Bibliographie

Rainer E. Burkard—Ulrich Derigs, Assignment and Matching Problems: Solutions Methods with FORTRAN Programs, (Lecture Notes in Economics and Mathematical Systems, 184) VIII+48 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1980.

Assignment and matching problems belong to those combinatorial optimization problems which are well understood in theory and have many applications in practice. This book deals with some well-known assignment and matching problems studied by a research group of the Mathematical Institute in Cologne.

The problems studied are as follows: the Linear Sum Assignment Problem, the Linear Bottleneck Assignment Problem, the Cardinality Matching Problem, the Sum Matching Problem, the Bottleneck Matching Problem, the Chinese Postman Problem, Quadratic Assignment Problems.

All of the above problems have been solved by exact methods, exept the last one which was solved by heuristic methods of two different types. After presenting the theoretical background of the methods for these problems, the authors give the input and output lists of the FORTRAN-programs which were extensively tested on a CDC CYBER 76 in Cologne and on an IBM 4331 of the Sonderforschungbereich 21 at the University of Bonn. The book contains detailed references and the descriptions of FORTRAN-programs of all of the presented problems.

The programs are correct but there are some regrettable misprints (for example on page 36, on Figure 3.1 the edges (21, 23) and (15, 17) are missing).

Appart from these unimportant misprints the book is very useful for readers who can save a lot of time during the implementation of these algorithms.

G. Galambos (Szeged)

Complex Analysis, Methods, Trends and Applications, Edited by E. Lanckau and W. Tutschke, 398 pages, Akademie-Verlag, Berlin, 1983.

Holomorphy is the basic concept of today's complex analysis. The enlarged effectiveness of the concept of holomorphy has produced new results, methods and applications. For example, in the case of nonlinear elliptic differential equations there are 1—1 mappings between the solutions and holomorphic functions. It is possible to construct solutions and to describe the properties of given solutions with the help of solutions of corresponding problems for holomorphic functions. Thus, a nonlinear problem is reducible to a linear one.

This book presents new methods of complex analysis, and it compares and connects these methods with classical ones. The main tendencies, which express new relations between complex analysis and the theory of partial differential equations, are described in the book. It is written by an international team (24 authors). In the first theoretical part 8 chapters deal with value distribution theory, polyanalitic functions, cohomological methods, approximation methods and other problems of complex analysis. The 14 chapters of the second part contain various applications, especially to partial differential equations.

The book is directed not only to specialists in complex analysis but also to all mathematicians, physicists and to all scientists, who are interested in: analysis, in general.

T. Krisztin (Szeged)

K. J. Devlin, Fundamentals of Contemporary Set Theory, VIII+182 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1979.

This book provides an account of those parts of set theory which are of direct relevance to other areas of pure mathematics. The main emphasire is put on the question of how to axiomatize set theory. Therefore, parts of naive set theory are developed first (Chapter I). This is followed by the definition of a language of set theory (LAST), whereafter the axioms are presented (with motivations) in detail. Classes are described as certain formulas of the language LAST. Thereafter the Recursion Principle is discussed. Intiutively, it says that, in ZF, it is possible to define functions with recursion. A restricted version of this principle is proved first as a theorem scheme in LAST. Then the Recursion Principle is presented in full generality with a sketch of the proof. Chapter II is completed with a discussion of the Axiom of Choice. Chapter III develops the theory of ordinal and cardinal numbers. Chapter IV deals with some topics of pure set theory such as stationary sets, regressive functions, trees, etc. Chapter V discusses the Axiom of Constructibility, its consistency as well as the consistency of AC and of GCH. Proofs are omitted, but indications, how some proofs proceed, are given. Chapter VI sketches the proof of the independence of GCH by exhibiting a Boolean valued model.

This is a very useful book on the fundamentals of set theory containing a number of helpful comments which are not available elsewhere.

A. P. Huhn (Szeged)

Differential Equations, Proceedings, Sao Paulo, 1981, Edited by D. G. de Figueiredo and C. S. Hönig (Lecture Notes in Mathematics, 957), VIII+301 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1982.

This volume contains 14 papers presented at the 1st Latin American School on Differential Equations, held at Sao Paulo, Brazil, June 29—July 17, 1981. The four longer papers comprise the lectures of the courses, which were delivered by A. Castro B. (Reduction methods via minimax), D. G. de Figueiredo (Positive solutions of semilinear elliptic problems), J. Ize (Introduction to bifurcation theory) and P. H. Rabinowitz (The mountain pass theorem: theme and variations). The authors of the other 10 papers are A. Castro B. and J. V. A. Goncalves, S. Hahn-Goldberg, D. B. Henry, C. S. Hönig, A. F. Ize, J. Lewowicz, P. S. Milojevic, G. P. Menzala. L. L. Schumaker, J. Sotomayor. These papers are original research papers in different fields of differential equations and in the general field of mathematical analysis.

