Bibliographie

Analytische Theorie, Qualitative Theorie und Stabilitätstheorie, Dynamische Systeme und Bifurkationstheorie, VII. Internationale Konferenz über Nichtlineare Schwingungen, Berlin, 8—13. September 1975, Band I, 1—2; 498 and 410 pages, Akademie-Verlag, Berlin, 1977.

This series of conferences on nonlinear oscillations is organized jointly by the Academies of Sciences of Ukraine, Poland, ČSSR, and GDR. The Proceedings contain 100 papers written mostly in English, partly in Russian, German and French. The papers deal with ordinary differential equations of second and higher orders, partial differential and functional differential equations, and differential equations in abstract spaces. The plenary lectures were the following: *Qualitative conditions for nonlinear oscillations* (L. Cesari), *Singularly perturbed systems* (A. B. Vasil'eva), *Equations with hysteretic nonlinearities* (M. A. Krasnosel'skiĭ).

L. Pintér, L. Hatvani (Szeged)

L. Bolc—Z. Kulpa (ed.), **Digital image processing systems.** (Lecture Notes in Computer Science, Vol. 109), V+353 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1981.

In the first paper, a selected group of eleven universal (computer based) image processing systems is surveyed and compared by Z. Kulpa. They constitute a seemingly representative sample of the vast variety of such systems built in the last decade in European countries. The survey covers systems built for research purposes, either in image processing as such or for some other specific problem area, as well as more practically-oriented ones, including a commercially available routine picture analyzer. An overall classification of their general aims as well as basic parameters and features of their hardware structure, software support and application area is given.

In the next 5 papers several European computer systems are described in detail: GOP and CELLO from Sweden, BIHES ("Budapest Intelligent Hand-Eye-System") from Hungary, CPO—2/K—202 from Poland and S. A. M. (called previously MODSYS) from West Germany.

In order to show the readers possible practical usefulness of such systems and to introduce them into the methods and techniques of image processing, the book has been augmented by a paper by Milgram and Rosenfeld, leading specialists in the field. This paper describes algorithms for detecting and classifying objects such as tanks and trucks in forward-looking infrared imagery. It summarizes research conducted in the areas of image modeling, pre- and post-processing, segmentation, feature extraction, and classification.

The book gives a very good survey of picture processing techniques and systems.

J. Csirik (Szeged)

M. Golubitsky and V. Guillemin, Stable mappings and their singularities (Graduate Texts in Mathematics, 14), X+211 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1973.

The theory of singularities of stable mappings came into being in the late '50's when R. Thom noticed that previous separate results, mainly due to Hassler Whitney and Marston Morse can be incorporated into a single theory, which has been successively created by contributions of Harold Levin, John Mather, V. I. Arnold and C. T. C. Wall. The authors' objective is to give a presentation of this new theory which suites a first or second year graduate course.

The contents of the book can be summarized as follows: First prerequisites from the theory of differentiable manifolds are given. Then Sard's theorem, the Thom transversality theorem, and some basic facts concerning jet bundles are presented. The Whitney embedding theorem and the Morse theory are obtained via transversality. Then the basic ideas of stability theory are introduced, such as stable and infinitesimally stable mappings, immersions with normal crossings, and submersions with folds. The main result needed from analysis, the Malgrange preparation theorem is presented next. Then Mather's fundamental theorem on stability is derived. At last the classification schemes for stable singularities of Thom, Boardman and Mather are presented.

The authors managed to yield a clear-cut presentation of the theory where the main ideas are never lost in technicalities with which this subject necessarily abounds.

J. Szenthe (Budapest)

H. A. Maurer (ed.), **Automata, Languages and Programming,** Sixth Colloquium, Graz, July 1979. (Lecture Notes in Computer Science, 71), IX+684 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1979.

The book contains the full text of lectures presented at the Sixth Colloquium on Automata, Languages and Programming (ICALP 79), held in Graz, Austria, July 16—20, 1979. The preceeding colloquia of this series took place in Paris (1972), Saarbrücken (1974), Edinburgh (1976), Turku (1977) and Udine (1978), all sponsored by the Europian Association of Theoretical Computer Science (EATCS).

There are three papers from invited lecturers: *Recent advances in the probabilistic analysis of graph-theoretic algorithms* (R. Karp), *The modal logic of programs* (Z. Manna and A. Pnueli), *A systematic approach to formal language theory through parallel rewriting* (G. Rozenberg).

In addition, 50 papers have been selected by the program committee out of 139 submitted papers, thus insuring a very high standard of this volume. Papers are concerned with the theory of computation, formal languages, automata theory, complexity, programming languages, etc. The book is recommended to all research workers in these areas.

Z. Ésik (Szeged)

A. Mazurkiewich (ed.), **Mathematical Foundations of Computer Science,** 1976. (Lecture Notes in Computer Science, 45), XI+606 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1976.

