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BOOK REVIEWS

JAMES W. DEMMEL, *Applied Numerical Linear Algebra*, SIAM, Philadelphia, 1997, ISBN 0-89871-389-7, xi + 419 pp.

This book is intended to provide an introduction to the numerical linear algebra.

In chapter 1 – *Introduction* – there are introduced and motivated some basic notions and concepts.

Chapter 2 – *Linear Equation Solving* – deals with direct methods for linear systems. The Gaussian elimination and various aspects involved are described for general linear systems: perturbation theory, error analysis, improving the accuracy of a solution, blocking algorithms for higher performance.

In chapter 3 – *Linear least squares problems* – there are first discussed the techniques based on the normal equations, the *QR* decomposition and the singular value decomposition. The Householder transformations and the Givens rotations are described, together with some results on roundoff errors. The rank-deficient least squares problem is also treated.

Chapter 4 – *Nonsymmetric eigenvalue problems* – discusses the canonical forms (Jordan and Schur) perturbation theory and several algorithms for solving such problems. Generalized eigenproblems are also dealt with.

Chapter 5 is entitled *The symmetric eigenproblem and SVD*. The perturbation theory is treated in depth, followed by the description of direct methods. These algorithms are also described when used for the singular value decomposition. Some differential equations are presented for the motivation of symmetric eigenproblems.

In chapter 6 – *Iterative methods for Linear Systems* – the Poisson's equation constitutes the model problem on which the iterative methods successively introduced are discussed. There are analysed both classical and modern methods: Jacobi, Gauss-Seidel, SOR, Krylov, Fast Fourier Transform, block cyclic reduction, multigrid and domain decomposition methods.

The last chapter – *Iterative Methods for Eigenvalue Problems* – deals mainly with the symmetric case. The Rayleigh-Ritz method is discussed and then the Lanczos algorithm is analysed in detail both in exact and in floating point arithmetic, together with its variant of selective orthogonalization.

The author obtains a very clear and complete picture (in the sense of the different aspects involved) for each topic discussed. The perturbation theory is given for all the three main problems: linear systems, linear least squares and eigenproblems. The results and methods are presented in a simple and intuitively but yet rigorous manner. The fact that some proofs are only in sketch or are referred to some bibliographical items help in focusing on the essential in understanding the problems.

Each chapter contains at the end some exercises of increasing difficulty which help the reader to familiarize with the existing problems and with the techniques of solving them.

The methods are described mathematically and then algorithmically, different technical aspects being revealed. The advantages and disadvantages are presented both from theoretical and practical standpoints. Tables summarizing the performances of the algorithms and indicating which method is most suitable for a certain problem are given. The existing procedures in Matlab and Lapack are systematically presented, together with references to other existing software.

There are presented classical results but also current research trends, which makes this book both an introductory text and a reference describing the current state of the art in the domain of numerical linear algebra. Hence, the broad audience of this book includes not only students but also scientists interested in this field.

Emil Cătinaş

A. GREENBAUM, *Iterative Methods for Solving Linear Systems*, SIAM, Philadelphia, 1997, ISBN 0-89871-396-X, xiii + 220 pp.

The numerical solving of linear systems is a very important field of the numerical analysis, since many of the techniques used in practice finally lead to such problems. The present book offers an overlook on the modern topics on solving linear systems: Krylov methods and preconditioning techniques. These domains were subject to active research in the last decades and they still are continuously growing. In some cases the existing methods are well understood (e.g. hermitian systems) while in other cases few things are known.

This book is published in the *Frontiers in Applied Mathematics* series. It contains 12 chapters, a bibliography and an index. Its structure is the following:

1. *Introduction*

Part one: Krylov Subspace Approximations

2. *Some Iteration Methods*, 3. *Error Bounds for CG, MINRES and GMRES*, 4. *Effects of Finite Precission Arithmetic*, 5. *BiCG and Related Methods*, 6. *Is There a Short Recurrence for a Near-Optimal Approximation?*, 7. *Miscellaneous Issues*.