T. Krisztin (Szeged)

R. E. Edwards, Fourier Series. A Modern Introduction, Vol. 2 (Graduate Texts in Mathematics, 85), xi+369 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1982.

This is the second edition of a book appeared first in 1967. There are numerous minor corrections and changes. In addition, a substantial reformulation and up-dating of Chapters 14 and 15 has taken place.

The volume deals on the whole with the more modern aspects of Fourier series and related topics that fit most naturally in a functional analytic context. With their introduction to distributional concepts and techniques and to interpolation theorems, Chapters 12 and 13 are perhaps the most significant portions of Volume 2. The carefully detailed discussion of the Marcinkiewicz interpolation theorem renders this topic more accessible to a beginner. The major part of Chapter 11 is devoted to the elements of Banach algebra theory and its applications in harmonic analysis. In the final Chapter 16 there appears an unusually well-connected introductory account of multiplier problems and related matters. Chapter 14 is concerned with random Fourier series. A greater coherency is attained by involving harmonic analysis on the Cantor group. Chapter 15 is devoted to the study of lacunary Fourier series. Much of these two chapters is independent of the previous ones, or is easily made so.

Each chapter ends with a large number of exercises covering a wide range of difficulty. The more difficult ones are provided with hints to their solutions. The thorough bibliography comprising 25 pages contains many suggestions for further reading. There is a cross-referencing system in the two volumes. The treatment is supplemented by a list of Symbols and a long Index.

To sum up, with its companion volume, Fourier Series II provides a vital exposition of various aspects of harmonic analysis over the circle group which are of current research interest. It can be well adapted to course work, too. We highly recommend both volumes to graduate students who wish to continue studies as well as to research workers in Fourier Analysis.

F. Móricz (Szeged)

P. J. Federico, Descartes on Polyhedra, A Study of the "De Solidorum Elementis", Sources in the History of Mathematics and Physical Sciences 4, x+145 pages, with 36 figures, Springer-Verlag, New York—Heidelberg—Berlin, 1982.

This book is based on the "De solidorum Elementis", a short but extremely interesting work of Descartes, which has survived in a manuscript of Leibniz only. In this work Descartes developed some new ideas in the arithmetization of geometry. It is not the first edition of this text, but it differs from its predecessors. The present work is based on a fresh examination of the manuscript. The complete facsimile of the manuscript and the first English translation of it are contained in this volume as well as commentaries of the text. In a section the author compares the works of Euler and Descartes on polyhedra.

This book and the other volumes in this series are warmly recomended to everybody who is interested in the history of mathematics, especially in original texts.

Lajos Klukovits (Szeged)

Jens E. Fenstad, General Recursion Theory. An Axiomatic Approach (Perspectives in mathematical logic) Springer-Verlag, Berlin—Heidelberg—New York, 1980.

General recursion theory, in particular, the axiomatic development of computational theories is of primary interest in several different areas of logic and computer science. The author aims to present such a development. Quoting his words: "The book is introductory. The aim is to provide a reasonably unified view. Not the only possible one, but one broad and detailed enough to serve as a basis and general framework."

Central to the discussions is an analysis of the relation $\{a\}(\sigma)\simeq z$, which is to be understood as the "computing device" coded by "a gives output z for the input σ". In a preliminary chapter.

entitled Pons Asinorum, the author gives an extremely clear exposition on his ideas concerning the very nature of the relation above. In fact, he presents not only his concise views on the matter at an informal level, but he also relates them to and locates them among other approaches, such as inductive definability, computation theories and Platek's theory on computations in higher types.

The matterial is devided into four parts (disregarding the expository part), each consisting of two chapters. Chapter 1 deals with the combinatorial part of the general theory. Subcomputations and length of a computation enter the picture in Chapter 2. These first two chapters cover the fundamental representation theorems and a general version of the first recursion theorem. The next part is devoted to finite theories on one (Chapter 3) and two (Chapter 4) types. The first of them corresponds to a generalization of hyperarithmetic theory while the second one is a general version of recursion in higher types, or second order definability.

Part *C* treats infinite theories, that is, generalizations of ordinary recursion theories and those of admissibility theories, including general degree theory and some recent results in inadmissibility theory. The last part of the volume discusses set recursion and computations in higher types.

The book is excelently written, most of the material is new, and in the reviewer's belief, it would be enjoyable to read it to everyone, including experts and students, interested in recent developments and ideas of recursion theory.

P. Ecsedi-Tóth (Szeged)

Jörg Flum—Martin Ziegler *Topological Model Theory*. (Lecture Notes in Mathematics 769), Springer-Verlag, Berlin—Heidelberg—New York, 1980. p. X+151.

An algebraic structure enriched with a topology on its universe is called a topological structure. To study topological structures, a formal language L_t is introduced as a fragment of the monadic second order language, in which set variables range over the topology and second order quantification is allowed over small neighborhoods of a point.

