Acta Sci. Math., 56 (1992), 377—399

Bibliographie

K. Andersen, Brook Taylor's Work on Linear Perspective. A study of Taylor's Role in the History of Perspective Geometry. Including Facsimiles of Taylor's Two Books on Perspective. (With 114 Illustrations), (Sources in the History of Mathematics and Physical Sciences, 10), X+259 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1992.

In order to indicate the significance of Taylor's studies, the author cites Edward Noble's words: "...[Taylor's] fate has been to be more admired and celebrated than understood." K. Andersen explains this fact noticing two "paradoxes" (in the Concluding Remarks of the book). First, "... the part of Taylor's theory that was mostly applied — and presumably known as his principles — existed long before him. His real and impressive improvements of the theory of perspective — among which his wider use of vanishing lines, and his contributions to direct constructions, and the theory of inverse problems are especially significant — were, however, not much noticed." Secondly, "... precisely Taylor's studies, which are the most incomprehensible of the entire pre-nineteenth-century literature on perspective, evoked response in a circle of practitioners."

When Brook Taylor wrote his books, the theory of perspective and the everyday demands of the painting were in strong interrelation, and perspective was an independent theory in mathematics of its own. So that the linear perspective was the integrating part of the fine art — at least in Taylor's mind. His work reflects a typical viewpoint of some scientists'. Namely that the scientific understanding is a "sine qua non" for the appropriate practical problem (painting, design, etc.).

In the introductionary study K. Andersen presents Taylor's work as a comprehensive survey of the preceding and actual results of the early 18th century. Without this essay it would be almost impossible to establish the significance of the two works presented in facsimile form. The modern mathematician needs some help to understand the terminology and the treatment since the two books were written in the time of the evolution of the theory as a whole (and also in details). This task is entirely fulfilled (starting with the exposition of the basic concepts and methods, Taylor's "inheritance" and his contributions to development of the perspective geometry, proceeding to some historical overview).

After the preliminaries the author could restrict the deal of necessary remarks on the two facsimiles to 41 respectively 35 remarks (indicated by starts in the original texts).

A bibliography is also added, listing the most important works concerning this exciting material.

This volume is not only a useful book for any researcher in this field, but also an original contribution to the researches in the history of mathematics.

J. Kozma (Szeged)

R. R. Akhmerov—M. I. Kamenskii—A. S. Potapov—A. E. Rodkina—B. N. Sadovskii, Measures of Noncompactness and Condensing Operators, (Operator Theory: Advances and Applications, 55), VIII+249 pages, Birkhäuser Verlag, Basel—Boston—Berlin, 1992.

Kuratowski was the first who introduced (in 1930) a quantitative characteristic measuring the degree of noncompactness. In the mid Fifties in functional analysis various measures of noncompactness was applied to investigate condensing operators which map any set into a set which is in certain sense more compact than the original set. It turns out that condensing operators have similar properties as compact operators. The text is divided into four chapters. The first chapter introduces the notions of Kuratowski, Hausdorff and general measures of noncompactness, the notion of condensing operators and gives the basic properties. The second chapter is devoted to the characterization of linear condensing operators in spectral terms and studies the perturbation of the spectrum. The third chapter develops the theory of the index of fixed points for nonlinear condensing operators. The fourth chapter applies the theory to problems for differential equations in Banach space, stochastic differential equations, functional differential equations and integral equations.

The book can be offered to anyone who is interested in topological relation of functional analysis and has some background in functional analysis and general topology.

L. Gehér (Szeged)

R. Balian, From Microphysics to Macrophysics, Vol I., (Texts and Monographs in Physics), XXII+465 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

This is the English translation of the original French book, which has grown out from lecture notes for students of the Ecole Polytechnique in Paris. It is an advanced textbook of statistical physics and thermodynamics. One of its great merits is that the subject is based on the laws of quantum physics, which is necessary if one wants to avoid the problems and contradictions, raised by classical statistical mechanics. This modern approach is made familiar by beginning with the simple example of an ensemble of two-level magnetic atoms. Then the introduction of the concepts of statistical mechanics with its foundations in quantum mechanics follows naturally. Classical systems are treated as a special case. The concept of entropy is also introduced from the quantum physical point of view, and its connection with information theory is presented too. The connection between thermodynamics and statistical physics is built up gradually, first by only referring to elementary facts from thermal physics, and later on in two separate chapters devoted to advanced thermodynamics. In the first one the traditional presentation in the form of the main laws can be found, in the other one the more modern approach is presented by postulating the existence and the properties of the entropy as a thermodynamic potential. Among the examples the very delicate and problematical questions of dielectric and magnetic substances are treated with due attention. The perfect gas, the real gas, and the gas-liquid phase transition are also discussed in this first volume, while the ideal quantum gas together with other non-traditional applications of statistical physics are left for the second one.

There are several interruptions of the main text. Vivid discussions on the historical evolution of the fundamental concepts of statistical physics, and also philosophical considerations concerning its paradoxes makes the reading a pleasant entertainment. The clarity of the presentation and the comprehensive content will certainly make this book together with the forthcoming second volume a standard reference of the field.

M. Benedict (Szeged)

P. Bamberg—S. Sternberg, A course in mathematics for students of physics: 1, Cambridge University Press, Cambridge—New York—Port Chester—Melbourne—Sydney, 1991.

We have already recommended this book when read its 2nd volume. However, the reviewer is in the position of presenting a recommendation anew after reading the first volume, too.

This volume is "neither more" nor less than a very good textbook for studying mathematics necessary to understand most important physical concepts, phenomena and lows. It provides, at the same time, the basis for any mathematical studies: affine and Euclidean planes, linear transformations, matrix representations, linear differential equations (in 2-dimensional planes), calculus in the plane, differential forms, line and double integrals, vector spaces, and determinants. The above list indicates a standard material, however the demands on the physical applications completely satisfied in each sections and on all levels.

The reader meet this requirement firstly in the examples (e.g. applications of differential equations to the well-known physical systems, normal modes — also in higher dimensions). On the other hand, some significant chapters of the classical and modern physics are explicitly discussed (special relativity, Poincaré group and the Galilean group, momentum, energy and mass, Gaussian optics).

This text examines the most important concepts (on undergraduate level), paying attention to both excellent exposition and demonstration by clear reasonings.

The redaction systematically goes back to the notions and facts previously introduced and proved, so that the volume is self-contained in this respect. Every section begins with some introduction, which give an outlook of the subsequent material, and closes with a brief summary which is used to take some emphases on the appropriate place.

Various topics are described in a uniform manner. This is a good help for the beginner to find the relations between new and previously discussed ideas.

This new classical book is recommended as an undergraduate text as well as a good reading for anybody interested in physics, but with some need of mathematical backgrounds.

J. Kozma (Szeged)

T. Banchoff—J. Wermer, Linear Algebra Through Geometry (Second Edition), with 92 Illustrations, (Undergraduate Texts in Mathematics), XII+305 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1992.

The second edition of this classical book has been enlarged.

The first four chapters remained unchanged except for some additional remarks in Chapter 4: simultaneously are discussed the 4-spaces and the possibility of their generalization for n-spaces, closed by the general definition of the determinant of an $n\times n$ matrix. These four chapters represent a good introduction into linear algebra through geometry. The leading idea of the authors is to consider the Euclidean plane (space) as a vector space, and find their properties independent from the concrete geometric meaning. The first two chapters provides a detailed analysis of the geometry of vectors in the line and the plane, starting with the notion of the vector and linear transformation, furthermore a development of the elementary properties of the commonly used binary operations, and proceeding in the third chapter to a deeper study of vectors in a 3-space (by means of linear transformations). There is also given the classification of conic sections and quadric surfaces.

The content of the next chapter of the first edition is now partly attached to Chapter 4 (homogeneous and inhomogeneous systems of linear equations). The new 5th chapter treats the notion of an abstract n-dimensional vector space. There is no more direct contact with the (visualizable) space, however the uniform treatment helps the reader to remember the lower-dimensional analogues.