Part two: Preconditioners

8. *Overview and Preconditioned Algorithms*, 9. *Two Example problems*, 10. *Comparison of Preconditioners*, 11. *Incomplete Decompositions*, 12. *Multigrid and Domain Decomposition Methods*.

The author performs a deep and profound analysis of the iterative methods, pointing out the essential mathematical aspects in the solved and unsolved problems.

The methods are described both theoretically and algorithmically, the balance inclining not in favor of the algorithmically details but in the favor of the underlying mathematics of the methods.

We warmly recommend this book both to specialists and nonspecialists as well in numerical linear algebra.

Emil Cătinaş

M. MATZEU, A. VIGNOLI, *Topological Nonlinear Analysis II Degree, Singularity and Variations*, Birkhäuser, Boston-Basel-Berlin, 1997, 601 pp., ISBN 0-8176-3886-5.

The present volume is intended, at least partly, to be a continuation of the successful book *Topological Nonlinear Analysis: Degree, Singularity and Variations*, published by Birkhäuser in 1995. It contains survey articles concerning three main streams of research: topological degree, singularity theory and variational methods. Each article starts with an historical introduction, concludes with the discussion of significant achievements obtained during the last decades and finishes with a rich bibliography. The result is a dynamic overview on the field to which the author, a distinguished specialist, has himself brought major contributions. The most of the materials in this book were presented by the authors at the "Second Topological Analysis Workshop on Degree, Singularity and Variations: Developments of the Last 25 Years" held in June 1995 at Villa Tuscolana, Frascati, near Rome.

The contents are: G. Dell'Antonio, Classical solutions for a perturbed N-body system (86 pp. with proofs, 23 references); H. Brezis, Degree theory: old and new (22 pp. without proofs, 23 references); P. T. Church and J. G. Timourian, Global structure for nonlinear operators in differential and integral equations I. Folds (52 pp. with some proofs, 85 references); P. T. Church and J. G. Timourian, Global structure for nonlinear operators in differential and integral equations II. Cusps (86 pp., 123 references); K. Geba, Degree for gradient equivariant maps and equivariant Conley index (26 pp. with proofs, 30 references); U. Mosco, Variations and irregularities (42 pp. without proofs, 96 references); B. Ruf, Singularity theory and bifurcation phenomena in differential equations (82 pp. with proofs, 76 references); C. A. Stuart, Bifurcation from the essential spectrum (48 pp. with proofs, 84 references); P. P. Zabrejko, Rotation of vector fields: definition, basic proprieties, and calculation (157 pp. without proofs, many comments and examples, 726 references).

Such survey papers are very welcome; they are to systematize and make clear new material, point out the main problems and results, and guide the future research work. They will be of particular interest to postgraduate students and young mathematicians who would like to understand basic problems and methods in nonlinear analysis and make rapid progress through the more and more branchy literature in the fields. We also recommend this book to all specialists in these areas.

Radu Precup

GHEORGHE MICULA and SANDA MICULA, *Handbook of Spline*, Kluwer Academic Publisher, Dordrecht/Boston/London.

The purpose of this book is to give a comprehensive introduction to the theory of spline functions, together with some applications to various fields, emphasizing the significance of the relationship between the general theory and its applications.

At the same time, the goal of the book is also to provide new material on spline function theory, as well as a fresh look at old results, being written for people interested in research, as well as for those who are interested in applications.

The theory of spline functions and their applications is a relatively recent field of applied mathematics.

