STUDIA UNIV. "BABEŞ–BOLYAI", MATHEMATICA, Volume **XLVII**, Number 3, September 2002

BOOK REVIEWS

European Congress of Mathematics: Barcelona, July 10-14, 2000, Vol. I, l+582 pp., ISBN: 3-7643-6417-3, Vol. II, xii+641 pp., ISBN:3-7643-6418-1, Carles Casacuberta, Rosa Maria Miró-Roig, Sebastià Xambó-Descamps- Editors, Progress in Mathematics, Birkhäuser Boston-Basel-Berlin 2001.

These are the proceedings of the Third European Congress of Mathematics (3ecm), held from July 10th to July 14th, 2000, in Barcelona. The congress was organized by the Societat Catalana de Matématiques, under the auspices of the European Mathematical Society (EMS). The initiative of the organizations of ECMs belongs to Max Karoubi (France) and was et on course shortly after the creation of EMS in 1990. The first ECM took place in Paris in 1992 and the second in Budapest in 1996.

The 3ecm was attended by over than 1300 people coming from 87 countries. There were awarded the EMS Prizes to 8 young mathematicians: S. Alekser (Israel), R. Cerf (France), D. Gartsgory (U.S.A.), E. Grenier (France), D. Joyce (U.K.), V. Lafforgue (France), S.Yu. Nemirovski (Russia), P. Seidel (France). The Felix Klein Prize was attributed to D.C. Dobson (U.S.A.). The first volume contains short presentations of the winners. The volume contains also the speeches delivered at the opening and at the closing ceremonies, including two addresses by Rolf Jeltch, President of the EMS, on the aims and perspectives of the EMS.

Beside this introductory material, the first volume contains the articles written by plenary (8) and parallel speakers (30).

The second volume contains the the articles by prize winners and those presented and the mini-symposia organized during the Congress. There nine mini-symposian dealing with the following topics: Computer Algebra, Curves over Finite Fields and Codes, Free Boundary Problems, Mathematical Finance, Quantum Chaology, Quantum Computing, String and M-Theory, Contact Geometry and Hamiltonian

Dynamics, Wavelet Applications in Signal Processing. Seven round tables on topics of general interest were also organized. A third volume, containing material from these round tables, will be published jointly by Societat Catalana de Matématiques and Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE), Barcelona.

The ECMs are major events in the life of the European mathematical community, particularly this one, organized within the World Mathematical Year 2000 and having as motto *Shaping the 21st Century.*

The volumes are a must for any mathematics library.

S. Cobzaş

Roland Hagen, Steffen Roch and Bernd Silbermann, *C^*-algebras and Numerical Analysis,* Monographs and Textbooks in Pure and Applied Mathematics, Vol. 236, M. Dekker, Inc., Basel - New York 2001, 376 pages, ISBN: 0-8247-0460-6.

The book is concerned with two apparently unrelated fields–numerical analysis and Banach and C^*-algebras. Its aim is to emphasize how tools and results from Banach and C^*-algebras (e.g. Gelfand's theory, Fredholm theory, states and ideals) shed a new light on numerical methods for solving operator equations or eigenvalue problems. These methods are adequate mainly for the study of the stability of these methods. Other questions, such as, e.g., the rapidity of convergence, can't be treated within this framework. The general idea is the following: one considers an operator equation $Ax = y$, where A is a continuous linear operator on a normed space X, and a sequence (A_n) of continuous linear operators on X (the approximation operators), and the approximate equations $A_n x_n = y_n,\ n \in \mathbb{N}$. One supposes that the sequence (A_n) converges strongly to A, i.e. $A_n z \to Az$ in the norm of X, for every $z \in X$. If further, starting with some n_0 the equations $A_n x_n = y_n$ have unique solutions x_n for all sequences (y_n) converging to y, and the sequence (x_n) converges to x (the solution of $Ax = y$), then the approximation method (A_n) is called applicable. By a result of N.I. Polski (1963), if A is invertible then the approximation method (A_n) is applicable if and only if there is an n_0 such that the operators A_n are invertible for $n \geq n_0$ and the norms of their inverses are uniformly bounded. Such approximation sequences are called stable. Typical examples of approximation methods are the Galerkin type

methods or, more generally, finite section methods, which are largely studied in the book, with emphasis on equations with Toeplitz and Hankel operators and their finite sections. If the operator A is not invertible then one works with Moore-Penrose generalized inverses for matrices and for operators on Hilbert space or for elements of C^*-algebras.

One denotes by $\mathcal{F}$ the set of all uniformly bounded sequences (A_n) of operators on a Banach space X. With respect to the operations of addition, multiplication, multiplication by scalars, and the sup-norm $\|(A_n)\| = \sup_n \|A_n\|$, $\mathcal{F}$ becomes a Banach algebra, and the set $\mathcal{G}$ of all sequences (A_n) in $\mathcal{F}$ with $\|A_n\| \to 0$ is a closed ideal in $\mathcal{F}$. The main goal of the book is to prove that the quotient algebra $\mathcal{F}/\mathcal{G}$ is the adequate frame for the study of many problems of numerical analysis. For instance, the sequence (A_n) of approximation operators is stable if and only if the coset $(A_n) + \mathcal{G}$ is invertible in the algebra $\mathcal{F}/\mathcal{G}$ (a result of A.V Kozak (1973)). A finer and deeper study of numerical methods requires to work in some C^*-subalgebras of the Banach algebra $\mathcal{F}$. Beside the numerical solutions of operator equations, the algebraic approach proposed by the authors allows to treat problems concerning the approximation of eigenvalues, computation and stability of spectra or pseudospectra, the study of Rayleigh quotients of eigenvalues, of numerical ranges and of the asymptotic behavior of the determinants of the matrices A_n.