Chapter 6 is completely a new one, dealing with inner product vector spaces, the Gram-Schmidt orthonormalization process and orthogonal decomposition of a vector space.

In Chapter 7 we can find a brief summary on symmetric matrices in the necessary extent in order to prove the theorem on diagonalization.

Finally, Chapter 8 covers three applications: differential systems, least squares approximation and curvature of function graphs.

These latter new chapters contain welcome and useful material concerning the original topic.

In this new form the book can be recommended as an introductionary text-book. However, after studying algebra without parallel studies on geometry, every reader will find a strengthening of his or her former knowledge on both geometry and algebra.

J. Kozma (Szeged)

David M. Bressoud, Second Year Calculus (Undergraduate Texts in Mathematics), XI+386 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona, 1991.

This is an excellent textbook for multi-variable and vector calculus, emphasizing the historical physical problems from which the subject has grown, but couching much of it in the modern terminology of differential forms. The book guides the reader from the birth of the mechanized view of the world in Isaac Newton's *Mathematical Principles of Natural Philosophy* in which mathematics becomes the ultimate tool for modelling physical reality, to the dawn of a radically new and often counter-intuitive age in Albert Einstein's Special Theory of Relativity in which it is the mathematical model that suggests new aspects of that reality. The student learns to compute orbits and rocket-projections, model flows and force fields, and derives the laws of electricity and magnetizm. The languages of differential forms enables the reader to see how mathematical symmetry leads to the conclusion that matter and energy are interchangeable.

The chapter headings are: $F=ma$; Vector Algebra; Celestial Mechanics; Differential Forms; Line integrals; Linear Transformations; Differential Calculus; Integration by Pullback; Techniques of Differential Calculus; The Fundamental Theorem of Calculus; $E=mc^2$. Every chapter contains very good exercises helping the students to understand the text.

The style of the book is clear. It is highly recommended both to instructors and students.

J. Németh (Szeged)

Commutative Harmonic Analysis I, Edited by V. P. Khavin and N. K. Nikol'skij, (Encyclopaedia of Mathematical Sciences, 15), VI+268 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

This volume is consisting of three parts: I. Methods and Structure of Commutative Harmonic Analysis (V. P. Khavin); II. Classical Themes of Fourier Analysis (S. V. Kislyakov); III. Methods of the Theory of Singular Integrals: Hilbert Transform and Calderon—Zygmund Theorem (E. M. Dyn'kin).

In the first part the following topics are detailed: A short course of Fourier analysis of periodic functions; Harmonic analysis in R^d; Harmonic analysis on groups; Historical survey on Fourier series; Spectral analysis and spectral synthesis.

The second part is dealing with the following materials: Fourier series (convergence and summability); The harmonic conjugation operator; Fourier coefficients; Absolutely convergent Fourier series; Fourier integrals.

The third part is devoted to the subjects as: Hilbert transform (in L^1, in L^2, in L^p and in Hölder classes); Calderon—Zygmund operators; L^2 estimates, L^p estimates; The maximal operator.

At the end of all parts rich references can be found. Furthermore it should be pointed out that numerous examples illustrate the connections to differential and integral equations, approximation theory, number theory, probability theory and physics.

This excellent well-written book should serve as a standard reference for researchers in the field but it can also be recommended to students who want to become researchers in mathematics.

J. Németh (Szeged)

Delay Differential Equations and Dynamical Systems, Edited by S. Busenberg and M. Martelli, (Lecture Notes in Mathematics, 1475), VIII+249 pages, Springer-Verlag, Berlin—Heidelberg—New York — London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

This is one of the Proceedings of a Conference in honor of Kenneth Cooke held in Claremont, California, Jan. 13—16, 1990 under the title International Conference on Differential Equations and Applications to Biology and Population Dynamics. A companion volume in the Biomathematics Lecture Notes series of Springer contains papers devoted to applications in biology and population dynamics. The contents of the present volume is summarized in the Preface by the editors as follows:

"The contributions in this volume are collected in two groups, the first consisting of survey articles and the second of research papers. The three survey articles are by Kenneth Cooke and Joseph Wiener who review the recently opened area of differential equations with piecewise continuous arguments; by Jack Hale who discusses a fascinating array of results in the stability of delay differential equations viewed as dynamical systems; and by Paul Waltman who presents an overview of useful new results on persistence in dynamical systems. The research contributions part of the volume consists of nineteen papers which present new results in delay differential equations and dynamical systems. The papers are united by the common thread of the underlying topic but, as is characteristic of this field, employ a wide array of deep mathematical theories and techniques. These include methods from linear and nonlinear functional analysis, a number of topological and topological degree techniques, as well as asymptotic and other classical analysis methods. Many of these mathematical techniques were originally created in order to address problems arising in the field of differential equations and are still being stimulated by challenges from this field."

Kenneth Cooke has been one of the most artful and original practitioners in the interdisciplinary research work involving delay differential equations, dynamical systems and their applications in biology and population dynamics. This volume is worthy of him, it will be very interesting and useful for scientists interested in the topic.

L. Hatvani (Szeged)

F. Digne—J. Michel, Finite Groups of Lie Type (London Mathematical Society, Student Texts, 21), 159 pages, Cambridge University Press, Cambridge—New York—Port Chester—Melbourne—Sydneay, 1991.

The aim of this volume is to present basic facts concerning a particular class of finite groups, called of Lie type. They are finite groups arising as groups of rational points of reductive groups over $\bar{F}_q$ defined over F_q.

The text follows a course given at the University of Paris VII in the academic year 1987—88, so that it contains a fairly complete picture of the topic on introductionary level in the style of a well-organized series of lectures. It is enough refer to the strict and consequent definition-proposition-corollary-remark structure which is completed by references at the end of each chapter (lecture). On the other hand the reader can find introductionary sentences at the beginning of the chapters, gaining perspective for the "audience". Furthermore, the proofs are well thought, and for the omitted ones (easy or standard) can be found a good reference.

The book is divided into 16 chapters. The introductionary chapter (ch. 0) is directed towards the basic knowledge on algebraic groups. Further chapters develop the theory step by step. The first three chapters provide a good introduction to this theory by explaining basic concepts as Bruhat decomposition, intersection of parabolic subgroups, rationality and Frobenius endomorphism. The subsequent chapters include a treatment of cohomological methods and Gelfand-Graev representations. Finally, the last chapter ensures numerous examples of finite groups of Lie type.

This volume is suitable by its design for introductionary courses or seminars on the subject.

J. Kozma (Szeged)

L. R. Foulds, Graph Theory Applications. (Univeritext), 385 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong, 1992.

The book is divided into two parts: the first one discusses the theory of graphs and the second one is dealing with the applications.

The first part begins with a historical background and the basic notations. The next chapters concerned with such a fundamental graph theoretical disciplines as the connectivity (Chapter 2), the trees as the most important class of the graphs (Chapter 3), Euler and Hamiltonian Graphs (Chapter 4) and the planarity. Chapter 6, on the matrices on graphs, is essential for a later discussion, on graph theoretic algorithms. Chapter 7 is an introduction to the directed graphs. These graphs are widely used in electrical ingeneering. The next chapter discusses the coverings and colouring which has applications in industrial ingeneering and other disciplines. Chapter 9 covers graph theoretic algorithms. The electrical ingeneering uses the results of the matroid theory which are introduced in Chapter 10.

Part II has mainly longer chapters explaining the applications of the abovementioned material in various branches of engineering, operation research and science. Due to limitation of space just a few applications have been presented in some depth: some exact and heuristic algorithms in operation research, the printed circuit design in electrical engineering, production planning and control, the facility layout (in which the author's research activity is well known) in industrial engineering. Some other algorithms are mentioned from the fields of physics, chemistry and biology. The last chapter covers such civil engineering applications as earthwork projects and traffic network design.