In the last 50 years, spline function theory has undergone a wonderful development with many new directions appearing during this time. This book has its origins in the wish to adequately describe this development from the notion of "spline" introduced by I. J. Schoenberg (1901–1990) in 1946, to the newest recent theories of "spline wavelets" or "spline fractals". Isolated facts about the functions now called "splines" can be found in the papers of L. Euler, A. Lebesgue, G. Birkhoff, J. Favard, L. Tschakaloff, L. Collatz, T. Popoviciu, D. V. Ionescu. However, the theory of spline functions has been developed in the last 40 years through the effort of many mathematicians. As late as 1960, there were no more than a handful of papers mentioning spline functions by name. Today, less than 40 years later, there are, to our knowledge, more than 357 books, monographies and conference reports, many thousands original papers, and more than 311 dissertations for a doctoral degree or habilitation, on various aspects of spline functions and their applications, and it is still an active research area.

The rapid development of spline functions is due primarily to their great usefulness in applications. Classes of spline functions possess many nice structural properties as well as excellent approximation powers. Since they are easy to evaluate and manipulate on a computer, a myriad of applications to the numerical solution of a variety of problems in applied mathematics has been found. The enormous literature published during the last decades, shows that the actual development of spline theory has an essential influence on large areas of modern numerical mathematics, such as: data fitting, interpolation and approximation, numerical integration and differentiation, numerical treatment of integral, differential and partial differential equations, optimal approximation, calculation of eigenvalues and eigenfunctions of operators, control theory, computer aided geometric design and computational geometry, numerical methods of probability theory and statistics, wavelets and fractals.

While this book attempts to give a comprehensive treatment of the basic methods in spline and their applications, it is not meant to provide solutions to all problems that have arisen in this field in the last years.

However, it is our hope that enough information has been included which may be of interest to the reader.

A detailed analysis of many of the most important applications involves a great deal of material in the specific area from which they are taken. Therefore, an attempt has been made by the authors to include comprehensive (if not quite exhaustive) references to the literature, to enable the interested readers to find as much of the omitted material as they wish.

The book is organised as follows: Preface. 1. Spline Functions and the Representation of Linear Functionals. 2. Multivariate Spline Functions. 3. Nonlinear Sets of Spline functions. 4. Numerical Treatment of the Integral Equations. 5. Numerical Solution of Ordinary Differential Equations. 6. Splines and Finite Elements. 7. Finite Element Method for Solution of Boundary Problems Differential Equations. 8. Spline Functions in Computer Aided geometric Design. 9. From Spline to Fractals. 10. Box Splines. 11. Spline Wavelets. 12. References Index.

The references to the literature contained at the end of this book try to be the most exhaustive possible. To make the list as complete as possible, the first author has exhausted all sources available over many years. All publications that have become known to us until August 1998 are listed, subdivided in three sections: books, monographies and conference reports; original papers: dissertations for doctoral degree or habilitation.

Ion Păvăloiu

M. G. NADKARNI, *Basic Ergodic Theory*, Birkhäuser Advanced Texts, Birkhäuser Verlag, Basel-Boston-Berlin, 1998, vi + 149 pp., ISBN 0-8176-5816-5 and 3-7643-5816-5.

The book is an introductory text in ergodic theory, requiring from the reader only a knowledge of the basic measure theory and metric topology. The exposition focusses more on interactions with classical descriptive set theory than other texts on the same topic. For instance, some basic topics of ergodic theory such as Poincaré recurrence lemma, induced automorphisms and Kakutani towers, compressibility and E. Hopf's theorem, the theorem of Ambrose on the representation of flows, are treated first (in Chapters 1 and 2) using only descriptive set-theoretical tools, before presenting their measure theoretic or topological versions. These first two chapters of the book, Ch. 1, The Poincaré recurrence lemma, and Ch. 2, Ergodic theorems of Birkhoff and von Neumann, can serve as a base for a course of four to six lectures at the advanced or beginning graduate level (as it has been done by the author at some universities in India). The other chapters of the book are headed as follows: 3. Ergodicity, 4. Mixing conditions, 5. Bernoulli shifts and related concepts, 6. Discrete spectrum theorem, 7. Induced automorphisms and related concepts, 8. Borel automorphisms are Polish homeomorphisms, 9. The Glimm-Effros theorem, 10. E. Hopf's theorem, 11. H. Dye's theorem, 12. Flows and their representations.