A good idea on the contents of the book is given by the headings of its chapters: 1. *The algebraic language of numerical analysis*; 2. *Regularization of approximation methods*; 3. *Approximation of spectra*; 4. *Stability analysis for concrete approximation methods*; 5. *Representation theory*; 6. *Fredholm sequences*; 7. *Self-adjoint sequences.*

Containing fine results from analysis and functional analysis applied to numerical methods, the book is addressed to a wide audience, first students who want to see applications of functional analysis and to learn numerical analysis, but also to mathematicians and engineers interested in theoretical aspects of numerical analysis. The value of the book is raised by the wealth of nontrivial examples illustrating the theoretical concepts. The authors are well known specialists in functional analysis, and the book incorporates many of their recent results, some of them published here for the first time.

S. Cobzaş

V. V. Beletsky, *Essays on the Motion of Celestial Bodies*, Transl. from the Russ. by Andrei Iacob, Birkhäuser Verlag, Basel-Boston-Berlin, 2001, XVIII+372 pp, ISBN 3-7643-5866-1.

The book under review is the story of some interesting theoretical investigations in the mechanics of space flight, i.e., in the theory of motion of spacecraft. Some new problems of celestial mechanics are discussed as well.

..."Dear Fagot, show us something simple for the start" – it is with this epigraph from M. Bulgakov's *The Master and Margarita* that the first essay of the book under review begins. And the reader is not being lied to – the book begins with some well known, and for that reason simple, classical results about unperturbed and perturbed motion of a satellite, the problem of two fixed centers, the influence of the radiation pressure on the orbit of a satellite, the "Laplace Theorem", the restricted three-body problem, etc.

The book uses results published by other scientists, but essentially contains the outhor's own research. The problems treated in this essay (first Russian edition in 1972) continue to be investigated and developed by many authors. Interesting later developments was made by *A. P. Ivanov* in the theory of impact-free motions and by the author in the problem of the dynamics of a system of linked bodies.

In order to reveal the beauty of the research process leading to the results, the emphasis is put on the analysis that can be carried out on the level of graphs and drawings, and sometimes numbers. Whenever possible, the investigation relies on maximum intuitive, elegant geometric tools. The book can be read profitably by anyone with the mathematical background typically offered in the first few years of undergraduate studies in mathematics, physics and engineering, including students, teachers, scientists and engineers.

As *V. I. Arnold* and *Ya. B. Zeldovich* remark in they review of the first edition of Beletsky's "*Essays*" (*Priroda*, No. 10, 1973, 115-117), this book "marks the affirmation of a new style in the scientific literature. The author explains in a frank and detailed manner the reasons behind each calculation, its difficulties, and

the psychological side of the research. The book contains no attempts to inflate the importance of results or to give results while hiding the methods used to obtain them. The book is adorned by humorous illustrations by *I. V. Novozhilov*, Doctor in Physico-Mathematical Sciences. ... The general impression that the "*Essays*" make is not that this is a boring lesson, but rather a discussion with brilliant, knowledgeable and wise interlocutor. Even people with little interests in space problems will go through the book with satisfactions, perhaps omitting the calculations."

The Russian edition of this book was awarded the 1999 *F. A. Zander Prize* of the *Russian Academy of Science.*

Ferenc Szenkovits

Functional Analysis, Lecture Notes in Pure and Applied Mathematics, Vol. 150, Edited by Klaus D. Bierstedt, Albrecht Pietsch, Wolfgang M. Ruess and Dietmar Vogt, M. Dekker, Inc., New York 1994, xviii + 526 pp, ISBN 0-8247-9066-9.

These are the Proceedings of an International Symposium on Functional Analysis, held in Essen, Germany, November 24-30, 1991. The first goal of the conference was to emphasize and deep the interaction between three branches of functional analysis: (i) the geometry of Banach spaces; (ii) the theory of Fréchet spaces with applications to analysis and partial differential equations (PDE); (iii) semigroups of operators and evolution equations. The second one was to vitalize the scientific contacts between functional analysts in East and West, by taking advantage on the political opening which occurred that time in Eastern Europe.

The conference was structured into three main lecture series delivered by S. Heinrich (the topic (i)), R. Meise (ii), and Ph. Bénilan (iii), and about 30 further contributions. The volume contains 29 articles by 39 authors from 12 countries all around the world, and cover nearly all the topics presented at the conference, plus some additional ones.

To be more specific we mention some of them. Ph. Bénilan and P. Wittbold wrote a survey on nonlinear evolution equations in Banach spaces. Another survey, by S. Heinrich, is concerned with random approximation in numerical analysis. An interesting paper by A. Pelczynski surveys properties of function spaces depending on the

dimension of their domains of definition. Applications of orthonormal trigonometric systems to the geometry of Banach spaces are presented in a paper by A. Pietsch and J. Wenzel. There are several papers dealing with the analysis of vector-valued functions or with spaces of vector-valued functions as, for instance, vector-valued versions of some representation theorems in analysis (W. Arendt), vector-valued Lagrange interpolation and convergence of Hermite series (H. König), spaces of Lipschitz functions on Banach spaces (Ch. Stegall), Freét spaces of continuous vector-valued functions (P. Domanski and L. Drewnowski). Ultradistributions and with applications to PDE are discussed in two papers, one by R. Meise, B.A. Taylor and D. Vogt, and the other one by M. Langenbruch. Extensions of Josefson-Nissenzweig and Pitt's theorems to Fréchet setting are done by J. Bonet and M. Lindström, and M.S. Ramanujan and D. Vogt, respectively. Other topics are: spaces of harmonic functions (M. Zahariuta), Liouville theorem for coherent analytic sheaves (V. P. Palamodov), interpolation for Hardy spaces on disk and on bidisc (V. Kisliakov).

In spite of the time passed since the publication of the volume, the included topics are still valuable references for the working mathematician interested in functional analysis, mainly in its applications to the analysis of vector-valued functions, to spaces of vector-valued functions and to PDE.