Since the book offered to different university courses each chapter has a separate subtitle with different exercises. This book, like the other works of the author, is written in clear style. The book is well organized and self-contained. Is is recommended as a textbook in teaching experience and for those students who are interested in the applications of graph theory in practice.

Gábor Galambos (Szeged)

Geometric aspects of Functional Analysis, Edited by J. Lindenstrauss and V. D. Milman (Lecture Notes in Mathematics, 1469), IX+207 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

This is the fifth published volume of the proceedings of the Israel Seminar on Geometric Aspects of Functional Analysis. The program on the first page shows that in the period 1989—90, as in the previous years, the most outstanding representatives of the subject participated at the seminar. The papers collected in this volume are original research papers and some survey papers which also contain new results. From the contents:

L. Carleson, Stochastic models of some dynamical systems; V. Milman, Some applications of duality relations; Ya. G. Sinai, Mathematical problems in the theory of quantum chaos; P. M. Bleher, Quasi-classical expansions and the problem of quantum chaos; A. G. Reznikov, A strenghtened isoperimetric inequality for simplices; M. Talagrand, A new isoperimetric inequality and the concentration of measure phenomenon; P. F. X. Müller, Permutations of the Haar system; J. Bourgain, On the distribution of polynomials on high dimensional convex sets; J. Bourgain, J. Lindenstrauss, On covering a set in R^d by balls of the same diameter; M. Meyer, S. Reisner, Characterization of affinely-rotation-invariang log-concave measures by section-centroid location; J. Bourgain, Remarks on Mongomery's conjectures on Dirichlet sums; M. Schmuckenschläger, On the dependence on ε in a theorem of J. Bourgain, J. Lindenstrauss and V. D. Milman; G. Schechtman, M. Schmuckenschläger, Another remark on the volume of the intersection of two L_p^n balls; J. Bourgain, On the restriction and multiplier problem in R^3.

The papers prove taht the organizers of the seminar and the participants keep continue the developing of a new theory which is a combination of the very strong methods of probability theory, Banach space theory and convex geometry. The volume is recommended mainly to specialists who would like to follow the results of this subject.

J. Kincses (Szeged)

E. Hairer—G. Wanner, Solving Ordinary Differential Equations II, Stiff and Differential-Algebraic Problems (Springer Series in Computational Mathematics, 14), VIII+601 pages, Springer-Verlag, Berlin—New York—Budapest, 1991.

This book is the continuation of the excellent Part I. (published in 1987 as Vol. 8 of the same Series). The present volume has all the virtues of the first part plus even more up-to-date material, more references (from the last 3 centuries), more then 100 figures and more humour. Let me quote just one pun exercise from page 213:

"Interpret the meaning of the "N" in the definition for AN-stability. Check among

⋮
Nec plus ultra
Notre Dame
Nottinghamshire
No smoking
⋮
other

and send to the authors."

This second volume reconsiders and enlarges the material of Part I. Chapter IV investigates

Runge-Kutta methods for stiff problems. Chapter V is on multistep methods for stiff problems. The last Chapter VI introduces singular perturbations and differential-algebraic equations.

This book needs no special recommendations. Everybody opening it will read it, too. I think it will be 'the' book for my graduate courses in the next few years.

János Virágh (Szeged)

Y. Hino—S. Murakami—T. Naito, Functional Differential Equations with Infinite Delay, (Lecture Notes in Mathematics, 1473), X+317 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

In several processes, e.g. in biology and population dynamics, it is typical that the velocity of the change of the state variable depends not only on the momentary values of the state variables but also on their earlier values, too. In other words, the future depends not only on the present but on the past, too. If one has to take into account only a finite segment of the past, then one has a functional equation with finite delay. In that case the single natural phase space is the space of continuous functions over a finite interval with the usual supremum norm. However, if one has to take into account the whole past, then the delay is infinite, and there is a big variety in the choice of the phase space among the linear spaces with seminorms. There are many facts which hold independently of each concrete phase space. It is a natural idea to summarize these results from the discussion of the equation on an abstract phase space defined by some axioms induced from many examples for the phase space. The authors develop the theory of the functional differential equations with infinite delay from such a point of view.

Chapter 1 contains the formulation of axioms of the phase space together with many examples. After a brief presentation of the basic theorems on the existence, uniqueness, continuous dependence of the solutions (Chapter 2) and an introduction to Stieltjes integrals (Chapter 3), the theory of linear equations is developed from Chapter 4 through Chapter 6. Chapter 7 is devoted to fading memory spaces. In Chapter 8 the stability problem in functional differential equations on a fading memory space is studied in connection with limiting equations. Chapter 9 discusses the existence of periodic and almost periodic solutions of functional differential equations.

This is a very important monograph; it should be on the shelf of every mathematician who makes research on functional differential equations.

L. Hatvani (Szeged)

I. S. Hughes, Elementary Particles, Third edition, XXII+431 pages, Cambridge University Press, Cambridge—New York—Port Chester—Melbourne—Sydney, 1991.

It would be difficult to find any other science that has developed in recent years as fast as particle physics. Therefore there is a great demand for textbooks presenting the subject in a comprehensive manner. This was the aim of the author and he fulfilled his task very well, by upgrading the earlier editions of the book.

The text is written for undergraduates in physics, but it can be interesting for a mathematical physicist as well, who deals with gauge field theory and related issues. The volume explains in simple terms the interesting interplay between actual physical experiments and theoretical concepts, that has led to the great revolution in particle physics in the last two decades. The reader gets some insight, how people do work in the huge laboratories of the few giant accelerator centers of the world, what are the principal features of their complicated apparatus, and understands the common aims and efforts of theorists and experimentalists to understand and classify the different interactions of elementary particles.

The organization of the chapters follows the historical formation of particle physics, what is certainly the consequence of the fact, that this is already the third edition of the book. This can be advantageous from a pedagogical viewpoint, but leads also to a certain kind of unbalance in the exposition. For instance the detailed and common discussion of muons and pions — such very different particles — should have been possibly avoided. On the other hand the reader can find every important fact of the subject in this book, the theory of leptons, quarks, gluons, weak bosons, spontaneous symmetry breaking, supersymmetry and all that explained only with simple quantum mechanics. Especially remarkable is the last chapter, written for this third edition about the connection between particle physics and cosmology.

M. Benedict (Szeged)

Arthur Jones—Sidney A. Morris—Keneth R. Pearson, Abstract Algebra and Famous Impossibilities (Universitext) X+187 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

In this book three of the oldest problems of mathematics are discussed. They are the cube duplication (the Delian problem), the angle trisection and the quadrature of the circle. These are construction problems performed by straightedge and compass, which are more than 2000 years old and have mytical origin known in several version. For example, one version of the problem of doubling the cube, found in a work of Eratosthenes (c. 284—192 B.C.) relates that the Delians, suffering from pestilence, consulted the oracle, who advised constructing an altar double size of the existing one. The Delian realized that doubling the side would not double the volume and therefore they turned to Plato, who told them that the god of the oracle had not so answered because he wanted or needed a doubled altar, but in order to censure the Greeks for their indifference to mathematics and their lack of respect for geometry. Plutach also gives this story.

Actually, these construction problems are extensions of problems already solved by the Greeks. Various explanations of the restriction to straightedge and compass have been given. The straight line and the circle were, in the Greek view, the basic figures, and the straightedge and compass are their physical analogues. Hence constructions with these tools were preferable. The reason is also given that Plato objected to other mechanical instruments because they involved too much of the world of sense rather than the world of ideas, which he regarded as primary.

The unsolvability of these problems was proved in the last century, based on the Galois theory and Lindemann's result on the transcendence of π.

It is very useful if these questions are in the curriculum of mathematics, but after a course of Galois theory (with a course on Group theory as prequisite) and after a course of Complex variables very few students can be involved in it.

The excellent book of Jones, Morris and Pearson solves this problem by giving a very simple and nearly self-contained treatment of the unsolvability of the three ancient constructing problems. Most of the material needs only some knowledge of linear algebra. This is the content of the first six chapters.

