, No. 17). Edited by R. J. Knops. Fearon-Pitman Publishers, 1977. 241 pp. $13.50.

This volume consists of written versions of invited lectures given at two short symposia held in May and September 1976 at Heriot-Watt University, near Edinburgh, Scotland. The lectures are: Characteristics in hyperbolic conservation laws: a study of the structure and the asymptotic behavior of solutions (C. M. Dafermos); Generic bifurcation with applications (J. K. Hale); On the formulation of St.-Venant's problem (J. L. Ericksen); Constitutive inequalities and existence theorems in nonlinear elastostatics (J. M. Ball).

Stochastic problems in dynamics. Edited by B. L. Clarkson. Fearon-Pitman Publishers, Inc., 1978. 566 pp. $22.50.

These are the proceedings of a IUTAM symposium held in the University of Southampton, England, in July 1976. There are thirty papers, which fall into two broad categories: those given by mathematicians working on stochastic processes and those given by engineers trying to solve problems which are of a stochastic nature.

—BOOK REVIEW SECTION—

Problems and theorems in analysis. By G. Pólya and G. Szegö. Translated by D. Aeppli. Vol. I: xix + 389 pp.; Vol. II, xi + 391 pp. Springer-Verlag, New York, Heidelberg, Berlin, 1976 (second printing). I: $12.00; II: $14.80.

Elementary textbooks in mathematics seem to have a halflife of only a decade or so. Even the best ones, widely used in their time, seem to be rapidly superseded by others, although the substance has changed little in between. Does anyone still use Jordan's *Cours d'analyse?* Or Kiepert's calculus book?

There are however a few exceptions to this rule and among them is Pólya's and Szegö's celebrated *Aufgaben und Lehrsätze,* available in English since 1972, and now published in paperback.

One could argue that this book is not really elementary, at least not in the sense that its material is easy. Also, it is not a textbook of the usual format. Rather than presenting definitions, theorems, and proofs to a receptive reader, it tries to engage him actively. In order to get anything out of the book—and there is a lot—the reader must work through some of the problems himself. If he does this he can be sure of learning some useful and beautiful mathematics, often surprising, always elegant, and sometimes new even to an initiated reader.

Today, when so much of mathematics is fully occupied by structure and existence, graduate education is less oriented toward the skill of calculation than it used to be. To actually calculate an integral or exhibit a closed-form solution, rather than just proving convergence and uniqueness, used to belong to the mathematician's craftmanship.

Anyone who wishes to improve his ability to do concrete mathematics should read Pólya and Szegö. They show not just how to solve real problems but how to do it well, so that the mathematical substance is compressed during the analysis and real insight is gained.

The present edition is essentially the same as the original edition published more than half a century ago. Several new problems have been added, however, and some changes have been made.

It will still be in use, this reviewer believes, another half century from now.

ULF GRENANDER *(Providence, R.I.)*

Nonlinear equations in abstract spaces. Edited by V. Lakshmikantham. Academic Press, New York, 1978. ix + 483 pages. $24.00.

This is the proceedings of a conference held at the University of Texas, Arlington, in 1977. The papers deal with existence theory for nonlinear evolution equations in Banach spaces, applications of nonlinear semigroup theory to Volterra integral equations and semilinear partial differential equations, and a discussion of boundary-value problems using nonlinear superposition, alternative methods and fixed-point theory.

JACK K. HALE *(Providence)*