S. Cobzaş

Ronald Cross, *Multivalued Linear Operators,* Monographs and Textbooks in Pure and Applied Mathematics, Vol. 213, M. Dekker, Inc., Basel - New York 1998, ix+335 pages, ISBN: 0-8247-0219-0.

Let X, Y be linear spaces over the field $\mathbb{K} = \mathbb{R}$ or $\mathbb{C}$. A relation is a multivalued mapping $T : D(T) \subset X \to 2^Y \setminus \{\emptyset\}$. The relation T is called linear if $D(T)$ is a subspace of X and $T(\alpha x + \beta y) = \alpha Tx + \beta Ty$, for all $x, y \in D(T)$ and scalars α, β. The simplest example of a linear relation is the inverse T^{-1} of a linear operator $T : X \to Y$, defined by $T^{-1}y = \{x \in X : Tx = y\}$. In this case $D(T^{-1}) = R(T) = T(X)$. Linear relations were considered in the early thirties of the last century by J. von Neumann in order to define the adjoints of non-densely defined linear differential operators.

The aim of the present book is to develop a systematic study of linear relations, especially in the framework of normed spaces. Beside giving some elegant and transparent formulations and proofs of some theorems in classical operator theory in Banach spaces as, e.g., the closed graph and the closed range theorems, the study of linear relations contributes to the enrichment and clarification of many aspects of the operator theory, mainly those concerned with non-closable and non-densely-defined linear operators.

The first three chapters of the book, I. *Linear relations: Algebraic properties*, II. *Normed linear relations,* and III. *Adjoints of linear relations,* provide a self-contained foundation course on linear relations. Ch. IV, *Operational quantities of linear relations*, is concerned with various numerical functions defined on some classes of linear relations, most of them being generalizations of some well known quantities in the theory of bounded linear operators. Some important classes of linear relations, such as compact, precompact, strictly singular, strictly cosingular, upper and lower semi-Fredholm, are introduced and studied in Ch. V, *Semi-Fredholm linear relations.* The spectral theory for linear relations is developed in Chapters VI, *Spectral theory* and VII, *The essential spectrum.* The emphasis in Ch. VIII, *The second adjoints of linear relations* is on weakly compact and weakly completely continuous linear relations with applications to Tauberian theorems.

The book, largely based on the results obtained by the author and his collaborators or doctoral students, presents for the first time in book form a systematic treatment of various aspects of multivalued linear relations.

For these reasons, the book is of interest to a large audience, including researchers in functional analysis and operator theory, differential equations (ordinary or partial), mathematical economics and other domains. Its first three chapters can be used for advanced graduate, or post-graduate, courses in functional analysis or operator theory.

Tiberiu Trif

Solomon Leader, *the Kurzweil-Henstock Integral and Its Differentials–A Unified Theory of Integration on* $\mathbb{R}$ *and* $\mathbb{R}^n$, Monographs and Textbooks in Pure and Applied Mathematics, Vol. 242, M. Dekker, Inc., Basel - New York 2001, viii+335 pages,

ISBN: 0-8247-0535-1.

The main defects of the Riemann integral are the restriction to bounded integrands and feeble convergence properties. These defects were remedied by the Lebesgue integral, and its development led to general measure theory and integration on measure spaces, with many applications in functional analysis and probability theory. Beside requiring tedious preliminaries, the Lebesgue integral involve absolute integrability, so that the semiconvergent improper Riemann integrals can not be treated within this theory. A significant breakthrough was done around 1960 independently by J. Kurzweil and R. Henstock. Their main idea was to replace the number δ measuring the finesse of a division by a function $\delta(\ )$, called a gauge function. This simple modification yields the so called generalized Riemann integral, whose properties overcome the defects of both Riemann and Lebesgue integrals.

The present book is essentially based on the results published by the author between the years 1985 and 1995, mainly in the journal Real Analysis Exchange. Inspired by some ideas of Kurzweil and Henstock, he develops a process of integration based on "summants", which are functions S defined on the set of all tagged intervals contained in an elementary figure (a finite union of closed intervals) K. A tagged cell is a pair (I,t), where I is an interval in $[-\infty,\infty]$ and t is an endpoint of I. This definition includes equivalents of Lebesgue, Stieltjes, Denjoy-Perron integrals, considered on bounded as well as on unbounded intervals. Another important innovation is the definition of differentials based on the integration of summants–a differential is an equivalence class on an interval K with respect to the equivalence relation $\int_K |S-S'| = 0$. In this approach, every function f on K induces an integrable differential df and every integrable differential is the differential of a function. Also, the fundamental theorem of calculus can be proved under very general hypotheses.

The book is divided into eleven chapters headed as follows: 1. *Integration of summants;* 2. *Differentials and their integrals;* 3. *Differentials with special properties;* 4. *Measurable sets and functions;* 5. *The Vitali Covering Theorem applied to differentials;* 6. *Derivatives and differentials;* 7. *Essential properties of functions;* 8. *Absolute continuity;* 9. *Conversion of Lebesgue-Stieltjes integrals into Lebesgue integrals;* 10. *Some results on higher dimensions;* 11. *Mathematical background.* Each

section ends with a set of exercises, some of them being research topics, deserving further investigation.

The book can be used as a textbook for a graduate course on special topics in real analysis, or as a supplementary text for first year graduate courses in real analysis. It can be used also as a monograph by people interested in the foundation of integration theory and calculus.

S. Cobzaş

Stephen Lynch, *Dynamical Systems with Applications using MAPLE.*

The book is a good introduction to dynamical systems theory. In the first part of the text, differential equations are used to model examples taken from mechanical systems, chemical kinetics, electric circuits, interacting species and economics. In the second part real and complex discrete dynamical systems are considered, with examples taken from economics, population dynamics, nonlinear optics and material science.