In the fairly independent Chapter 7 complete and elegant proofs of transcendence of e and π are given. In contrast to the most known proofs they need only elementary facts from the calculus.

A special feature of this volume that at the begining of the more complicated or long proofs there is an outline of the procedure.

Each chapter contains examples and exercises which makes the book more comfortable for teaching purposes. It is warmly recommended for second year university courses.

Lajos Klukovits (Szeged)

H. Jürgensen—F. Migliorini—J. Szép, Semigroups, 121 pages, Akadémiai Kiadó, Budapest, 1991.

The authors describe the book in the introduction as follows:

"This volume does not attempt to provide a "complete" presentation of semigroup theory. Instead, we focus on essentially one aspect: the classification of elements by properties of the induced translation and the related global structural properties of a semigroup. Several new results were found in particular, on increasing elements in semigroups and many new open problems were identified. In this sense, we hope that this book may serve not only as a summary but also a starting point for further research."

L. Megyesi (Szeged)

Frances Kirwan, Complex Algebraic Curves (London Mathematical Society Student Texts, 23), VIII+264 pages Cambridge University Press, Cambridge—New York—Port Chester—Melbourne—Sydney, 1992.

The purpose of this book is to give an introduction to the elementary methods of algebraic geometry and Riemann surface theory on the basis of the usual undergraduate courses of algebra, surface topology and complex analysis. Chapter 1 contains a collection of motivations from different areas of classical mathematics and historical background for the study of algebraic curves. Chapter 2 is devoted to the introduction of complex projective space and to the investigation of elementary properties of algebraic curves in this space. Chapter 3 studies the tangent and intersection properties of complex algebraic curves. Chapter 4 gives an investigation of the intuitive topological properties of algebraic curves and proves the degree-genus formula. In Chapters 5 and 6 the methods of holomorphic and meromorphic function theory are used for the study of the relations between complex algebraic curves and Riemann surfaces. There is given an introduction to the theory of abelian integrals and to the Riemann—Roch theory of nonsingular projective curves in the complex projective plane. Finally Chapter 7 is devoted to the study of the singularities of algebraic curves.

The book contains three appendices on the basic results of algebra, topology and complex analysis which are used in the treatment. Thus it is as self-contained as possible. There are given many exercises of different difficulties.

This well-organised book can be recommended to lecturers and students of universities and for mathematicians who are interested in the interrelation of algebra, geometry and analysis.

Péter T. Nagy (Szeged)

Helmut Koch, Introduction to Classical Mathematics I (Mathematics and Its Application, 70), XII+453 pages, Kluwer Academic Publishers, Dordrecht—Boston—London, 1991.

The main purpose of this volume is expressed by the author as follows: "This book is directed towards all those who have mastered two years of university mathematics. It aims to convey an overview of classical mathematics, particularly that of the 19th centrury and the first half of 20th century".

Here "classical" means that the methods and results discussed are the real classics of mathematics. Motivation, especially the original motivation, is a prime concern and so is clarity and, consequently, proofs and discussions are in terms of modern concepts and ideas. The order of the contents follows historical development beginning with Gauss', *Disquesitions Arithmeticae* and ending with the *Idee der Riemannschen Fläche* of Weyl.

The book is divided into 30 chapters, all of them end with exercises.

For further orientation here are some of the most characteristic chapter headings: Congruences; Quadratic forms; Theory of surfaces; Harmonic analysis; Prime numbers in arithmetic progressions; Theory of algebraic equations; The beginnings of complex function theory; Entire functions; Riemann surfaces; Elliptic functions; Riemann geometry; Field theory; Dedekind's theory of ideals; Theory of algebraic functions of one variable; Proof of the prime number theorem; Combinatorical topology.

The book is well written, the presentation of the material is clear. The necessary prerequisities are a basic knowledge of algebra and calculus.

This very valuable, excellent book is recommended to researchers, students and historian of mathematics interested in the classical development of mathematics.

J. Németh (Szeged)

Bernhard Korte—László Lovász—Rainer Schrader, Greedois. (Algorithms and Combinatorics, 4), 211 pages, Springer-Verlag, Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong, 1991.

This book is organized as follows. After an exhausting historical overview the authors review some basic concepts of matroid theory in Chapter II. Chapter III gives a comprehensive study of antimatroids and gives a large variety of examples. In the next three chapters the basic toolbox of matroid theory to greedoids have been extended. The chapters VII—X deal with special classes of greedoids. The first three of these answer the general question: which greedoids can be obtained from matroids and antimatroids by certain construction principles? In Chapter X the class of transposition greedoids is treated. Chapter XI was devoted to the optimization in greedoids and the last section deals with the connection between greedoids and topology.

The algorithmic principles play an ever increasing role in mathematics. The connection between the algorithms and the structure of the underlying mathematical object is obvious. The idea of greediness plays a fundamental role not only in discrete algorithms but in the design of continuous algorithms as well. This excellent book leads the reader to the current borderline of open research problems of greedoid theory. By unifying different approaches this self-contained book is an indispensable tool for all scientists interested in algorithmic aspects and computer science.

Gábor Galambos (Szeged)

P. Latiolais, Topology and Combinatorial Group Theory, (Lecture Notes in Mathematics, 1440), VI+207 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona, 1990.

In the last decades more and more nice and deep theorems and methods was born as a result of the interaction among topology, algebraic topology and combinatorial group theory. The aim of the editor of this proceeding was to present some of the most typical results of this subject. From the contents:

I. L. Anshel, On two relator groups; M. A. Bogley, When is the homotopy set $[X, Y]$ infinite?; R. N. Cruz, Periodic knots and desuspensions of free involutions on spheres; C. Droms, J. Lewin, H. Servatius, The Tits conjecture and the five — string braid group; C. Droms, B. Servatius, H. Servatius, The finite basis extension property and graph groups; B. Fine, Subgroup presentations without coset representatives; M. Frame, J. Hefferon, Fractal dimensions of limit sets of some Kleinian groups; R. Goldstein, Bounded cancellation of automorphisms of free products; C. Hog — Angeloni, A short topological proof of Cohn's theorem; C. Hog — Angeloni, On the homotopy type of 2 — complexes with a free product of cyclic groups as fundamental group; C. Hog — Angeloni, M. P. Latiolais, W. Metzler, Bias ideals and obstructions to simple — homotopy type; G. Huck, Embeddings of acyclic 2 — complexes in S^4 with contractible complement; W. Imrich, E. C. Tuener, Fixed subsets of homomorphisms of free groups; G. Lupton; A note on a conjecture of Stephen Halperins; M. Lustig, On the rank, the deficiency and the homological dimension of groups: the computation of a lower bound via Fox ideals; S. Rosenbrock, A reduced spherical diagram into a ribbon — disk complement and related examples; C. Schaufele, N. Zumoff, *-groups, graphs, and bases; T. W. Tucker, some topological graph theory for topologists: A sampler of covering space constructions;

The ideas and methods of these papers can be regarded as a kernel from which a new theory can be developed. This volume is recommended to everybody who is interested in this new subject of mathematics.

J. Kincses (Szeged)

Stanislaw Łojasiewicz, Introduction to Complex Analytic Geometry, XIV+523 pages, Birkhauser-Verlag, Basel—Boston—Berlin, 1991.

This monograph is a self-contained presentation of the basic results and methods of complex analytic geometry, i.e. the geometry of analytic spaces (sets) described by systems of analytic equations.

We can fully agree with the aim of the author: "It does not pretend to reflect the entire theory. Its aim is to familiarize the reader with the basic range of problems, using means as elementary as possible." So that it presents a number of the results and techniques in detail.