MFCS 76, held in Gdansk, September 6—10, 1976, was the fifth in the series of MFCS symposia organized in Poland (every even year) and Czechoslovakia (every odd year). These symphosia cover all branches of theoretical computer science, such as the theory of computations, programming languages, data bases, complexity of algorithms, formal languages and automata theory.

The volume contains the text of 14 invited lectures and 67 communications. The latter were selected by the program committee out of a great number of papers submitted. In spite of the five

years passed, most of them are relevant and timely, even at present. The book is recommended to specialists working in theoretical computer science.

The invited papers are the following: *Exercises in denotational semantics* (K. R. Apt and J. W. de Bakker), *W-Automata and their languages* (W. Brauer), *On semantic issues in the relational model of data* (J-M. Cadiou), *The effective arrangement of logical systems* (E. W. Dijkstra), *Recursivity, sequence recursivity, stack recursivity and semantics of programs* (G. Germano and A. Maggiolo-Schettini), *Descriptional complexity (of languages). A short survey* (J. Gruska), *On the branching structure of languages* (I. M. Havel), *Observability concepts in abstract data type specification* (V. Giarratana, F. Gimona, and U. Montanari), *Algorithms and real numbers* (N. M. Nagorny), *On mappings of machines* (M. Novotny), *Recent results on L systems* (A. Salomaa), *Decision problems for multitape automata* (P. H. Starke), *Recursive program schemes and computable functionals* (B. A. Trakhtenbrot), *Some fundamentals of order-algebraic semantics* (E. G. Wagner, J. B. Wright, J. A. Goguen, and J. W. Thatcher).

Z. Ésik (Szged)

Theodor Meis and Ulrich Marcowitz, Numerical solution of partial differential equations (Applied Mathematical Sciences, 32), VIII+541 pages, Springer-Verlag, New York—Heidelberg—Berlin, 1981.

This book is the English translation of the original German edition "Numerische Behandlung Partieller Differentialgleichungen" published in 1978 also by Springer-Verlag. The material presented grew out of two courses of lectures delivered by the authors at the University of Cologne in 1974/75.

The reader is not supposed to be familiar with the theory of partial differential equations and functional analysis. Sections 1, 2, 4 and 12 contain some basic material and results from these areas. There is much emphasis on theoretical considerations, too. They are discussed as thoroughly as the algorithms which are presented in full detail and together with the programs. The guiding principle of the authors is that the theoretical and practical aspects are equally important for a genuine understanding of numerical mathematics.

The book is divided into three parts, which are largely independent of each other and can be read separately. Part I is devoted to the initial value problems for hyperbolic and parabolic differential equations, while Part II to the boundary value problems for elliptic differential equations. In the treatment particular emphasis is placed upon the fundamental concepts of properly (or well) posed problems, consistency, stability, and convergence. The situation is illuminated everywhere by an abundance of examples. Part III provides a good account of the methods for solving systems of linear and nonlinear equations obtained when we discretize boundary value problems for elliptic differential equations. Since we usually have systems of equations with a great number of unknowns, the utility of such a discretization is highly dependent on the effectiveness of the methods for solving these systems of equations.

The path from the mathematical formulation of an algorithm to its realization as an effective program is often difficult. This is illustrated by six typical examples of FORTRAN programs in the Appendices. As an aid to readibility each program is divided into a greater number of subroutines than usual. This approach greatly simplifies the development and debugging of programs.

The book ends with a Bibliography and Index.

This well-written textbook is highly recommended to every mathematician, physicist and engineer, who wishes to begin studies in the area of numerical solution of partial differential equations.

Ferenc Móricz (Szeged)

Sidney A. Morris, Pontryagin duality and the structure of locally compact abelian groups (London Mathematical Society Lecture Note Series, 29) VIII+128 pages, Cambridge University Press, Cambridge—London—New York—Melbourne, 1977.

One of the central results in the theory of locally compact abelian groups is the Pontryagin-van Kampen duality theorem which implies that a locally compact abelian group is completely determined by its dual and thus yields a powerful method to study the structure of such groups. Utilizing this fact, the author gives an approach to the structure theory of locally compact abelian groups which proceeds simultaneously with the derivation of the duality theorem. This approach is made possible by a new and simple proof of the duality theorem, which beyond some basic facts from group theory and topology, presupposes only the Peter-Weyl theorem.

First, a concise general introduction to the theory of topological groups, some basic facts concerning subgroups and quotient groups of R^n and concerning uniform spaces are given. Then dual groups are introduced. The duality theorem is proved first for compact and discrete abelian groups and then extended to all locally compact abelian groups. The structure theory of locally compact abelian groups including the Principal Structure Theorem is derived simultanesouly. Then some consequences of the duality theorem and applications in diophatine approximations are discussed. The structure theory is further developed by considering its relations to the structure theory of general locally compact groups. At last some important results are given concerning the structure of non-abelian locally compact groups. Each chapter contains a number of stimulating and illustrating exercises, which help to develop the reader's technique.