The bibliography at the end of the book is arranged by chapters. Some chapters ends with a section entitled Asides, containing very interesting historical remarks and comments on the relevance of ergodic theory for other disciplines, mainly mechanics (celestial) and physics.

The book was first published in 1995 and in this second edition, besides the correction of some errors and inaccuracies, a brief discussion of the ergodic theorem of Wiener and Wintner and a section on rank one automorphisms have been incorporated in Chapters 2 and 7, respectively.

The book can be warmly recommended to every desiring to be acquainted, in a relatively short time and on an accessible, but rigourous way, with the basic results and tools of ergodic theory.

S. Cobzaş

M. G. NADKARNI, *Spectral Theory of Dynamical Systems*, Birkhäuser Advanced Texts, Birkhäuser Verlag, Basel-Boston-Berlin, 1998, vii + 182 pp., ISBN 0-8176-5817-3 and 3-7643-5817-3.

The book is concerned with the spectral theory of dynamical systems, where by a dynamical system one understands a measure space on which a group of automorphisms acts preserving sets of measure zero.

The first five chapters of the book are dealing with spectral measures and unitary operators on Hilbert space and present results on unitary equivalence of two spectral measures on two L^2-spaces, multiplicity, rank and spectral theorem for unitary operators, Hahn-Hellinger theorem, symmetry and denseness of the spectrum, skew products. Applications to stochastic processes are also included. In Ch. 6 a deep result of H. Helson and W. Parry on measure preserving transformation of a countable group which is orbit equivalent to a week von Neumann automorphisms, is proved. In Ch. 7 probability measures on the circle are studied and Ch. 8 is concerned with some Baire category methods in ergodic theory and presents results obtained by V. Rokhlin, A. Katok, A. Stepin, A. del Junco. Other topics treated in the book are: translations of measures on the circle (Weil-Mackey theorem), Host's theorem on weakly mixing measure preserving automorphisms, non-singular automorphisms and their L^∞ eigenvalues, imprimivity, generalized Riesz products with applications to rank one automorphisms.

The last chapter of the book, Ch. 16, Additional topics, contains the proof of V. Alexeyev on the existence of a bounded function with maximal spectral type, some results due to O. Ornstein on mixing rank one automorphisms, and the total ergodicity lemma (a proof by El Houcein).

The bibliography at the end of the book is arranged by chapters and includes some original papers of the authors, too.

Bringing together results scattered in the literature and exposing them in a unified and accessible way, moving from introductory material to some topics of current research, the book is directed both to advanced students intending to enter this modern and very promising area of investigations, as well as to researchers in dynamical systems.

S. Cobzaş

SERGEY BAGDASAROV, *Chebyshev Splines and Kolgomorov Inequalities*, Operator Theory-Advances and Applications, vol. 105, Birkhäuser Verlag, Basel-Boston-Berlin, 1998, ISBN 3-7643-5984-6 and 0-8176-5984-6, xiii + 205 pp.

The perfect polynomial spline functions of degree r (i.e. functions whose derivatives of order r take the values $+1$ and -1 on adjacent intervals) play an essential role in the study of some extremal problems in $W_\infty^r(I)$ such as: the best approximation of a function by elements in finite dimensional subspaces, the problem of sharp Kolmogorov inequalities for intermediate derivatives of functions, etc.

Consider the classes of functions:

$$W^rH^\omega([a,b]) := \{x \in C^r[a,b] : \omega(x^{(r)}; t) \le \omega(t),\ t \in [0, b-a]\}$$

and

$$\tilde{W}^rH^\omega := \{x \in W^rH^\omega(\mathbb{R}) : x(t+2\pi l) = x(t),\ t \in [-\pi, \pi],\ l \in \mathbb{Z}\}$$

($W^0H^\omega = H^\omega$), where $\omega : \mathbb{R}_+ \to \mathbb{R}_+$ is a concave modulus of continuity.