The first 138 pages develop most of the necessary background material on algebra, topology and complex analysis (on complex manifolds). The first chapter deals with rings of holomorphic functions, while the notion of analytic sets and germs can be found in the following chapter. The aim of the third chapter is to make clear the local structure of analytic sets. As a consequence of Rickert's descriptive lemma can be found the Hilbert Nullstellensatz. Chapter IV and V include some observations on local structure, singularity problems and holomorphic mappings (Rouche's theorem, Andreotti—Stoll theorem). Problem of normalization is considered in Chapter 6, based on Cartan-Oka theorem. The last chapter contains a comprehensive presentation of the ideas of Serre about the "necessary" algebraicity of analytical objects in projective spaces, including the most important theorems on algebraicity and normality from the elementary discussion of the manifold structure on the projective and Grassmannian spaces up to the characterization of biholomorphic mappings of Grassmann manifolds.

This new edition is an important contribution to the (English language) literature. It is a slightly revised and extended version of the Polish edition (translated from Polish by Maciej Klimek). The important changes in chapter V and VI are, first of all, the Grauert—Remmert formula, Cartan's closedness theorem and Serre's normality criterion (among others). These changes call forth some minor corrections and additional remarks in the first chapters, as well.

The book is a clearly written excellent expository text on the theory. It is carefully organized so convenient for the reader for individual study or as a text-book of seminars.

J. Kozma (Szeged)

Mathematik, Realität and Ästhetik — Eine Bilderfolge Zum VLSI Chip Desing —, Mathematics, Reality, and Aesthetics — A Picture Set on VLSI Chip Design —, Forschungsinstitut für Diskrete Mathematik Rheinische Friedrich — Wilhelms — Universität, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona, 1991.

About fifty years ago in the course of a discussion on the teaching of calculus in the secondary schools G. Alexits — a famous Hungarian mathematician — tried to sketch the intention of the teaching of mathematics in these schools. In his opinion one of the most important thing is the emphasis of the aesthetical features of the subject. G. H. Hardy wrote the following words in his booklet "A Mathematician's Apology": "The mathematician's patterns, like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way." The aesthetical features of the mathematics show a great variety. This (picture) book is produced by the Forschungsinstitut für Diskrete Mathematik Rheinische Friedrich — Wilhelms — Universität. The role of the discrete mathematics is constantly increasing. The partical and also the theoretical problems demand the changes. Perhaps the best is to cite some sentences of the (short) texts (the texts are in German and in English): "The Research Institute of Discrete Mathematics/Institute of Operations Research of the University of Bonn is engaged in the mathematical calculation and desingn of VLSI (very large scale integrated) logic chips within the framework of a scientific cooperation contract with IBM Germany.

The pictures shown here have been chosen to provide an insight into this design process. We have in particular tried to emphasize the contrast between the mathematical design (plotter plan) and physical reality (microphotograph of the chip).

For this purpose we have chosen a telecommunication chip with the code name ZORA.

It is especially satisfying for a mathematician interested in applications to see a direct relationship between the mathematical model and reality. We begin by showing several examples of the ZORA chip which can also be viewed in tenfold magnification. We next present a complete wiring and placement plan as calculated with methods of discrete mathematics. This is contrasted with a picture of the produced chip magnified 40fold. The pictures that follow show corresponding portions magnified 220fold to 4500fold.

As mathematics — and its applications — always has an aesthetic component, we have made the daring attempt to contrast some of our pictures which are a direct result of our desing algorithms with several chosen pictures of modern constructivist art. We hope that our artistically interested public as well as the artists themselves: De Stijl, Bauhaus, Mondrian, Albers, Bill, Lohse will forgive us."

This unusual book gives an interesting visual adventure to the reader and if he is a teacher then he will show these pictures to his students too, and perhaps everyone will see the connections of mathematics, arts and technology in another way.

L. Pintér (Szeged)

Matroid Applications. Edited by Neil White, 350 pages, Cambridge University Press, Cambridge—New York—Port Chester—Melbourne—Sydney, 1992.

This is the third volume of a series that began with Theory of Matroids and continued with Combinatorial Geometrics.

This volume begins with a chapter on the applications of matroid theory to the rigidity of frameworks (Walter Withley). In the next chapter M. Deza discusses the perfect matroid design problem which is one of the most beautiful application of the matroids. In Oxley's chapter different methods are considered for generalizing the matroid axioms to infinite ground sets. The next chapter (Simoes Pereira) is dealing with the matroidal families of graphs. Rival and Stanford consider two questions of algebraic aspects of partition lattices. T. Brylawski and J. Oxley discusses the matroid connection of the Tutte Polynomial and its applications. The last but one chapter (by A. Björner) desribes the homology and shellability properties of several simplicial complexes associated with a matroid. The book is concluded with an exposition by Björner and Ziegler on greedoids.

The book concentrates on the applications of matroid theory to a variety of topics from geometry, combinatorics and operation research. The contributors have written their articles to form a cohesive account so this volume is a valuable reference for research workers.

Gábor Galambos (Szeged)

Peter Meyer-Nieberg, Banach Lattices, XV+395 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

The book contains five chapters each of which is divided into sections. The first chapter introduces the notions of Riesz spaces and Banach lattices and develops the classical theory of these spaces. The second chapter is devoted to classical Banach lattices and contains technical results being essential for the remainder of the book. The third chapter studies operators which are defined on Riesz spaces or have values in a Riesz space from topological as well as lattice theoretical point of view. The fourth chapter is concerned with the spectral properties of positive operators on complex Banach lattices. In this chapter the so-called order spectrum of regular operators is also introduced. The last chapter investigates the structural properties of Banach lattices. At the end of each section a rich collection of exercises can be found. The familiarity of the reader with the Banach space theory is supposed.

L. Gehér (Szeged)

Microlocal Analysis and Nonlinear Waves, Edited by Michael Beals, Richard B. Melrose and Jefferey Rauch, (The IMA Vlumes in Mathematics and its Applications, 30), XI+199 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona, 1991.

The volume contains articles based on proceedings of a workshop which was a part of the 1988—89 IMA program on "Nonlinear Waves". Twenty years ago it was shown that some methods used for the investigation of the behaviour of linear hyperbolic waves can be applied to nonlinear problems, too. The use of these relatively new techniques characterizes the articles of this volume. The titles and authors of the works: On the interaction of conormal waves for semilinear wave equations (A. S. Barreto); Regularity of nonlinear waves associated with a cusp (U. Beals); Evolution of a punctual singularity in an Eulerian flow (J. Y. Chemin); Water waves, Hamiltonian systems and Cauchy integrals (W. Craig); Infinite gain of regularity for dispersive evolution equations (W. Craig, T. Kappeler and W. Strauss); On the fully nonlinear Cauchy problem with small data. II (L. Härmander); Interacting weakly nonlinear hyperbolic and dispersive waves (J. K. Hunter); Nonlinear resonance can create dense oscillations (J-L. Joly and J. Rauch); Lower bounds of the life-span of small classical solutions for nonlinear wave equations (Li Ta-Tsien); Propagation of stronger singularities of sulutions to semilinear wave equations (Liu Lingi); Conormality, cusps and non-linear interaction (R. B. Melrose); Quasimodes for the Laplace operator and glancing hypersurfaces (G. S. Popov); A decay estimate for the three-dimensional inhomogeneous Klein—Gordon equation and global existence for nonlinear equations (T. C. Sideris); Interaction of singularities and propagation into shadow regions in semilinear boundary problems (U. Williams).

L. Pintèr (Szeged)

Miscellanea Mathematica, Edited by P. Hilton, F. Hirzenbruch, R. Remmert, XIII+326 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

Mathematics is surrounded by certain mysticism. It is mostly due to its exactness, abstractness and his own individual language which often disguise its origins in and connections with the physical world. Publishing mathematics, therefore, requires special efforts and talent. Dr. Heinz Götze, with his typical enthusiasm, took up this challenge and has dedicated his life to scientific publishing. He has made a unique and invaluable contribution to the spread of the mathematical culture.

A group of 22 eminent mathematicians, including the editors of this volume, has decided to publish a "Festschrift" for him (a series of papers dedicated to him).