The theory and applications are presented with the aid of the MAPLE algebraic manipulation package. Throughout the book, MAPLE is viewed as a tool for solving systems or producing exciting graphics. The author suggests that the reader should save the relevant example programs. These programs can then be edited accordingly when attempting the exercises at the end of each chapter.

The text is aimed at graduate students and working scientists in various branches of applied mathematics, natural sciences and engineering. The material is intelligible to readers with a general mathematical background. Fine details and theorems with proof are kept at a minimum. This book is informed by the research interests of the author which are nonlinear ordinary differential equations, nonlinear optics and fractals. Some chapters include recently published research articles and provide a useful resource for open problems in nonlinear dynamical systems.

An efficient tutorial guide to MAPLE is included. The knowledge of a computer language would be beneficial but not essential. The MAPLE programs are kept as simple as possible and the author's experience has shown that this method of teaching using MAPLE works well with computer laboratory class of small sizes.

I recommend "Dynamical Systems with Applications using MAPLE" as a good handbook for a diverse readership, for graduates and professionals in mathematics, physics, science and engineering.

Damian Trif

Jon H. Davis, *Differential Equations with MAPLE*, Birkhäuser Verlag 2000, xiv + 409 pp, ISBN 0-8176-4181-5.

Differential Equations is an important subject in pure and applied mathematics. MAPLE is a program for symbolic manipulation of mathematical expressions, numerical computations and graphics. The ability of Maple to handle complicated calculations makes it possible to deal with much more interesting and substantial problems than are possible if only hand calculations are allowed.

Some differential equations are susceptible to analytic means of solution while others require the generation of numerical solution trajectories to see the behavior of the equation under study. Maple can be used for both situations. The student does not understand an algorithm unless he can code it and, of course, the solution curve plots are more informative than columns of numbers when numerical methods are used.

The first part of the text introduces MAPLE, by a self contained discussion. The second part covers conventional differential equation topics: first order equations, n-th order equations and systems, periodic solutions, stability, boundary value problems, Laplace transform methods and numerical methods. The last part of the text consists of MAPLE differential equations applications and some hard programming projects.

The book integrates MAPLE with differential equations by using it to investigate topics that are inaccessible without computational aid. There are routines for recognizing and solving a variety of differential equation problems but more important is the experience of what sort of problems have simple solutions and what the form of those solutions should look like.

MAPLE exercises are part of the learning process. It is important that students undertake learning MAPLE as a programming tool. This enables them to use MAPLE to solve their own problems.

As universities throughout the world move to incorporate a programming package into the differential equations curricula, I recommend this book as an excellent combination of basic theory of differential equations and MAPLE.

Prof. Damian Trif

Cristian E. Gutiérrez, *The Monge-Ampére Equation,* Progress in Nonlinear Differential Equations and Their Applications, Birkhäuser Boston-Basel-Berlin, 2001.

The classical Monge-Ampére equation has been the center of considerable interest in recent years because of its important role in several areas of applied mathematics. In reflecting these developments, this works stresses the geometric aspects of this theory, using some techniques from harmonic analysis - covering lemmas and set decompositions. Moreover, Monge-Ampére type equations have applications in the areas of differential geometry, the calculus of variations, and several optimization problems, such that Monge-Kantorovitch mass transfer problem.

This book is an essentially self-contained exposition of the theory of weak solutions, including the regularity results of L.A. Caffarelli. The presentation unfolds systematically from introductory chapters, and an effort is made to present complete proofs of all theorems. There are included examples, illustrations, bibliographical references at the end of each chapter, and a comprehensive index.

The topics covered in the book include: Generalized solutions, Non-divergence equations, The cross-sections of Monge-Ampére, Convex solutions of $D^2u = 1$ in $\mathbb{R}^n$, Regularity theory, $W^{2,p}$ estimates.

The Monge-Ampére equation is a concise and useful book for students and researchers in the field of nonlinear equations.

Adriana Buică

Raghavan Narasimhan and Yves Noevergelt, *Complex Analysis in One Variable*, Second Edition, Birkhäuser Verlag, Basel-Boston-Berlin 2001, xiv + 381 pp, ISBN 3-7643-4164-5 and 0-8176-4164-5.

The book is a presentation of complex analysis in one variable with connections to other branches of mathematics (several complex variables, real analysis, de Rham theory etc.). It has two parts. The first part, due to Raghavan Narasimhan, is essentially just a reprint of the first edition and contains the theory of complex analysis. The second part, due to Yves Noevergelt, is a collection of exercises, problems, examples and relevant references.

The first three chapters of the first part (Elementary theory of holomorphic functions, Covering spaces and the Monodromy theorem and The winding number and the Residue theorem) deal with classical material. They also include the Looman-Menchoff theorem. Chapter 4 presents Picard's theorem. Chapters 5 and 6 are devoted to inhomogenous Cauchy-Riemann equation, Runge's theorem and its various application. The Riemann Mpping theorem is presented in the next chapter. Chapter 8 (Functions of several complex variables) is meant to contrast the behavior in higher dimensions with that in the complex plane. Chapter 9 is an introduction on Riemann surfaces. Chapter 10 contains Tom Wolff's proof of the Corona theorem. The last chapter, Chapter 11, deals with subharmonic functions and their generalizations to several variables.

The book is addressed to graduate students who intend to specialize in mathematics. It can also be useful in doctoral work in mathematics, teaching careers in colleges or technical activities. The book requires knowledge of multivariable calculus, set theory, Lebesgue integration and elementary functional analysis.