The declared aims of the book are the following: (1) to introduce the notion of perfect ω-splines in W^rH^ω; (2) to describe various extremal properties of these functions; and (3) to apply the general theory of perfect splines to the calculation of N-width of classes $W^rH^\omega(I)$. The author applies also this theory to give a solution to the famous Kolmogorov problem on sharp inequalities between intermediate derivatives in the Hölder classes $W^rH^\omega(X)$, for $X = \mathbb{R}_+$ and $X = \mathbb{R}$.

The book contains 17 chapters, two Appendices, a Bibliography of 93 titles and an Index.

Chapters 0–3 contain some auxiliary results as Borsuk theorem, Chebyshev theorem, the notion of simple kernel and that of a rearengement of it. The emphasis is on results needed for the study of extremal problems in W^rH^ω.

Chapter 4 is concerned with the definition of perfect Chebyshev splines and their properties, while in Chapter 5 one obtains a formula of numerical differentiation and a sufficient condition for a function $f \in W^rH^\omega[0,1]$ to be extremal for the Kolmogorov-Landau (K-L) problem.

Chapter 6 contains the main result of the book: the description of the family of Chebyshev ω-splines $\{Z_n;\ n \ge r\}$ of the Kolmogorov-Landau problem on a finite interval.

In Chapters 7 to 16 there are studied some extremal problems of (K-L)-type ($f^{(m)} \to \sup$) or concerning N-width, in various classes of functions.

The Appendices are concerned with Kolmogorov problem for functions $f \in W^rH^\omega(\mathbb{R}_+)$: $\|f\|_{L_p(\mathbb{R}_+)}$ (Appendix A) respectively in $W^{-1}H^\omega(\mathbb{R}_+)$ and $W^1H^\omega(\mathbb{R}_+)$ (Appendix B).

The book is clearly written, contains a lot of results (including author's original results) and will be of interest for researchers in approximation theory, applied functional analysis and numerical analysis.

C. Mustăţa

G. H. GOLUB and C. F. VAN LOAN, *Matrix computations*, third edition, The Johns Hopkins University Press, Baltimore and London, 1996, ISBN 0-8018-5413-X, xxvii + 694 pp.

The third edition of this famous book improves the former one by additional information and by rewritten topics. It contains 12 chapter followed by a bibliography and an index. The titles of the chapter are as follows: *1. Matrix Multiplication problems, 2. Matrix Analysis, 3. General Linear Systems, 4. Special Linear Systems, 5. Orthogonalization and Least Squares, 6. Parallel Matrix Computations, 7. The Unsymmetric Eigenvalue Problem, 8. The Symmetric Eigenvalue Problem, 9. Lanczos Methods, 10. Iterative Methods for Linear Systems, 11. Functions of Matrices and 12. Special Topics.*

It is hard to say in few words all the things that should be said about the impressive work of Golub and Van Loan. We begin by noting that this book refers to the major aspects occurring in

the numerical treatment of the main problems concerning matrices: linear systems, eigenvalue / eigenvector problems and least squares problems. The mentioned aspects are: perturbation theory, methods of solving, algorithms for implementing the methods, round-off error analysis and corresponding routines of performant software.

The important results on perturbation theory are systematically given. Classical and recent developed methods are described in a simple and easy to understand manner. Different results and properties are either proved or enounced as exercises. The methods are also described algorithmically, the practical aspects being revealed. There is addressed the important topic of round-off analysis. The related Matlab and Lapack routines are listed for each subject.

These facts naturally lead to the conclusion that the present book successfully accomplishes the difficult task of treating so many topics in a single volume.

The impressive bibliography constitutes another distinct characteristic. Every section from each chapter contains notes and references to relevant books and articles. Moreover, in the end of the book there is given a comprehensive list of bibliography items.

All these reasons make us believe that this book is addressed, as any such encyclopedic work, to all persons interested in numerical mathematics.