The result of their efforts is this volume which contains 22 independent articles. They are not usual research papers rather contributions to the culture of mathematics. Most of them have strong historical and/or personal feature.

The reviewer is sure that this Festschrift, this series of essays will be enjoyed by mathematicians and a lot of non-mathematicians, teachers and students of mathematics, everybody who interested in the culture of mathematics.

Lajos Klukovits (Szeged)

Numerical Methods for Free Boundary Problems, Edited by P. Neittaanmäki (International Series of Numerical Mathematics, 99), XV+439 pages, Birkhäuser-Verlag, Basel—Boston—Berlin, 1991.

This volume contains 4 invited lectures and 35 contributed papers of a Conference held at the University of Jyväskylä, Finland on July 23—27, 1990.

The invited lectures were: H. W. Alt and I. Pawlow: A mathematical model and an existence theory for non-isothermal phase separation — V. Barbu: The approximate solvability of inverse one-phase Stefan problem — H. D. Mittelmann, C. C. Law, D. F. Jankowski and G. P. Neitzel:

Stability of thermocapillary convection in float-zone crystal growth — V. Rivkind: Numerical solution of coupled Navier-Stokes and Stefan equations.

The contributed papers can be grouped around the topics Stefan like problems, optimal control, optimal shape design, identification, dam and fluid flow problems.

Many participants of the Conference came from Eastern Countries and their papers — hitherto hardly accessible to Western scientists — could be of special interest to both mathematicians and applied scientists.

János Virágh (Szeged)

Jan Okniński, Semigroup Algebras (Monographs and Textbooks in Pure and Applied Mathematics, 138), IX+357 pages, Marcel Dekker, Inc., New York, 1991.

The present book is the first monograph on the theory of noncommutative semigroup rings. This branch of ring theory has grown rapidly during the last ten years, and has proved to be very useful not only for constructing examples in various domains of ring theory but also as a tool in theories like those of linear representations of semigroups, representations of finite dimensional algebras, growth and Gelfand—Kirillov dimension of algebras.

Here is the table of contents of the book:

Part I. Semigroups and their algebras: 1. Completely 0-simple and linear semigroups. 2. Semigroups with finiteness conditions. 3. Weakly periodic semigroups. 4. Semigroup algebras: general results and techniques. 5. Munn algebras. 6. Gradations. — Part II. Semigroup algebras of cancellative semigroups. 7. Groups of fractions. 8. Semigroups of polynomial growth. 9. Δ-methods. 10. Unique-/two-unique-product semigroups. 11. Subsemigroups of polycyclic-by-finite groups. — Part III. Finiteness conditions. 12. Noetherian semigroup algebras. 13. Spectral properties. 14. Descending chain conditions. 15. Regular algebras. 16. Self-injectivity. 17. Other finiteness conditions: a survey. — Part IV. Semigroup algebras satisfying polynomial identities. 18. Preliminaries on PI-algebras. 19. Semigroups satisfying permutational property. 20. PI-semigroup algebras. 21. The radical. 22. Prime PI-algebras. 23. Dimensions. 24. Monomial algebras. 25. Azumaya algebras. — Part V. Problems.

Most of the material comes from the literature of the past 10 years, and several new results are included. The author's main concern was ring theoretical properties for which a systematic treatment could be presented. The starting point is mostly results on group rings, in the case of PI-semigroup algebras also those on commutative semigroup rings. The approach is that of ring theory, no special class of semigroups (except cancellative ones) is considered for its own sake. In consequence of this approach, putting together the results from pure semigroup theory in the book, one gets a rather specific and unusual but interesting selection of material.

Each chapter ends with bibliographical notes and comments on related results appearing in the literature. The last part presents 37 open problems (many of them extracted from the main text) with information on partial results and sometimes comments on possible developments.

Summarizing: This book is a valuable contribution to the literature. It puts together an important collection of results, and will therefore certainly serve as a basic reference in the field. By developing various interesting topics up to the borders of our present-day knowledge, it will hopefully stimulate further research. The exposition is very clear, suitable also for graduate students who are familiar with the fundamental results in ring theory. For the reviewer it was a pleasure to read this book.

László Márki (Budapest)

Robert E. O'Malley, Jr., Singular Perturbation Methods for Ordinary Differential Equations, (Applied Mathematical Sciences, 89), VIII+225 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

Perturbation theory provides a useful collection of methods for the study of equations close to equations of a specific (simpler) form. These equations are called *unperturbed*, and their solutions are assumed to be known. Perturbation theory studies the effect of small changes in the differential equations on the behaviour of solutions. The perturbed problem $P_\varepsilon(y_\varepsilon)=0$ (e.g. a boundary value problem, an integral or other operator equation) typically contains a small parameter $\varepsilon>0$ which represents the influence of many nearly negligible physical influences. The problem is a regular perturbation problem if its solution $y_\varepsilon(x)$ converges as $\varepsilon\to 0$ to the solution $y_0(x)$ of the unperturbed (limiting) problem $P_0(y_0)=0$. A singular perturbation is said to occur whenever the regular perturbation limit $y_\varepsilon(x)\to y_0(x)$ fails. This is the case e.g. if the small parameter ε is the coefficient of the highest derivative in the differential equation.

The book treats both the initial and boundary value problems, linear and non-linear ones· The methods are illustrated by interesting applications such as relaxation oscillations, a combustion model, semiconductor modeling, shocks and transition layers, nonlinear control problems. The numerous exercises closing the sections are extremely valuable.

This well-written and well-organized book can be highly recommended to both mathematicians and users of mathematics interested in ordinary differential equations.

L. Hatvani (Szeged)

Bruce P. Palka, An Introduction to Complex Function Theory (Undergraduate Texts in Mathematics), XVII+559 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona, 1991.

This book is the outgrowth of lectures held by the author at the University of Texas. The work is intended for a broad class of students, for students who are interested in practical questions and also for students who are primarily interested in theoretical problems. This great variety of the audience (and — I hope — the readers) requires a considerable effort from the author. To find the right level of mathematical rigor and to present the necessary details of considerations is such a task which does not go without rich pedagogical experiences. To offer the right emphasis on techniques and — on the other hand — on concepts and motivation is an important problem of the author. For the reviewer the most characteristic feature of this work is the excellent "mixing" of the conservative and modern discussions. Also the titles of the points of Chapter 5 (Cauchy's Theorem and its Consequences) give an insight into the attitude of this work: The Local Cauchy Theorem; Winding Numbers and the Local Cauchy Integral Formula. (Do you know where the expression "winding number" comes from? The author gives an answer to this question.); Consequences of the Local Cauchy Integral Formula; More about Logarithm and Power Functions; The Global Cauchy Theorems; Simply Connected Domains; Homotopy and Winding Numbers; Exercises (There are 83 exercises here, some of them with hints).

In the book you can find the customary themas of complex function theory, sequences and series of analytic functions, isolated singularities, conformal mapping and so on. My favourite one is the (short) chapter on harmonic functions. I am sure that the reader after investigating this chapter will be eager to read more about these problems.

The exercises worked out in the text and especially the proposed exercises at the end of the chapters represent an essential part of the work. Sometimes it is evident that the author spent as much effort in preparing these examples as he did on the corresponding main text itself.

At last I would like to mention the great number of the beautiful figures.

L. Pintér (Szeged)

Prospects in Complex Geometry. Proceedings of the 25th Taniguchi International Symposium held in Kata, and the Conference held Kyoto, July 31—August 9, 1989. Edited by J. Noguchy—T. Ohsawa (Lecture Notes in Mathematics, 1468), 421 pages, Springer-Verlag, Berlin—Heidelberg, 1991.

These contributions report on recent research on a wild spectrum of modern geometry. The central subject is complex structure with the point on geometric connections.

Each article is written by a prominent author specially for this volume.