Grigore Şt. Sălăgean

p-Adic Functional Analysis, Lecture Notes in Pure and Applied Mathematics:
Vol. 192, W.H. Schikhof. C. Perez-Garcia, J. Kakol - Editors, M. Dekker, New York 1997, 399 pp, ISBN 0-8247-0038-4.
Vol. 207, J.Kakol, N. De Grande-De Kimpe, V. Perez-Garcia - Editors, M. Dekker, Inc., New York 1999, 331 pp, ISBN 0-8247-8254-2.

p-Adic (ultrametric or non-archimedean) analysis is the analysis over a field with an ultrametric valuation, i.e. a valuation $|\ |$ satisfying the strong (or ultrametric) triangle inequality

$$|a+b| \leq \max\{|a|, |b|\},$$

which is essential for the entire theory. Classical examples of non-archimedean (n.a.) valued fields are the fields $\mathbb{Q}_p$, for p a prime natural number, which entail the name "p-adic analysis" attributed to the domain. It was developed by A.F. Monna in a series of papers published in Proceedings of the Dutch Royal Academy of Sciences,

starting with 1943. He collected the results up to 1973 in a book, A.F. Monna, *Analyse Non-Archimédienne,* Springer Verlag, Berlin 1973. Another book on the same topic is A.C.M. van Rooij, *Non-Archimedean Functional Analysis,* M. Dekker, New York 1978.

Although, at the beginning, the theory looked a little strange and useless, the efforts of a permanently increasing number of mathematicians transformed it into a well established mathematical discipline. Beside interesting and nontrivial results, most of them drastically contrasting with those in classical real or complex analysis, the theory has found recently some spectacular applications to mathematical physics and probability theory. Two recent books, V.S. Vladimirov, I.V. Volovich, E.J. Zelenov, *p-adic numbers in mathematical physics*, World Scientific, Singapore 1994, and A.Yu. Khrennikov, *p-adic valued distributions in mathematical physics,* Kluwer AP, Dordrecht 1994, are good sources for these applications .

Motivated by the growing interest in n.a. functional analysis, a conference on this topic was organized in 1990 at Laredo, Spain, by Jose M. Bayod, N. De Grande-De Kimpe and J. Martinez-Maurica. Its Proceedings were published by M. Dekker in 1992 as volume 137 in the series Lecture Notes in Pure and Applied Mathematics (LNPAM).

The present two volumes contain the Proceedings of the fourth conference, held in 1996 at the University of Nijmegen, The Netherlands, and of the fifth conference held in 1998 at the University Adam Mickiewicz of Poznan, Poland. They reveal the state of the art in the realm of n.a. analysis and contain research articles presented at the conference in 30-minute talks.

The fourth conference was attended by over than 40 researchers from 15 countries. The 1996 Proceedings volume (vol. 192 in LNPAM) contain 29 papers dealing with topics as spaces of p-adic analytic or continuous functions, functional and differential p-adic equations, uniform approximation (Stone-Weierstrass type theorems), almost periodic functions, Euclidean models for p-adic spaces, inductive limits of locally convex spaces and closed graph theorems, hypergeometric series, Tauberian theorems. N.a. convexity has a more algebraic character than the classical (real) convexity and is developed in a paper on locally convex modules.

The fifth conference was attended by mathematicians from Europe, North and South America, Africa and Japan, and its Proceedings, the volume 207 in LNPAM, contain 21 contributed papers. Various topics discussed by the participants were inspired by recent designs for p-adic models in modern physics and probability theory. Again, p-adic analytic functions and the properties of spaces of analytic functions are discussed in several papers. Other topics included in the volume are: Fourier transform for p-adic tempered distributions, spectral properties of p-adic Banach algebras, Banach-Dieudonné theorem, orthonormal bases, Mahler bases .

These conferences on p-adic functional analysis, and the corresponding Proceedings volumes, are the most authoritative sources in this relatively new area of investigation which is p-adic analysis. The volumes are addressed first to researchers in p-adic analysis, but researchers in mathematical physics and probability theory will find new and unexpected approaches to their field. The young researchers can find here a fertile land, with a lot of open problems deserving further investigation.

S. Cobzaş

Victor P. Pikulin and Stanislav Pohozaev, *Equations of Mathematical Physics*–A practical course, Birkhäuser Verlag, Basel-Boston-Berlin 2001, viii+207 pp., ISBN: 3-7643-6501-3.

The aim of this book is to present the main methods and tools for solving the basic problems from mathematical physics. This course is addressed especially to students for the study of the main equations from the mathematical physics, but it is also a valuable book for all those interested in the theory of partial differential equations, by means of the superposition method. Regarding the structure of the book, let me list the titles of the three chapters: I. Elliptic Problems (including the Green function method and the method of conformal mappings) II. Hyperbolic Problems (including the Fourier, Laplace and Hankel integral transforms) III. Parabolic problems (including also the Fourier and Laplace integral transform methods and the method of separation of variables). Let us remark that each chapter contain several examples, as well as, problems for independent study and answers to them.

Because of the importance of the domain, the very good quality of the paper and the writing style of the authors, I must recommend this well written book as a textbook for

students and a mini-handbook for other scientists from applied mathematics.

Adrian Petruşel

Categorical Perspectives, Editors: Jürgen Koslowski and Austin Metlon, Trends in Mathematics, Birkhäuser (2001), x+281pp, SBN 0-8176-4186-6 SPIN 10761690 ISBN 3-7643-4186-6.

The volume under review contains papers presented at the conference held in honor of Professor George E. Strecker's 60th birthday which was held in August 1998 on Kent State University.

The aim of the editors was to exhibit some fundamental facts in the category theory and some interaction between this and other domains (topology, computer science, etc.). The volume contains 15 teaching, expository and research papers.