All interesting topological concepts are expressible in L_t, while, on the other hand, L_t is mathematically tractable as opposed to other more general second order languages. In fact, L_t is the largest extension of the first order language with set variables appropriate to investigate topological structures and yet to possess compactness and Löwenheim-Skolem properties. Several methods and results known from the model theory of first order languages apply directly to L_t. The first part of this volume is devoted to import these results and methods to L_t.

The authors start with overwieving preliminaires, and in particular, with introducing the concept of invariant second order formulae which play a central role in their considerations. It turns out, that several topological notions are invariant. Moreover, it is proved in §§2, 4, that any formula of L_t is invariant and conversely, any invariant formula (of the full monadic second order language) is equivalent to a formula of L_t. Section 3 is devoted to translating the language L_t into a two-sorted first order language in a truth-value preserving way thus establishing some basic results of L_t like compactness and Löwenheim-Skolem theorems. In the next section, two algebraic characterization of L_t-elementary equivalence are given. Sections 5, 6 deal with interpolation and preservation theorems under dense and open substructures, products and sums of topologies. The next section is devoted to definability problems concerning both classical explicit definability in topological structures and explicit definability of topologies. In Section 8, several other topological languages are compared and a Lindström-type characterization is given for L_t. The omitting types theorem is proved for a fragment of L_t in Section 9. It is also shown, that this theorem fails to hold in L_t. Finally, the infinitary version $(L_{\omega_1\omega})_t$ of L_t is investigated in the last section of the first part and several results obtained in earlier sections are generalized to this case.

The second part of the volume is devoted to applications of the first one to topological spaces and in particular to topological abelian groups, fields and vector spaces. In the last section, topological vector spaces are investigated. Firstly, an L_t axiomatization of locally bounded real topological vector spaces is given and is proved to be complete if the dimension is fixed. Secondly, it is shown, that the L_t-theory of surjective and continuous linear mappings is axiomatizable.

The book seems to be a basic reference for researchers in several different areas of model theory, algebra and topology. The matterial is clearly presented (disregarding some misprints), concise and easily comprehensible, hence the text can be useful for experts as well as graduate students.

P. Ecsedi-Tóth (Szeged)

Geometry and Analysis. Papers Dedicated to the Memory of V. K. Patodi, V+166 pages, Published for the Indian Academy of Sciences, Bangalore and Tata Institute of Fundamental Research, Bombay, Springer-Verlag, New York—Heidelberg—Berlin, 1981.

The early death of the brilliant differential geometer Vijay Kumar Patodi (1945—1976) is a great loss not only to his mother country India but also to the international mathematical community. The book is a collection of papers, intended to be a mathematical tribute to the memory of the great mathematician. It contains articles by V. Arnold (On some problems in singularity theory), M. F. Atiyah and R. Bott (Yang-Mills and bundles over algebraic curves), J. Dodziuk (Vanishing theorems for square-integrable harmonic forms), J. J. Duistermaat (On operators of trace class in $L^2(X, \mu)$), J. Eells and L. Lemaire (Deformations of metrics and associated harmonic maps), Peter B. Gilkey (Curvature and the heat equation for the de Rham complex), H. P. McKean (Units of Hill curves), Harish-Chandra (A submersion principle and its applications), J. J. Millson and M. S. Raghunathan (Geometric construction of cohomology for arithmetic groups I), M. S. Narasimhan and M. V. Nori (Polarisations on an abelian variety), S. Raghavan and S. S. Rangachari (Poisson formulae of Hecke type), S. Ramanan (Orthogonal and spin bundles over hyperelliptic curves).

The book also contains the biography and the list of publications of V. K. Patodi and his photograph.

Z. I. Szabó (Szeged)

T. W. Hungerford, Algebra (Graduate Texts in Mathematics, 73), XXIII+502 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1980.

In the preface of this volume the author gives exactly the motivations of writing the book. (This is the second edition of the first *Algebra*, published in 1974, Holt, Rinehart and Winston, Inc. No substantial changes have been made, only misprints and errors have been corrected and some proofs have been rewritten.) He feels that a student learning algebra at the beginning graduate level or anyone who wants to get acquainted with beginning abstract algebra needs a textbook containing the basic material in sufficient breadth and depth, the knowledge of which is essential for studying special topics of algebra or the applications of abstract algebra in other mathematical sciences. Years ago, the author was unable to find a suitable textbook for such aims. So he decided to write one, trying to fill this long-felt gap. In our opinion he succeeded very well in carrying out this plan, not only in a masterful matching but in giving such a treatment, which makes easy to adapt the material to the modern universal algebraic and category theoretic framework. A very large number of exercises is offered at the end of every section; the full treatment of these surely requires skill and a steady knowledge of the corresponding topic. But some results of classical higher algebra are also contained here (e.g. the equations of degree $n \leqq 4$, Lagrange's interpolation formula and so on), so the solution of at least these exercises is important.