Emil Cătinaş

Statistical and Probabilistic Models in Reliability, D. C. Ionescu and N. Limnios (Editors) Statistics For Industry and Technology, Birkhäuser Verlag, Basel-Boston-Berlin, 1999, xxxvi + 352 pp., ISBN 0-8176-4068-1 and 3-7643-4068-1.

In our world, dominated by more and more sophisticated and complex plants, reliability is one of the most important task of technological research, design and production. Reliability theory is based on statistical and probabilistic models. Modelling and models appear in all stages of the reliability analysis, a model being a representation in mathematical terms of reality: based on some hypotheses representing particular features of technical systems. These hypotheses are given by the technologists, while the mathematicians have the task to build up the models starting from these hypotheses and to give numerical evaluations. It is obvious that the elaboration of a working model needs cooperation of both categories of analysts, technologists and mathematicians. A technologist will hardly be able to identify the right hypotheses without knowing the modelling techniques and a mathematician will never be able to build purely theoretical models capable to answer all technical problems. In fact, due to the complexity of the problems, the reliability analysis is decomposed and modulated in specific submodels.

The present volume contains 24 papers selected from the 61 presented at the 1st International Conference on Mathematical Methods in Reliability, held from 16 to 19 September 1997 at the Polytechnic University of Bucharest, Romania, and organized in cooperation with the Technological University of Compiègne, France. The main target of the Conference was to bring together mathematicians and technologists interested in reliability theory, in order to exchange information, to discuss open problems, and to fill in the gap between theory and real-life problems.

The papers are grouped in three parts: I. Statistical methods, II. Probabilistic methods, and III. Special techniques and applications. This volume contains both survey and contributed papers dealing with topics as: estimation of accelerating of life date, modelling of the components subject to random diffuse stress environment, semi-Markov reliability models, statistical methods for repairable systems, accelerating life testing, asymptotic methods in reliability analysis of stochastic systems, etc.

The volume is very well organized: a detailed contents including the titles sections for each paper, lists of tables and of figures, a glossary of key technical terms, a subject index and a list of participants (with full addresses). A Foreword by Marius Iosifescu, Honorary President of the Organizing Commitee, and a Preface by the Editors of the volume are also included.

The volume contains up-to-date surveys of new models and methods, covering relevant statistical and probabilistic methods. The style is informal, with many tables, data sets and graphs, making it accessible to a broad audience.

The volume is recommended to mathematicians and engineers interested in statistical and probabilistic models, in reliability theory, reliability engineering and risk analysis.

C. Mustăţa

PREM K. KYTHE, *Computational Conformal Mapping*, Birkhäuser Verlag, Basel-Boston-Berlin, 1998, xvi + 462 pp., ISBN 3-7643-3996-9 and 0-8176-3996-9.

As it is well known, Green's functions for simple regions, as circles, squares, or annuli, can be calculated effectively, allowing to find exact solutions of boundary problems for these regions, even for rather complicated boundary conditions. But this method doesn't work for more complicated regions, even for simple boundary problems such as the Dirichlet problem. A possible approach to overpass this difficulty is to map conformally multiple connected regions onto simpler connected regions, yielding in change not only the regions and the boundary conditions, but also in the governing differential equations. Conformal mappings of multiple connected regions are harder to handle than those of simple connected ones, most of the computational details being carried out only numerically.

The main purpose of the present book is to provide a self-contained and systematic introduction to the theory and computation of conformal mappings of simply or multiply connected regions onto the unit disc or onto other canonical regions, with applications to boundary problems for integral equations. It is based on a graduate course for students in applied mathematics or engineering, taught by the author at the University of New Orleans in 1997. The prerequisites for its reading are a first course in complex analysis and familiarity with basic results in numerical analysis and integral equations (of Fredholm and Stieltjes type). A good working knowledge of Mathematica as well as a knowledge of a programming language (Fortran or C++) are also required.