The author's skill and exceptional knowledge of the subject enabled him to achieve his purpose completely. The lecture note is very clearly and elegantly written and can be recommended as a text for first year graduate courses both by its content and by the educational value of its presentation.

J. Szenthe (Budapest)

William Parry, Topics in ergodic theory (Cambridge Tracts in Mathematics, 75), X+110 pages, Cambridge University Press, Cambridge—London—New York—Melbourne, 1981.

Ergodic theory stands at the junction of many areas like probability theory, group actions on homogeneous spaces, number theory, statistical mechanics, etc. In this slim volume the author provides a speedy introduction to a considerable number of topics and examples. He aimed neither for the utmost generality in the theorems nor for scholarly comprehensiveness. On the other hand, the material presented exhibits a nice unity.

The book consists of a preface, introduction, five chapters and an appendix. The introduction includes a brief account of the origins of ergodic theory and an outline of present trends. Chap. 1 collects the principal ergodic theorems of von Neumann, Birkhoff, Wiener, etc. Chap 2 is a concise study of martingales and the ergodic theorem of information theory. Chap. 3 treats the notions of weak and strong mixing as well as those of Markov and Bernoulli shifts in the theory of Markov chains. Chap. 4 is devoted to 'entropy' and contains, among others, the Halmos and von Neumann classification theorem, and the Rohlin and Sinai theorem. Chap. 5 presents special examples such as flows and changes in velocity, abolishing eigenvalues, minimality without unique ergodicity, and some further information about mixing. For the reader's convenience the spectral multiplicity theory of unitary operators is included in the appendix.

The book is supplemented by References, Future Literature, and (a subject) Index. Each section ends with exercises, which are used to extend theory, to illustrate a theorem, or to obtain a classical result from one recently proven.

To sum up, the present book is a good introduction of a rapidly developing and important subject. There are many directions a researcher might take in ergodic theory and the chapters in this book could provide the first steps in these directions.

Ferenc Móricz (Szeged)

K. Weihrauch (ed.), **Theoretical Computer Science.** 4th GI Conference, Aachen, March 26—28, 1979 (Lecture Notes in Computer Science, 67), VII+324 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1979.

The subject includes automata theory, complexity theory, and formal languages.

L. Boasson discusses context-free sets of infinite words. H. Maurer deals with homomorphisms in language theory, e.g. homomorphism equivalence, homomorphic representation, grammar forms and L forms. A. R. Meyer and I. Greif report on programming language semantics. R. Milner develops an algebraic approach to the theory of communicating systems. A. Schönhage reports on°storage modification machines. L. Valiant relates combinatorial enumeration questions to the P=NP problem. J. Beauquier considers strong versions of properties of context-free languages, e.g. of ambiguity and non-determinism. V. L. Bennison relates complexity-theoretic properties (s.a. speedability, levelability) to information-content characterisations (related to the jump operator). N. Blum and K. Mehlhorn show that the average number of rebalancing operations in a weight-balanced tree is constant. G. Boudol studies program transformations, strong equivalence, giving a new recursion induction principle. B. von Braunmühl and R. Verbeek discuss a relation between time and space by the means of an intermediate model, the "finite-change" automata. P. van Emde Boas and J. van Leeuwen investigate the pebble-game, a model for time-space trade-offs in computation. D. Friede studies transformation diagrams and strong deterministic grammars. P. Gács gives relations between measures of complexity and randomness. H. Ganzinger discusses the reduction of storage needs of attribute evaluation in the course of automatic compiler generation. I. Guessarian deals with various completions of posets. J. Heintz shows new applications of algebraic geometry in complexity questions of calculating polynomials. M. Jantzen studies languages defined by zero-testing-bounded multicounter machines. A. Kanda and D. Park deal with effectively given domains. M. Latteaux discusses properties of two linear languages with respect to substitution closed full AFL and rational cones. M. Majster and A. Reiser discuss the construction of position trees, related to various pattern-matching problems. K. Mehlhorn gives a new sorting method, which sorts presorted files quickly. Th. Ottmann, A. L. Rosenberg, H. W. Six and D. Wood deal with node-visit optimal 1-2 brother trees. W. J. Paul and R. Reischuk discuss graph-theoretic separability properties and their relation to the P=NP problem. J. E. Pin gives characterisations of three varieties of languages (rational, aperodic and locally testable). L. Priese deals with the construction of minimal universal Turing-Machines. Ch. Reutenauer considers closure properties of varieties of languages and monoids. H. A. Rollik answers in the negative the question whether there exists a finite set of automata searching all planar graphs. J. Sakarovitch shows a transversal property for a mapping related to pushdown automata. C. P. Schnorr develops lower bounds for the complexity of calculating polynomials. E. Ukkonen shows the noncoverability of certain grammars. K. Wöhl discusses Presburger arithmetic and equivalence of simple programs.

G. Turán (Szeged)