The book consists of an Introduction and 10 chapters. The Introduction contains the necessary set-theoretical concepts and statements, such as sets, maps, set operations, Zorn's lemma, and elementary cardinal number arithmetic. The chapters are I. Groups, II. The structure of groups, III. Rings, IV. Modules, V. Fields and Galois Theory, VI. The Structure of Fields, VII. Linear algebra, VIII. Commutative Rings and Modules, IX. The Structure of Rings, X. Categories; the interdependence of these is given by the author. For those interested only in the most frequent types of structures and the possibility of the simplest applications of abstract algebra it is sufficient to read the Introduction and chapters I, III, IV and VII. The further chapters are dealing in more details with groups, rings, fields and modules, and treat special kinds and problems of these (fundamental theorem of finitely generated Abelian groups, the Krull—Schmidt Theorem, Sylow's theorems, field extensions, Galois groups, the general equations of degree n, transcendence degree, separability, Noetherian rings and Dedekind domains, Hilbert's famous theorem on proper ideals of a polynomial ring (Hilbert's Nullstellensatz), prime and Jacobson radicals of rings, simple and semisimple rings, structure and characterization theorems for left Artinian and Noetherian semisimple rings, and in Chapter X, morphisms, functors, adjoint functors). We call particular attention to Chapter VII, which is an excellent and brief summary, from an abstract point of view, of the most important results of a traditional area, the theory of matrices, linear transformations and determinants.

The book is recommended for university students and for those interested in abstract algebra, and for research workers, too. Reading of this volume requires no preliminary knowledge from higher mathematics but a high mathematical intelligence, ability of doing abstract considerations. The full attainment of the book gives a very good base for studying e.g. universal algebra (with an additional acquaintance in lattice theory) and other modern branches of algebra. A bibliography partitioned according to different topics gives good instructions for further studies.

Attila Lenkehegyi (Szeged)

Iterative Solution of Nonlinear Systems of Equations (Proceedings, Oberwolfach 1982), Edited by R. Ansorge, Th. Meis, and W. Törnig (Lecture Notes in Mathematics, 953), VII+202 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1982.

The conference indicated in the title was held in the "Mathematisches Forschungsinstitut Oberwolfach" (Federal Republic of Germany) between January 31 and February 5, 1982. In all twenty four talks were given, thirteen of which are presented in these proceedings.

The table of contents: 1. O. Axelsson: On global convergence for nonlinear problems. 2. W. Hackbusch: Multi-grid solution of continuation problems. 3. H. D. Mittelmann: A fast solver for nonlinear eigenvalue problems. 4. H. Cornelius and G. Alefeld: A device for the acceleration of convergence of a monotonously enclosing iteration method. 5. B. Kaspar: Overrelaxation in monotonically convergent iteration methods. 6. A. Neumaier: Simple bounds for zeros of systems of equations. 7. K. Nickel: Das auflösungsverhalten von nichtlinearen Fixmengen-Systemen. 8. F. A. Potra: On the convergence of a class of Newton-like methods. 9. U. Hornung: ADI-methods for nonlinear variational inequalities of evolution. 10. G. Kolb and W. Niethammer: Relaxation methods for the computation of the spectral norm. 11. Th. Meis and W. Baaske: Numerical computation of periodic solutions of a nonlinear wave equation. 12. C. Weiland: Erfahrungen bei der Anwendung numerischer Verfahren zur Lösung nichtlinearer hyperbolischer Differentialgleichungssysteme. 13. W. Werner: On the simultaneous determination of polynomial roots.

Emphasis lies on three main topics: (1) multigrid methods (talks 1—3), (ii) monotone and interval arithmetic iterations (talks 4—8), (iii) applications in industrial practice (talks 9—12). The book provides an up-to-date account of the present stage of the subject. We warmly recommend it to everybody, who works in Numerical Analysis and/or in Applied Mathematics in Engineering.

F. Móricz (Szeged)

J. H. van Lint, Introduction to Coding Theory (Graduate Texts in Mathematics, Vol. 86), IX+171 pages with 8 illustrations, Springer-Verlag, New York—Heidelberg—Berlin, 1982.

A gap has been filled: here is a book on conding theory written for outsiders. Many mathematicians and engineers have to study coding theory since it belongs to the most up-to-date part of applied mathematics. A number of authors referred to in the book are (former) members of the staff of Bell Telephone Laboratories. It is explained how satellites can transmit excellent pictures which were taken of Mars and other planets to Earth.

This book is a revised and enlarged edition of van Lint's previous book Inleiding in de Coderingstheorie.

A fairly thorough mathematical background is required to read this book. In the first place this means algebra, but elements of combinatorics and probability theory are required as well.

The existence of good codes is proved by random techniques and many codes are constructed, e.g. Hadamard codes, Reed—Muller codes, Golay codes, BCH codes, Reed—Solomon codes, quadratic residue codes, Goppa codes and the major development in coding theory in the seventies: Justesen codes.

Several bounds are given for the codes. The book is provided with exercises, hints and complete solutions are contained. It is of interest to mathematicians and computer scientists, students of mathematics and computer science.