As teaching papers we mention the papers of Y. T. Rhineghost *The Functor that Wouldn't be* and *The Emergence of Functors* as well as the George E. Strecker's paper *10 Rules for Surviving as a Mathematician and Teacher* and the Alois Zmrzlina's paper *Too Many Functors.* Expository papers are *Categories: A Free Tour* by Letz Schróder, *Contributions and Importance of Professor George E. Strecker's Research* by Jürgen Koslowski, *Connections and Polarities* by Austin Melton and *Categorical Closure Operators* by G. Castellini. As research papers the reader can find *Extension of Maps from Dense Subspaces* by H. L. Bentley, *Characterisation of subspaces of Important Types of Convergence Spaces in the Realm of Convenient Topology* by Gerhard Preu, *The Naturals are Lndelöf iff Ascoli Holds* by Y. T. Rhineghost, *Revisiting the Celebrated Thesis of J. de Groot: "Everything is Linear"* by Ludvik Janos, *Finite Ultrametric Spaces and Computer Science* by Vladimir A. Lemin, *The Copnumber of a Graph is Bounded by [3/2 genus (G)]+3* by Bernd S. W. Schroeder and *Abelian Groups: Simultaneosly Reflective and Coreflective Subcategories versus Modules* by Robert El Bashir, Horst Herrlich and Miroslav Hušek.

The authors are experts from quite different well known schools.

The book permits an easy access to the current information in the field. Graduate students and researchers interested in category theory and related areas will take a full benefit and they find here a good source of inspiration.

Simion Breaz

Stefan Caenepeel and Freddy Van Oystaeyen Editors, *Hopf Algebras and Quantum Groups*. Lecture notes in pure and applied mathematics 209, Marcel Dekker, New York-Basel, 2000, xii+309 pp., Softcover, ISBN 0-8247-0395-2.

The volume under review is based on the proceedings of the colloquium on Hopf Algebras and Quantum Groups held at the Free University of Brussels, Belgium. It contains high quality refereed research papers and survey papers covering topics like Nichols algebras and pointed Hopf algebras, cross product algebras, graded coalgebras, coalgebra-Galois extensions, Doi-Hopf modules, cyclic cohomology, Schur-Weyl categories, classical Lie superalgebras and finite-dimensional quantum groupoids.

The authors and their contributions are the following. *N. Andruskievitsch and H.-J. Schneider*, Lifting of Nichols algebras of type A_2 and pointed Hopf algebras of order p^4; *Y. Bespalov and B. Drabant*, Survey of cross product algebras; *C. Boboc*, A Morita-Takeuchi context for graded coalgebras; *T. Brzeziński*, Coalgebra-Galois extension from the extension theory point of view; ıS. Caenepeel, B. Ion, G. Militaru and S. Zhu, Separable functors for the category of Doi-Hopf modules II; *M.A. Farinati and A. Solotar*, Cyclic cohomology of coalgebras, coderivations and de Rham cohomology; *D. Gurevich and Z. Mriss*, Schur-Weyl categories and non-quasiclassical Weyl-type formula; *Y. Kashina*, A generalized power map for Hopf algebras; *I.M. Musson*, Associated varieties for classical lie superalgebras; D. Nikshych and L. Vainerman, Algebraic version of a finite-dimnesional quantum groupoid; *F. Panaite and F. Van Oystaeyen*, Quasi-Hopf algebras and the centre of a tensor category; *Ş. Raianu*, An easy proof for the uniqueness of integrals; *M. Takeuchi*, The coquasitriangular Hopf algebra associated to a rigid Yang-Baxter Coalgebra; *A. Tyc*, On the regularity of the algebra of covariants for actions of pointed Hopf algebras on regular commutative algebras; *A. Van Daele and Y. Zhang*, A survey on multiplier Hopf algebras.

The book is an important addition to the literature on this subject which had a tremendous development in the last 15 years. It will be a useful source of information and ideas for researchers in algebra, number theory and mathematical physics, and for all those interested in Hopf algebras.

Andrei Marcus

Gary F. Birkenmaier, Jae Keol Park, Young Soo Park (Eds), *International symposium on ring theory*, Birkhäuser Verlag, Boston, 2001, xviii+446 pp., Hardcover, ISBN 0-8176-4158-0.

The present volume is the Proceedings of the Third Korea-China-Japan International Symposium on Ring Theory held jointly with the Second Korea-Japan Joint Ring Theory Seminar, which took place at Kyongju, Korea, between June 28 and July 3, 1999.

It contains more than 30 both survey and research articles of mathematicians from Korea-China-Japan area, but also from Europe and the United States.

The articles covering various actual topics of Ring Theory may be classified in several main branches: Classical Ring Theory, Module Theory, Representation Theory, Hopf Algebras Theory and some other special subjects.

In the papers on classical part of Ring Theory, the results refer to stability properties of exchange rings, generalized principally injective maximal ideals, Auslander-Gorenstein rings, skew polynomial rings, non-commutative valuation rings, generalized Jordan derivations, theories of Harada in artinian rings, quasi-Frobenius or finitely pseudo-Frobenius rings.

Among the topics connected to Module Theory we mention generalized deviations of posets and applications, good conditions for the total, generalizations of injectivity, a short history of the flat cover conjecture, CS-properties, dual bimodules and Nakayama permutations, maximal t-corational extensions, torsion-free modules over valuation domains, generalized Matlis duality, hopfian modules or linkage maps.

Representation Theory is present through semicentral reduced algebras, derived equivalences and tilting theory, generalized Jordan derivations, Hecke orders, cellular orders and quasi-hereditary orders, infinite quivers and cohomology groups.

Topics of Hopf Algebras included in the articles are the coinduced functor and homological properties of Hopf modules, Hopf algebra coaction and group-graded rings or QcF-algebras.

The final section presents several open problems, especially on Classical Ring Theory and Module Theory, offering ideas for future research.

The well-known mathematicians which contributed to this book, touching a rather wide range of important topics of the nowadays research in Ring Theory, make the volume a valuable tool and source of inspiration for an algebraist working on a high level in this field.

Septimiu Crivei

Schwartz, Laurent – *A Mathematician Grappling with His Century*, Birkhäuser, 2001, 504 pp., Softcover, ISBN 3-7643-6052-6.

"I am a mathematician". It is the first sentence of this autobiography of Laurent Schwartz. A great Romanian mathematician, Gr. C. Moisil, used to say that one of the biggest temptations of a mathematician is to be *only* a mathematician. Without any doubt, Laurent Schwartz is a good illustration of how someone could be determined enough to resist such a temptation.