The book is divided into 15 chapters and 4 appendices. The first one, Chapter 0, contains a hystorical overview of the problem: backgrounds and modern developments. The basic concepts of complex analysis including Scwartz-Christoffel transformations of polygonal domains, are presented (some without proofs) in Chapters 1 and 2. Chapter 3 is concerned with computational methods (e.g. Newton method) for Schwarz-Christoffel improper integrals. This chapter contains also the recent complete solution, given by A. L. Elcrat and L. N. Trefthen in 1986, to the old flow problem stated by Kirchoff in 1868. Polynomial approximation, minimum area problem and Ritz and Bergmann kernel algorithms are treated in Ch. 4. Chapter 5 is concerned with nearly circular regions and Ch. 5 with numerical evaluations of Green functions for various kinds of regions.

Numerical methods for various integral equation formulations of the conformal mapping problem are discussed in Chapters 7, 8, 9, 11 and 13. Ch. 10 is concerned with Jukowski function and airfoils. Ch. 12 presents an important aspect of the conformal mapping problem, namely for regions with boundaries with corners. The behavior of univalent mapping for doubly connected domains are studied near the boundary in Ch. 12. this study being continued in Ch. 13 for multiple connected domains. The last chapter of the book, Ch. 14, gives applications of conformal mappings in adaptive grid generation.

The book contains 74 case studies and 96 end-of-chapter problems supplied with hints. Concerning the computational aspects, many of the programs included in the book are available in the public domain and the included algorithms are detailed enough to generate computer programs with ease.

The book is clearly written, the topics are carefully selected and meticulously presented. The bibliography is extensive, including references to computer programs.

In conclusion, the book is highly recommended as a reference text for applied mathematicians, computer scientists, physicists and engineers, interested in numerical aspects of complex analysis with applications to integral equations. It can be used also as a textbook for teaching or for self-study.

S. Cobzaş

WERNER C. RHEINBOLDT, *Methods for Solving Systems of Nonlinear Equations*, SIAM, Philadelphia, 1998, CBMS-NSF Regional Conference Series in Applied Mathematics, ISBN 0-89871-415-X, ix + 148 pp.

This is the second edition of this monograph, the first edition being published in 1974. It comprises 10 chapters, a bibliography and an index.

Chapter 1 contains an overview of the problem of solving nonlinear systems of equations, followed by some notations and background results.

In the second chapter there are described some model problems which lead to nonlinear systems in $\mathbb{R}^n$.

Chapter 3 deals with general iterative processes and their rates of convergence. The classical rigorous definitions and properties of the q- and r-convergence orders are reviewed. For fixed point iterations the Ostrowski theorem and some aspects concerning superlinear rates of convergence are treated.

Chapter 4 – *Methods of Newton type* – is the first chapter devoted to such methods. There is presented the linearization concept, together with some classical local convergence results for the Newton method. The discretized Newton methods and attraction basins are then discussed.

Chapter 5 deals with the methods of secant type. It describes the general secant methods and presents results based on consistent approximation. The update methods are then thoroughly analysed.

Chapter 6 is entitled *Combination of processes*. It begins with the discussion of using the classical iterative methods in solving the linear systems at each Newton step. It continues with the analysis of the nonlinear SOR methods. The inexact Newton methods are then presented, together with results dealing with their local and global convergence, and residual controls. The GMRES method is briefly discussed, but the finite-difference Newton-Krylov methods are not mentioned.

The following chapter is concerned with parametrized systems of equations. Some background results are presented, the following topics being then analysed: continuation using ODEs, continuation with local parametrization, and simplicial approximation on manifolds.

Chapter 8 is devoted to unconstrained minimization methods and discusses admissible step-length algorithms, gradient related methods, collectively gradient related directions and trust-region methods.

The ninth chapter is concerned with nonlinear generalizations of several matrix classes.

The last chapter – *Outlook at further methods* – discussed some higher-order methods, piece-wise linear methods and some additional minimization methods.