L. A. Székely (Szeged)

Uwe Kastens—Brigitte Hutt—Erich Zimmermann, GAG: A Practical Compiler Generator, (Lecture Notes in Computer Science, 141), Springer-Verlag, Berlin—Heidelberg—New York, 1982.

Attribute grammars have proved useful tools for specifying programming languages and their implementations in compiler writing systems. The GAG-System is a compiler *G*enerator based on *A*ttribute *G*rammars. In general, the main problem connected with attribute grammars is to produce an efficient attribute evaluator. During the parsing a parse tree is constructed and the evaluator computes the values of the attribute instances attached to the parse tree. In the GAG-System the OAG (Ordered Attribute Grammars) attribute evaluation technique was implemented. Using this technique efficient evaluators can be generated for a large subclass of the non-circular attribute grammars.

The space management technique of GAG finds those attributes which can be implemented by global variables or stacks. Thus, the space requirements of the generated compilers are close to those of conventional compilers.

The metalanguage of the GAG-System is based on a powerful type concept and the system was implemented in Pascal. The complete description of Pascal in GAG can be seen in Appendix *A*.

Tibor Gyimóthy (Szeged)

Tosio Kato, A Short Introduction to Perturbation Theory for Linear Operators, XI+161 pages, Springer-Verlag (New York—Heidelberg—Berlin), 1982.

Professor Kato's excellent *Perturbation Theory for Linear Operators* (for a review cf. *these Acta*, **40** (1978), p. 398) is a Bible of this branch of Operator Theory and, accordingly, it is rather voluminous. Readers who are interested in a shorter introduction to the subject, not going beyond the case of finite-dimensional spaces, will find it convenient to have now this handy shorter version. Actually, it contains the first two chapters of the original. As the author states in the Preface, these two chapters were intended from the outset to be a comprehensive presentation of those parts of perturbation theory that can be treated without the topological complications of infinite-dimensional spaces. What results is an interesting introduction to linear algebra, which systematically uses complex functions, by way of the resolvent theory. Of course, not all parts of Perturbation Theory have non-trivial contents in finite-dimensional spaces. Such are, in particular, the parts pertaining to scattering problems.

Some new sections and paragraphs have been added, e.g. on product formulas, dissipative operators and contraction semigroups, positive matrices, etc.

The booklet is not, and cannot be, a condensation of the whole theory, but, within its restricted framework, it is appealing to a wider audience and will certainly be a welcome addition to the existing literature.

Béla Sz.-Nagy (Szeged)

Jesper Lützen, The Prehistory of the Theory of Distributions (Studies in the History of Mathematics and Physical Sciences 7), VIII+232 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1982.

This book is not primarily a story about how Sobolev and Schwartz developed the theory of distributions. All the important techniques and theories (generalized derivatives and generalized solutions to differential equations, generalized Fourier transforms, early generalized functions, de Rham's currents), which anticipated the theory of distributions, are discussed. These four theories and their connection to the theory of distributions constitute the bulk of the book. The author says: "Did Sobolev and Schwartz construct distributions from scratch or were there earlier trends and, if so, what were they? It is this, concerning the prehistory of the theory of distributions, which I attempt to answer in this book".

The book is divided into six chapters. In the first the development of functional analysis is summarized. The next four chapters discuss the four main trends of the prehistory mentioned above. The last chapter deals with L. Schwartz's creation of theory of distribution. Each of the six chapters can be read separately. Thus, this book may well be of interest to readers who are only interested in the work of Sobolev and Schwartz or in one of the four trends of the prehistory.

T. Krisztin (Szeged)

Yu. I. Manin, A Course in Mathematical Logic (Graduate texts in mathematics; 53), Springer-Verlag, New York—Heidelberg—Berlin, 1977.

This book, translated from the Russian original by N. Koblitz, leads the reader from the very beginning of mathematical logic up to recent discoveries, including the independence of the continuum hypothesis and the result on the Diophantine nature of enumerable sets and others.

The first two chapters are a beginner's course in predicate logic with outstanding clarity, and several useful explanations on the background ideas. Central to the presentation are the concepts of models, truth and some other semantical notions. In the last part of Chapter 2, using a method due to Smullyan, the author proves Tarski's theorem on the undefinability of truth in arithmetic without introducing recursive functions. This theorem will be the main tool for proving Gödel's incompleteness result in a later chapter. Also, Chapter 2 contains a section dealing with quantum-logic. The third and fourth chapters are devoted to the complete and detailed proof of the independence of the continuum hypothesis by developing constructible sets of Gödel in the von Neumann's cumulative hierarchy and Boolean-valued models due to D. Scott for presenting Cohen's forcing. Recursive functions, enumerable sets, Church's thesis and some problems of algorithmic undecidability are treated in Chapter 5. The next chapter continues the study of enumerable sets by establishing a recent result on their Diophantine nature, and in particular, the existence of undecidable enumerable sets. In the last section, the very interesting (and in logical textbooks mostly neglected) theory concerning the length of proofs is presented following the ideas of Gödel and Kolmogorov. The seventh chapter is devoted to Gödel's incompleteness theorem and contains several detailed explanations on the significance of this result. Finally, in the last chapter of the volume, recursive structures, in particular, recursive groups are discussed in an attractive way.