It would be pointless to try to describe the contents of the book. What could be said in just a few lines about an entire life of one of the greatest mathematicians of the last century, who was, at the same time, one of its greatest consciences?! Let me only mention that he did not stay away from any important problem or idea. He was involved in the communist movement, as a supporter of the ideas of Trotzki, he experienced the problems of the Jewish people during the second World War, being himself a Jew. After the war, he became involved in a lot of committees, fighting for the rights of people from Algeria, Vietnam or Afghanistan. He was one of the founders of the International Committee of Mathematicians, an international organization which managed to help some of the Soviet mathematicians that were subjects to persecution in their country, back in the communist period.

Of course, in any (auto)biography of a scientist, the personal and professional matters do interfere, they cannot be treated separately. This is no exception. If I didn't say a word about the mathematics of Laurent Schwartz, it is because this is, by now, well known to any mathematician. It is, nevertheless, instructing to find out about the mathematical discoveries and inventions of Schwartz came into being.

A great scientist is not necessarily a good writer. I would rather say that the writing skill is the exception, not the rule, but the book of Schwartz is more fascinating than a novel. It really keeps you awake at night. Usually, we are smiling unconfidentely when someone tells us: "My life was a novel". The life of Schwartz *was*, indeed.

Let me mention that the book is, also, a valuable (and personal, of course) contribution to the history of mathematics of the twentieth century. Many important figures of contemporary mathematics are present in the pages of Schwartz autobiography, not only as colleagues and friends, but also as relatives (he is the nephew of Jacques Hadamard and the son in law of Paul Lévy).

A final word of appreciation is due to the photographic material present in the book, which is very interesting and inedit.

Paul A. Blaga

I. John Cagnol, Michael P. Polis, Jean-Paul Zolesio (Eds.)- *Shape Optimization and Optimal Design,* Lecture Notes in Pure and applied Mathematics, vol. 216, Marcel Dekker, New York-Basel, 2001, ISBN: 0-8247-0556-4.

II. Giuseppe Da Prato, Jean-Paul Zolesio (Eds.)-*Partial Differential Equation Methods in Control Analysis,* Lecture Notes in Pure and Applied Mathematics, vol. 188, Marcel Dekker, New York-Basel-Hong Kong, 1997, ISBN: 0-8247-9837-6.

The first volume mentioned comprises papers from the sessions "Distributed Parameter Systems" and "Optimization Methods and Engineering Design" held within the 19th conference System Modeling and Optimization in Cambridge, England.

The second volume presents papers from the Conference on Control and Shape Optimization held at Scuola Normale Superiore di Pisa, Italy. Both the conferences were organized by the International Federation for Information Processing (IFIP).

The papers present the latest developments and major advances in the fields of active and passive control for systems governed by partial differential equations- in particular in shape analysis and optimal shape design.

Traditionally, optimal shape design has been treated as a branch of the calculus of variations, more specifically of optimal control. The subject interfaces with at least four fields: optimization, optimal control, PDEs and their numerical solutions.

The main question that optimal shape design tries to answer is: "What is the best shape for a physical system?".

Many problems that arise in technical and industrial applications can be formulated as the minimization of functionals with respect to a geometrical domain which must belong to an admissible family. Optimal shape design is used in various fields, like those mentioned in the books: fluid mechanics, linear elasticity, thermo-elasticity, soil mechanics, electricity, aircraft industry, material sciences, biodynamics.

The authors of the articles are well known for important results in this field of research.

Some of the aspects treated are:

- shape sensitivity analysis (that is the sensitivity of the solutions with respect to the shape of the domain) for the Navier-Stokes equation, Maxwell's equation, for some problems with singularities (I)

- the study of the material derivative, the shape derivative on a fractured manifold (I), the shape derivative for the Laplace-Beltrami equation (II), the shape hessian for a nondifferentiable variational free boundary problem (II),the shape gradients for mixed finite element formulation (II),the eulerian derivative for non-cylindrical functionals (I)
- numerical aspects (using finite element approximation and other methods, some of them original) for: shape problems in linear elasticity (I), parallel solution of contact problems (I), modeling of oxygen sensors (I), control of a periodic flow around a cylinder (I), shape identification problems associated with the stationary heat conduction in 2D(II)
- boundary controllability of thermo-elastic plates (I)
- regularity properties for the weak solutions to certain parabolic equations(II)
- homogenization and continuous dependence for Dirichlet problems, asymptotic analysis on singular perturbations (II), asymptotic analysis of aircraft wing model in subsonic flow (I)
- mapping method in problems governed by hemivariational inequalities (I)
- feedback laws for the optimal control of parabolic variational inequalities

Many more subjects are treated in the 41 papers by 50 authors, which allow the reader to get a good idea about the latest research directions in this very active field of applied mathematics.

Daniela Inoan

Stephanie Frank Singer, *Symmetry in Mechanics: A Gentle, Modern Introduction*, Birkhäuser, Boston-Basel-Berlin, 2001, VII+193 pp, ISBN 0-8176-4145-9.

This book is aimed at anyone who has observed that symmetry yields simplification and wants to know why. The author eschews density of topics and efficiency of presentation in favor of a gentler tone, a coherent story, digressions on mathematicians, physicists and their notations, simple examples worked out in detail, and reinforcement of the basics.

This text introduces some basic constructs of modern symplectic geometry in the context of an old celestial mechanics problem, the two-body problem. The derivation of Kepler's laws of planetary motion from Newton's laws of gravitation are presented, first in the style of an undergraduate physics course, and then again in the language of symplectic

geometry. All necessary constructs of symplectic geometry are introduced and illustrated in text.

Chapter 0 covers some preliminary material. Here are presented basic notations and conventions, the physical and mathematical background.