The former book of Rheinboldt (J. M. Ortega and W. C. Rheinboldt, *Iterative Solutions of Nonlinear Equations in Several Variables*, Academic Press, New York, 1970) is one of the fundamental books in the field of solving nonlinear systems of equations. However, a lot of progress has been made since this book has appeared. Rheinboldt gathers in the present monograph some important results achieved since then and presents them on the rigorous bases previously settled with Ortega.

The monograph is intended to present the theoretical foundations of the methods in favor of the computational aspects. Many of the results are accompanied by proofs, which make this second edition more self-contained than the first one; it is worth noting that the author has contributed to this book with many personal results.

We believe that for its conciseness and clearness, this monograph can be a valuable tool not only for the scientist concerned with the theoretical aspects in solving nonlinear systems of equations, but also for those interested in the practical aspects. The reason is obvious: the practitioners must first know how the methods behave in the ideal setting.

Emil Cătinaş

Mathematical Essays in Honor of Gian-Carlo Rota, Bruce E. Sagan and Richard P. Stanley (Editors), Progress in Mathematics, vol. 161, Birkhäuser Verlag, Basel-Boston-Berlin, 1998, 463 pp., ISBN: 0-8176-3872-5 and 3-7643-3872-5.

These are the Proceedings of a Conference held at M.I.T., Cambridge, Massachussets, to celebrate the 64th anniversary of Gian-Carlo Rota's birthday. The organizers considered more adequate that the anniversary of one of the greatest combinatorialists in the world to be for a power of 2 rather than for 65 years, although nothing is said about the next 2-power anniversary. Gian-Carlo Rota obtained outstanding results in combinatorics, the theory of posets (partially ordered sets), cubical algebras, invariant theory and umbral calculus.

The volume contains 24 articles, connected with the mathematical contributions of G. C. Rota, some of them presented at the Rotafest and Umbral Workshop while others were written especially for this Festschrift. Among the contributors we mention the names of G. E. Andrews, L. J. Billera, J. E. Bonin, D. A. Buchsbaum, W. Chan, W. Y. C. Chen, H. Crapo, O. M. D'Antona, P. Diaconis, A. Di Bucchianico, R. Ehrenborg, D. Eisenbud, J. M. Freeman, A. M. Garsia, M. E. H. Ismail, C. Krattenthaler, J. P. S. Kung, C. Le Conte de Poly-Barbut, Z.-G. Tiu, D. E. Loeb, M. A. Mendez, A. Ram, N. Ray, M. Readdy, J. Remmel, G.-C. Rota, R. P. Stanley, D. Staton, B. Sturmfels, B. D. Taylor, W. Whiteley, J. Wimp, J. S. Yang.

The papers included in the volume are dealing with topics as umbral calculus (5 papers), combinatorics (lecture hall partition, zonotopes, letter-place methods in homotopy, classification of trivectors, axiomatization of cubic algebras combinatorial geometry), algebraic topology, special functions, commutative algebra and statistics.

I. A. Rus

INSTRUCTIONS FOR CONTRIBUTORS

Revue d'Analyse Numérique et de Théorie de l'Approximation will consider for publication papers on the following subjects: the best approximation, uniform approximation, interpolation, numerical analysis, mathematical programming and also their applications in different areas of sciences.

Authors wishing to submit an article for publication are strongly encouraged to prepare their manuscript in a LATEX file (or AMS TEX or TEX), or in a file using Word 6.0 (or higher) under Windows. The figures must be either translated into the picture environment of LATEX, or sent into a PCX file format.

The proper position of each table and figure must be clearly indicated in the paper.

The first page should begin with:

Title[1)]
Author[2)]

Abstract-Summary in English (at most 20 printed lines, approx. 200 words).

The footnotes should contain:

(1) Work supported by...
(2) Affiliation...

AMS Subject Classification:
Received... (date inserted by the editor).

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For books there should be given: author, title, publisher, place and year of publication. For instance: J. F. Traub, *Iterative Methods for the Solution of Equations*, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1964.

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