Contents. Hyperkähler Structure on the Moduli Space of Flat Bundles (A. Fujiki), Hardy Spaces and BMO Riemann Surfaces (H. Shiga), Application of a certain Integral Formula to Complex Analysis (K. Takegoshi), On Inner Radii of Teichmüller Spaces (T. Nakanishi—T. Velling), On the Causal Structures of the Šilov Boundaries of Symmetric Bounded Domains (M. Taniguchi), A strong Harmonic Representation Theorem on Complex Spaces with Isolated Singularities (T. Ohsawa), Mordel-Weill Lattices of Type E_8 and Deformation of Singularities (T. Shioda), The Spectrum of a Riemann Surface with a Cusp (S. Wolpert), Moduli Spaces of Harmonic and Holonormic Mappings and Diophantine Geometry (T. Miyano), Global Nondeformability of the Complex Projective Space (Y.-T. Siu), Some Aspects of Hodge Theory on Non-Complete Algebraic Manifolds (I. Bauer—S. Kosarew), L^p-Cohomology and Satake Compactifications (S. Zucker), Harmonic Maps and Kähler Geometry (J. Jost—S. T. Yau), Complex-Analycity of Pluriharmonic Maps and their Constructions (Y. Ohnita—S. Udagawa), Higher Eichler Integrals and Vector Bundles over the Moduli of Spinned Riemann Surfaces (K. Saito).

J. Kozma (Szeged)

S. Prössdorf—B. Silbermann, Numerical Analysis for Integral and Related Operator Equations (Operator Theory: Advances and Applications, 52), 542 pages, Birkhäuser-Verlag, Basel—Boston—Berlin, 1991.

This monograph is devoted to the investigation of the 'boundary element methods' (sometimes referred to as 'boundary integral equation methods') for solving boundary value problems.

As the Authors state: "The book is addressed to a wide audience of readers. We hope that both the mathematician interested in theoretical aspects of numerical analysis and the engineer wishing to see practically realizable recipes for computations will find a few suggestions."

And now the bad news: "... The study of the equations we encounter... requires having recourse to a series of heavy guns from mathematical analysis." Chapters 1, 2 and 6 contain the theoretical background.

The primary aim of the book is to demonstrate the power of Banach algebra techniques in numerical analysis. In Chapter 7 they are introduced and applied to the finite section and collocation methods for singular integral operators. In Chapters 10—13 this approach is carried over to spline collocation and spline Galerkin methods. For further orientation here are a few characteristic notions tackled throughout the book: the convergence manifold concept for Fredholm integral equations of the second type, Wiener—Hopf integral equations and convolution equations of the Mellin type.

The 'Notes and Comments' part at each chapter gives full references and historical remarks of the presented material. Equipped with Notation, Name and Subject indices this book is a valuable source of information for all specialists working in this field.

János Virágh (Szeged)

Jeffrey Rauch, Partial Differential Equations (Graduate Texts in Mathematics), X+263 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

This work is based on a course given by the author at the University of Michigan. In our days perhaps one of the main problems of the lectures (writers) of partial differential equations is the following. Several important mathamatical notions appear in connections with problems concerning partial differential equations at first. See e.g. the Fourier series, various orthogonal systems and so on. But at the same time e.g. the application of the theory of Fourier series, Fourier transforms and other mathematical notions becomes an indispensable and powerful tool to our treatment. So e.g. the theory of the partial differential equations gives a natural introduction of the notion of the orthogonal series and at the same time it uses the results of the theory of these series. (Sometimes these results are relatively deep ones.) The author of this work assumes that the reader is trained in advanced calculus, real analysis, complex analysis and functional analysis. In an appendix there is a short introduction into the theory of distributions, but since from Chapter 2 the distribution theory is the basic language of the text. I hope that the reader has some knowledge from this theory, too. Although the aim of the author is to present such a text which requires no previous knowledge of differential equations, in my opinion only the reader who has some classical bases in differential equations will enjoy this work really. But for a qualified reader I can not recommend a better work in partial differential equations (taking into account the number of pages, too). I think this is a modern up to date discussion. The style is clear and inspiring. I like the remarks: "The reader is invited to give the generalizations by using the language of..."; "There are many ways of defining the notion of a function with derivative in $L^2(I)$. Most are equivalent and useful. One which is not good is that..." and the similar ones. Chapter headings and some titles of points are: Power series methods (The fully nonlinear Cauchy—Kovalevskaya theorem; F. John's global Holmgren theorem; Characteristics and singular solutions); Some harmonic analysis (Tempered distributions; L^2 derivatives and Sobolev spaces); Solution of initial value problems by Fourier synthesis (Schrödinger equation; Fourier synthesis for the heat equation; Fourier synthesis for the wave equation; Inhomogeneous equations, Duhamel's principle); Propagators and x-space methods (Applications of the heat propagator; The wave equation propagator for $d=1$, for $d=3$; The method of descent); The Dirichlet problem (Dirichlet's principle; The direct method of the calculus of variations; The Fredholm alternative; Maximum principles from potential theory).

L. Pintér (Szeged)

Reinhorld Remmert, Funktionentheorie II (Grundwissen Mathematik, 6), XIX+299 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

For a reader about to embark on research work in any field in which complex function theory plays a part this volume is a splendid and probably an essential introduction. The most characteristic feature of this book is a strange phenomenon: the readers see the finished work (building) but at the same time they see the starting-points, the development of the work (the support of the building). This development may be followed closely step by step. E.g. in the first chapter the presentation of the well-known product form of sin πz is a mathematical gem. The presentation of the material reminds me of the best Pólya's works. I have seen only a few books where the historical remarks form such an essential and natural part of the work as in the present case. To mention an especially interesting citation see p. 60 where we find: "Demonstratio formulae $\int_0^1 w^{a-1}(1-w)^{b-1}dw...$" by C. G. J. Jocobi, in original form written in Latin. (Of course this is not the most significant citation but a strange one.) The book consists of three main parts: infinite products, theory of mappings and selecta, and these parts consist of chapters. Some themas from these chapters: products of holomorphic functions; the gamma function; entire functions; holomorphic functions with given zeros; functions with given rational singular part; theorems of Vitali and Montel; the Riemann's mapping theorem etc. (The chapter on Riemann's mapping theorem is my favourite one in this book. A citation from the book: Ahlfors: "Riemann's writings are full of almost cryptic messages of the future. For instance, Riemann's mapping theorem is ultimately formulated in terms which would defy any attempt of proof, even with modern methods." Here are some mathemeticians who worked on the mapping theorem: C. Neumann, H. A. Schwarz, H. Poincaré, D. Hilbert, P. Koebe, C. Carathéodory, L. Fejér and F. Riesz. What a list of names!) The third part (Selecta) consists of special important questions. In general one cannot find these problems gathering systematically in one volume. Some of these questions are: theorems of Bloch, Schottky, Picard (after the „small" Picard's theorem we have "two amusing applications"), Fatou, M. Riesz, Ostrowski and the theory of Runge. Perhaps a reference to the solution Bieberbach's conjecture by de Branges fails to me in this part. Naturally this subjective remark does not diminish the advantages of this excellent work.

L. Pintér (Szeged)

Representation Theory of Finite Groups and Finite-Dimensional Algebras, Edited by G. O. Michler and C. M. Ringle, Proceedings of the Conference at the University of Bielefeld from May 15—17, 1991, IX+520 pages, Birkhäuser-Verlag, Basel—Boston—Berlin, 1991.

Besides the seventeen research papers in this book the first 220 pages are devoted to seven survay articles, which are:

B. Fischer: Clifford matrices,

B. Huppert: Research in representation theory at Mainz (1984—1990),

K. Lux and H. Pahlings: Computational aspects of representation theory,

B. M. Matzat: Der Kenntnisstand in der konstruktiven Galoisschen Theorie,

G. O. Michler: Contributions to modular representation theory of finite groups,

C. M. Ringel: Recent advances in the representation theory of finite dimensional algebras, and

K. W. Roggenkamp: The isomorphism problem for integral group rings of finite groups.

These papers give a good account of what progress has been made in group representation theory recently and how are the recent developments related to classical results and problems.