This book seems to be an excelent introduction to modern applications of mathematical logic for graduate students.

P. Ecsedi-Tóth (Szeged)

Mathematical Modeling of the Hearing Process. Proceedings, Troy, NY 1980, Edited by Mark H. Holmes and Lester A. Rubenfeld (Lecture Notes in Biomathematics, 43), V+104 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1981.

The cochlea, making possible hearing to humans and other mammals, is a mystic instrument which nevertheless is phisical enough to allow various deterministic mathematical models. Cochlear mechanics exists since Helmholtz, but his models were replaced by the "long wave" theories in the 1950's. These models came into question since the early 1970's following Rhode's measurements of the vibration of the basilar membrane in monkeys. According to the classification of the editors, cochlear mechanics is presently in the third stage of its history. The six papers in these proceedings provide a comprehensive overview of this third stage of research in the mathematical modeling of the hearing process. Beside experts in hearing, the volume may be of interest to workers in vibration mechanics and in differential equations.

Sándor Csörgő (Szeged)

Numerical Integration of Differential Equations and Large Linear Systems (Proceedings, Bielefeld 1980), Edited by Juergen Hinze (Lecture Notes in Mathematics, 968), VI+412 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1982.

The use of electronic computers has formed a firm basis for extensive mathematical experiments in the field of numerical solution of differential equations. The resulted developments in the methods are carried out not only by numerical analysts in general, but also by chemists, physicists and engineers. The latter, faced with specific problems, have developed selective methods, which appear to be the most suitable for the specific problem at hand.

It was the purpose of the two consecutive workshops on "Numerical Integration of Differential Equations" and "Large Linear Systems; Eigenvalue and Linear Equations" held at the

"Zentrum für interdisziplinäre Forschung" of the University of Bielefeld (Federal Republic of Germany) in spring 1980, to bring together numerical analysts and chemical physicists in order to make a further progress of the numerical methods used in chemical physics. The same purpose is to be surved by this volume, a proceedings of these workshops. It contains twenty eight papers. To emphasize the interdisciplinary character, the first ten papers included focus on specific applied problems in chemical physics. Besides, valuable additional information on the numerical methods used in scattering theory can be found in the first four contributions. The following ten papers are devoted to specific improvements in the methodology of integrating various types of differential equations and error estimates of bounds for such methods. The major emphasis in the procedures is on finite difference methods. Since every discretization algorithm of differential equations leads to a large linear equation or eigenvalue problem, the main theme for the last eight papers is the efficient solution of such large linear systems, where the coefficient matrices are of special stucture or sparse.

To sum up, the present volume deals with numerical methods useful in atomic and molecular physics, in particular scattering calculations and the solution of the coupled differential equation in chemical kinetics. Thus, it is highly recommended to all who work in one of these fields, and without doubt, it must be found in every applied mathematics library.

F. Móricz (Szeged)

Probability in Banach Spaces IV. Proceedings, Oberwolfach, Germany. Edited by A. Beck and K. Jacobs (Lecture Notes in Mathematics, 990), V+234 pages, Springer-Verlag, Berlin—Heidelberg—New York—Tokyo, 1983.

This volume contains 16 papers read at the seminar on probability in Banach spaces held in Oberwolfach, July, 1983. This meeting was the fourth in a series of meetings on the above subject (Oberwolfach 1975, 1978 and Medford, Massachusetts, 1980) which fact well illustrates that geometric aspects of probability became a very rapidly growing field of recent research. This Oberwolfach Conference probed the conjection of probability and geometry, testing the contribution of geometrical assumptions to the classical type results of probability. The papers expose various directions of the subject and they present the latest results in the field. The technically prepared non-expert may use Woyczynski's survey on the asymptotic behaviour of sums of independent random vectors and Dettweiler's longer expository papers on Banach space valued processes with independent increments as a guide to join to the research on this area.

Lajos Horváth (Szeged)

Probability Theory and Mathematical Statistics. Proceedings, Tbilisi, USSR, 1982. Edited by K. Ito and Yu. V. Prokhorov (Lecture Notes in Mathematics, 1021), VIII+747 pages, Springer-Verlag, Berlin—Heidelberg—New York—Tokyo, 1983.

The Fourth USSR—Japan Symposium on Probability Theory and Mathematical Statistics was held in the Georgian SSR, August 23—29, 1982. This volume contains a part of the papers presented at the conference. Altogether 73 short papers are published in the volume, so the topics treated virtually cover present day Japanese and Soviet probability and statistics. For information we only list the section headings: Limit theorems, Stochastic equations and martingales, Mathematical statistics, Statistical physics, Stochastic analysis, Stability of stochastic models, Statistics of random processes, Stochastic control, Queueing theory, Ergodic theory, Branching processes, Gaussian processes, Semi-Markov processes, Random fields, Probability distributions and Noncommutative probability.