I recommend this excellent book mainly for experts of group (representation) theory and related topics.

Gábor Czédli (Szeged)

Y. S. Samoilenko, Spectral Theory of Families of Self-Adjoint Operators (Mathematics and Its Applications, 57), XVI+293 pages, Kluwer Academic Publishers, Dordrecht—Boston—London, 1991.

This volume is a translation by E. V. Tisjachnij; the title of the original work is: »Элементы математической теории многочастотных колебаний. Инвариантные торы« and it was published by »Наука« in Moscow, 1987.

The book deals with finite and countable families of self-adjoint operators which are connected by various algebraic relations. Such families are closely connected with representation theory of Lie groups and Lie algebras and are applied in the mathematical models of quantum systems.

Part I is devoted to commutative families of self-adjoint operators and discusses their joint spectral properties, the connections of such families with the unitary representations of inductive limits of certain Lie groups and (as illustration) deals with differential operators on functions of countably many variables. In Part II countable dimensional Lie algebras are discussed which are inductive limits of finite dimensional ones. Dealing with their representations, families of self-adjoint operators are treated, which establish basises in these Lie algebras. In Part III some algebraic relations are exactly defined for unbounded self-adjoint operators, and collections satisfying such relations are considered. Among others spectral properties are studied and structure theorems are given. In Part IV constructive methods of description of non-commutative random sequences are presented. The Bibliography lists more than five hundred items connected with the contents of the book.

The reader needs (of course) some backgrounds. The prerequirements include the basic theory of ∗-unbounded self-adjoint operators, Lie groups and Lie algebras as well as some knowledge of algebras and their representations. The book can be recommended to mathematicians and physicists interested in spectral theory, Lie algebras, (non-commutatative) probability, statistical physics, physical systems with many degrees of freedom or quantum field theory.

E. Durszt (Szeged)

W. M. Schmidt, Diophantine Approximations and Diophantine Equations (Lecture Notes in Mathematics, 1467), VIII+217 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong—Barcelona—Budapest, 1991.

This is the printed version of the author's lecture at Columbia University in the fall of 1987 and at the University of Colorado 1988/1989.

The text is devided into five chapters. The main topics of the first chapter are: Siegel's Lemma and heights (or "field height"). The second chapter is devoted to Roth's theorem, and its some useful generalizations. The Thue equation is in the centre of the third chapter. Among others there are interesting new results given by Bombieri, Mueller and the author (on the number of solutions of such equation, furthermore on the number of solutions of Thue equation with few nonzero coefficients). The fourth chapter deals with the S-unit equations and hyperelliptic equations. One of the interesting equations is: $2^x+3^y=4^z$; Evertse's results for this equation are very useful. The final chapter is devoted to diaphantine equations in more than two variables.

The rich Bibliography includes more than hundred references.

The book is easy-to-read, it may be a useful piece of reading not only for experts but for students as well.

J. Németh (Szeged)

J. B. Seaborn, Hypergeometric Functions and Their Applications, (Texts in Applied Mathematics, 8), XI+250 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona, 1991.

The main purpose of this book is to develop the theory of special functions which often occurs in applied mathematics, engineering and in classical and quantum physics. These functions (gamma function, Bessel functions, Hermite, Lagrange and Laguerre polinomials etc.) are solutions of differential equations, but more equivalent ways of defining these functions can be found in the text. It is shown that these functions can be expressed in terms of special power series, called hypergeometric functions which is the most practical method to the study and numerical calculation of these functions. The text is divided into 12 chapters. It is assumed that the reader is familiar with classical analysis and has some knowledge of Schrödinger equation.

L. Gehér (Szeged)

V. A. Smirnov: Renormalization and Asymptotic Expansions (Progress in Physics, 14), X+380, pages, Birkhäuser-Verlag, Basel—Boston—Berlin, 1991.

The monograph treats the fundamental problem of quantum field theory, how to remove divergences in the perturbation expansion of Feynman amplitudes. This is a very important procedure in modern theoretical physics, and it has shown up considerable successes in calculating experimentally measurable quantities. Renormalization is not only a certain calculational method, however, but also a theoretical construction involving group theory, graph theory, and the author tries to introduce both the practical and the principial aspects of the subject. The book is divided into three parts. The first one outlines the general problem and characterizes the nature of divergences. Part two is devoted to the different regularization schemes the Bogoliubov — Parasiuk — dimensional, the analytic and the auxiliary mass renormalizations. The infrared counterpart of usual renormalization is examined in detail. Part three contains the methods of asymptotic expansions, when the relevant energies and momenta are large. It is a pity that the author does not place this very interesting theme into a somewhat wider scope, at least a more detailed introduction would have been very useful. The style and the presentation is rather technical. Therefore, the book can be recommended mainly to the experts in quantum field theory.

M. Benedict (Szeged)

André Weil, The Apprenticeship of a Mathematician, 198 pages, Birkhäuser-Verlag, Basel—Boston—Berlin, 1992.

This excellent book is the English edition of the author's autobiography. It shows the life of a great mathematician whose horisons have never been limited to mathematics. His career led him to a lot of countries: to Italy, Germany first of all; to India where he lived and thaught at a critical time in the history of that country; to Russia; to Princeton called at times a mathematician's paradise to Finland (to a prison, where he narrowly escaped execution); to France where he was convicted for dodging his military obligations (in the prison — like a lot of mathematicians in the history — he had time to write one of his best mathematical works); to England where lived through the Battle of London before returning to France and then to United States and finally to Brasil, scene of the last of his vicissitudes, before returning permanently to United States. Through these often picturesque episodes, the destiny of a mathematician is unfolded, of which perhaps the most important event was his participation in the foundation of the Bourbaki Group.

This very enjoyable reading is recommended to all mathematicians.

J. Németh (Szeged)

Anatoly A. Zhigljavsky, Theory of Global Random Search (Mathematics and Its Application, 65), Edited by J. Pintér, XVIII+341 pages, Kluwer Academic Publishers' Dordrecht—Boston—London, 1991.

The book is the English translation of an earlier work of the author written in Russian (Leningrad University Press, 1987). Beyond the general overview of global optimization methods, the majority of the volume deals with random search methods and their theoretical background.

In recent years, several review books and monographs have been published on global optimization. Dixon and Szegő edited two volumes of contributed papers of the Workshops Towards Global Optimisation 1 and 2 (North-Holland, 1975 and 1978). The first overview of the field was the book of Törn and Žilinskas (Global Optimization, Springer, 1989) followed by the volumes of Horst and Tuy (Global Optimization — Deterministic Approaches, Springer, 1990) and Floudas and Pardalos (Recent Advances in Global Optimization, Princeton, 1991). Specific parts of the field have been addressed by Pardalos and Rosen (Constrained Global Optimizations Algorithms and Applications, Springer, 1987), Mockus (Bayesian Approach to Global Optimization, Kluwer, 1989) and Floudas and Pardalos (A Collection of Test Problems for Constrained Global Optimization Algorithms, Springer, 1990).

The book of Zhigljavsky completes this series quite well: the random search and sampling methods have not been studied in such a detailed way. The reader will find an interesting comparison of present global optimization methods according to their conditions, type of information utilised, theoretical grounds and amount of numerical results available. The construction and convergence of global random search algorithms and the role of statistical inference in global optimization are investigated thoroughly together with some auxiliary results.

The strength of the bibliography including some 240 references is that special attention is devoted to the Russian language literature that remains usually hidden for the English-oriented part of the optimization community. The unusual typesetting (e.g. $\mathscr{R}^n$ and χ instead of the more common R^n and X causes an uneven line-spacing in the book that (together with many other errors) makes the reading somewhat tiring. The volume can be recommended for those working in the field of multiextremal nonlinear optimization and interested in stochastic methods.

T. Csendes (Szeged)