Lajos Horváth (Szeged)

Séminaire de Probabilités XVII, 1981/82. Proceedings. Edité par J. Azéma et M. Yor (Lecture Notes in Mathematics 986), V+512 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1983.

This volume continues the traditional Strasbourg—Paris seminar notes and, of course, the main subject is the traditional general theory of stochastic processes. The topics cover a broad part of recent probability theory (local time of stochastic processes, stochastic differential equations, stochastic calculus, martingales, stopping times, Markov processes and invariance principles), so everybody doing research in probability theory can find something interesting and useful for himself. The last page contains corrections to the previous volumes of the Séminaire de Probabilités.

Half of the papers presented in this book are written in French without English summary. I believe that most readers would find useful English abstracts attached to these papers.

Lajos Horváth (Szeged)

Colin Sparrow, The Lorenz Equations: Bifurcations, Chaos, and Strange Attractors (Applied Mathematical Sciences, 41), XII+269 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1982.

This book is concerned with the system of differential equations $\dot{x}=\sigma(y-x)$, $\dot{y}=rx-y-xz$, $\dot{z}=xy-bz$, where σ, r and b are three real positive parameters. One might think: "How is it possible to write a whole book on a particular differential system, even which seems quite simple? If it is not integrable by quadratures, or does not allow to get phase portrait by methods of the qualitative theory, then it has to be integrated numerically by computers." The system was obtained by E. N. Lorenz, who is a meteorologist as well as a mathematician, in 1963 in the course of modelling a two dimensional fluid cell warmed from below and cooled from above. During the numerical experiments something strange happened: for wide ranges of values of the parameters, approximate solutions to the equations calculated on a computer looked extremely complicated. Unfortunately, presenting figures is beyond the frame of this review (the reader can find 91 illustrations in the book!) so we have to illuminate the behaviour of the solutions in words. The trajectories in the phase space R^3 were not periodic. Nevertheless, however long the numerical integration had been continued, the trajectories continued to wind around and around, first on one side, then on the other, without ever settling down to either periodic or stationary behaviour. The strange feature of the phenomenon consists in the fact that the equations are deterministic, they contain no random, noisy or stochastic terms and yet the trajectories are chaotic. As the author writes: "The suggestion, that complicated 'turbulent' behaviour in systems with an infinite number of degrees of freedom (such as atmosphere) might be modelled by simple deterministic finite-dimensional systems is one of the reasons why the Lorenz equations have attracted so much attention." The book interprets many different kind of chaotic behaviour that have been observed by other authors, and gives a global, geometric and intuitive understanding of these phenomena.

These notes are accessible also to readers possessing only the most basic concepts of the theory od differential equations. They can be suggested for every user and mathematician interested in differential system-models, because they excellently illustrate an approach to study many other systems behaving in ways which seem to be very similar to one or more of the behaviours shown by the Lorenz equations.

L. Hatvani (Szeged)

Stability Problems for Stochastic Models, Proceedings of the 6th International Seminar Held in Moscow, USSR, April 1982. Edited by V. V. Kalashnikov and V. M. Zolotarev (Lecture Notes in Mathematics, 982), XVII+295 pages, Springer-Verlag, Berlin—Heidelberg—New York—Tokyo.

This is a carefully compiled volume containing 22 articles. The average mathematical level of the papers included is much higher than what is usual in similar proceedings, and this fact makes tolerable the sometimes very bad English. More then half of the papers deal with characterisations of univariate or multivariate probability distributions and the stability of these characterisations. There are papers on stability of limit theorems, robust estimation, queueing systems, estimation of the parameters of stable distributions, on the $D(0, \infty)$ space, and three papers deal with probability metrics in a manner initiated by Zolotarev. In his nice foreword, emerging to a research paper, Zolotarev provides a broad notion of the stability of stochastic models, into which most of the specific problems above fit conveniently, and illustrates his method of metric distances for a concrete stability problem involving extreme value distributions.

Sándor Csörgő (Szeged)

The Mathematical Gardner, Edited by David A. Klarner, VIII+382 pages, Wadsworth International, 1981.

This book contains articles dedicated to Martin Gardner for his 65th birthday.

Martin Gardner is one of the world's greatest popularizer of mathematics. For more then twenty years he had had a column in each issue of Scientific American entitled Mathematical Games. (Now this appears in alternate issues.) These columns present old and new problems in a popular way. The articles contain examples, puzzles and questions answered in the next issue. Gardner's inimitable style makes the articles interesting for specialists and amateurs stimulating their creative activity. Gardner's books reached great success too, they are translated into several languages.

The articles in this book — edited by D. A. Klarner — are written by well-known mathematicians and are "real Gardners". The six chapters are: Games, Geometry, Two-Dimensional Tiling, Three-Dimensional Tiling, Fun and Problems and, finally, Numbers and Coding Theory. Here are some of the articles (following their original order in the book) which were extraordinarily interesting for the referee. "A Kriegspiel Endgame" is written by J. Boyce. Kriegspiel is a variant of chess: each player tries to mate his opponent, but neither player knows where the other player's pieces are. V. Chvátal's article "Cheap, Middling or Dear" especially shows how games could motivate readers toward deeper mathematics. The paper of S. Burr entitled "Planting Trees" illustrates the charms of combinatorial geometry. W. T. Tutte wrote an article on dissections into equilateral triangles. B. Grünbaum and G. C. Shephard give an excellent survey on some problems on plane tilings. H. S. M. Coxeter's paper "Angels and Devils" on mathematics and on Escher's work is beautiful aesthetically as well. In the introduction of his article entitled "My life among the polyominoes" D. A. Klarner relates Martin Gardner's role in his mathematical development. Some mathematical gems can be found in R. Honsberger's article. A new proof of Chvátal's art gallery theorem given by. S. Fisk is especially interesting for the referee. Surely, the reader will find some of the other articles more interesting than the above mentioned ones.

In conclusion, this is a book that certainly should be in every library.

L. Pintér (Szeged)

J. Uhl—S. Drossopoulou—G. Porsch—G. Goos—M. Dausmann—G. Winterstein—W. Kirschgässner, An Attribute Grammar for the Semantic Analysis of Ada. LNCS, Vol. 139, 511 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1982.

Attribute grammar is an established tool for the formal specification of the semantics — generally in the form of a compiler — of a programming language. The symbols of the context-free grammar are associated via this specification with the groups of "attributes" expressing the various properties of the corresponding constructs of the programming language. This book contains an attribute grammar specifying the static semantics of ADA, as published in July 1980. An informal review of the GAG (Generator for Attribute Grammars) system is as follows. The metalanguage used by the GAG system is called ALADIN (A Language for Attribute Definition). The Karlsruhe Ada Compiler front-end (generated by GAG) consists of:

— The scanner (lexical analysis), which analyzes the input text and recognizes all lexical tokens of Ada.
— The parser (syntactic analysis), which generates from the sequence of lexical units the equivalent Diana Parse Tree with all lexical attributes (for example, identifier codes). The parser contains a complete error recovery system.
— The semantic analyzer, which reports any statically detectable error in the Ada program and calculates the semantic attributes required by Diana. It starts with the program representation by a Diana Parse Tree and adds the semantic attributes to this tree. These attributes convey information about the meanings of several language elements to subsequent compiler phases or to other tools of an Ada programming environment.

The front-end has, therefore, two internal interfaces: the list of lexical units as the output of the scanner, and the *structure tree* as the output of the parser. The structure tree represents the abstract syntax with the lexical information, and it is called the *Diana Parse Tree.*

The output of semantic analysis is the structure tree with lexical *and* semantics attributes. This abstract data type is called the *Diana Tree.* Semantic analysis mainly deals with name analysis (overloading resolution), type-checking and context conditions.

The complete static semantics of Ada is given by using attribute grammar and the description is written in ALADIN language.

Endre Simon (Szeged)

M. I. Yadrenko, Spectral Theory of Random Fields. Translation Series in Mathematics and Engineering, III+259 pages, Optimization Software, Inc., Publications Division, New York, 1983. (Distributed by Springer-Verlag, Berlin—Heidelberg—New York—Tokyo.)

This is the first volume in this new translation series and, according to Series Editor A. V. Balakrishnan, "typifies aboundantly" the aim of "this new series: to combine the best in mathematics and engineering, emphasizing the theoretical while strongly oriented toward applications". The latter orientation is only potential in this book, though, no doubt, many people from the engineering side who possess the necessary prerequisites to read it may find it very useful. The book is indeed first class mathematics both in its depth and in the arrangement of the material. It is really the first one in its kind and virtually covering the present state of knowledge in this important and vigorously developing area, it fills a long apparent gap in the literature.

The unified spectral theory of the 104 pages Chapter I (with section headings: Homogeneous and isotropic random fields, Spherical Averages of homogeneous and isotropic random fields, Homogeneous and isotropic random fields of the Markov type, Homogeneous and isotropic random fields in Hilbert space, Isotropic random fields on spheres, Isotropic random fields on Euclidean spaces, Strong law of large numbers for isotropic random fields) will surely become indispensable for both students and experts in the field as a main source of reference. Following a short Chapter II on the local behaviour of sample functions of random fields, Chapter III deals with absolute continuity and singularity of measures corresponding to random fields. The last Chapter IV is devoted to selected problems concerning the statistics of random fields with section headings: Linear forecasting for random fields observed on a sphere, On extrapolation of a homogeneous and isotropic random field from observation on a countable system of concentric spheres, Optimal estimates of regression coefficients and mean value of an isotropic random field observed on a sphere, On the integral equations for the statistics of homogeneous and/or isotropic random fields.

The bibliographical notes and a list of 276 references, 208 of which is to Soviet periodicals or books, are a very valuable help to the reader, especially to the Western reader.

Sándor Csörgő (Szeged)