Chapter 1 presents the two-body problem, i.e., the derivation of Kepler's laws of planetary motion from Newton's laws of gravitation in the classical language of vector calculus.

Chapters 2-7 develope the concepts and terminology necessary for the final chapter, providing a detailed translation between the quite different languages of mathematics and physics. In this part are presented: the symplectic structure of the phase space of mechanical systems (chapter 2), a bridge to differential geometry (chapter 3), the importance of total energy (chapter 4), symmetries as Lie group actions (chapter 5), the Lie algebras of infinitesimal symmetries (chapter 6), and relationship between conserved quantities and momentum maps. This part of the monograph contains many examples, illustrations and exercices.

Chapter 8 presents the derivation it started with (chapter 1), but in the more sophisticated language of modern symplectic and differential geometry, presented in the previous chapters.

Readers desiring broader or more sophisticated texts should consult the Recommended Reading sections.

For the student, mathematician or physicist, this gentle introduction to symplectic reduction via mechanics will be a rewarding experience. This book can be used as a supplement to courses on differential geometry or Lie theory, or could be a major component of a course on symplectic geometry or classical mechanics, providing motivation for a more standard exposition of the mathematics. It would also be appropriate at the end of an example-driven semester course on classical mechanics, in which case students should be encouraged to work out the symplectic versions of examples treated earlier. *Symmetry in Mechanics* requires only competency in multivariable calculus, linear algebra and introductory physics.

Ferenc Szenkovits

Recent Advances in Operator Theory and Related topics – The Béla Szőkefalvi-Nagy Memorial Volume, László Kérchy, Ciprian Foias, Israel Gohberg, Heinz Langer - Editors, l+669 pp., Operator Theory: Advances and Applications, Vol. 127, Birkhäuser Verlag,

Boston-Basel-Berlin 2001, ISBN 3-7643-6607-9.

Béla Szőkefalvi-Nagy was born in Kolozsvár, Transylvania, (now Cluj-Napoca, Romania), in 1913. In 1929 his family moved to Szeged, Hungary, where he followed the university, having as teachers great mathematical personalities as F. Riesz and A. Haar. Soon he became a collaborator of F. Riesz and their collaboration culminated in the monograph "Leọns d'analyse fonctionelle" published in 1952, a standard reference in functional analysis, translated into six languages. He passed away in 1998 and the present volume contains the proceedings of Szőkefalvi-Nagy Memorial Conference held in Szeged in August 1999. The conference was attended by 91 mathematicians all over the world, who delivered 19 plenary talks in the morning and 63 talks in two parallel sections in the afternoon. The volume contains 35 contributed talks by participants at the conference or by experts who were unable to attend the conference. The included papers deal with various topics in operator theory, a field which owes so much to Szőkefalvi-Nagy, written by friends, former students or collaborators. Among the contributors we mention: D. Alpay, I. Gohberg, H. Bercovici, C. Foias, A. E. Frazho, J. B. Conway, L. Zsido, R G. Douglas, J. Eschmeier, J. Esterle, D. Gaşpar, N. Suciu, Z. Sebestyén, L. Kérchy, H. Langer.

Beside these research papers, the volume contains the farewell speech given by Ciprian Foias at the grave site in Szeged, some reminiscences by Israel Gohberg, and a presentation of the life and work of Szőkefalvi-Nagy by L. Kérchy and H. Langer. A list of publications of Szőkefalvi-Nagy and some photos from the family album provided by Erszébet Szőkefalvi-Nagy, Béla's daughter, are also included.

Giving tribute to one of the founders of modern operator theory and bringing together important contributions of leading experts in operator theory, this valuable volume will be of interest first to operator theorists, but also to researchers in functional analysis and mathematical physics.

S. Cobzaş

Turaev, V. – *Introduction to Combinatorial Torsions*, Birkhäuser (Lectures in Mathematics, ETH Zürich), 2000, 123 pp., Softcover, ISBN 3-7643-6403-3.

In the recent period, the various kind of torsions became an important tool in low dimensional topology. The book under review, written by one of the best experts in the

field, aims to provide a systematic introduction to combinatorial torsions of cellular spaces and manifolds (especially the three dimensional case).

The first notion of torsion was introduced by Reidemeister in 1935 and the theory was later developed mainly by Whitehead and Milnor.

The book is divided in three chapters. The first two are devoted to an exposition of the algebraic theory of torsions as well as to various geometrical realisations due to Reidemeister, Franz, Whitehead, Milnor. There is presented, also, a notion due to the author, the so-called "maximal abelian torsion" and it is examined the connection between different torsions and and the Alexander polynomial of links and 3-manifolds.

The final chapter deals with more special subjects, namely some other notions introduced by the author: sign-refined torsions and other structures on manifolds (homological orientations, Euler structures) with an application to the construction of the Conway link function for homology 3-spheres. Finally, there is described the connection between the sign-refined torsions and the Seiberg-Witten invariant of 3-manifolds.

The intended audience includes graduate students and researchers in mathematics and physics, intersted in low dimensional topology, with a background in combinatorial topology and homological algebra.

Paul A. Blaga

Jonathan M. Borwein and Adrian S. Lewis, *Convex Analysis and Nonlinear Optimization, Theory and Examples,* Canadian Mathematical Society (CMS) Books in Mathematics, Vol. 3, Springer-Verlag, New York Berlin Heidelberg, 2000, ISBN:0-387-98940-4.

The book is a concise account of convex analysis, its applications and extensions. It is aimed primarily at first-year graduate students, so that the treatment is restricted to Euclidean space, a framework equivalent, in fact, to the space $\mathbb{R}^n$, but the coordinate free notation, adopted by the authors, is more flexible and elegant. The proof techniques are chosen, whenever possible, in such a way that the extension to infinite dimensions be obvious for readers familiar with functional analysis (Banach space theory). Some of the challenges arising in infinite dimensions are discussed in Chapter 9, *Postscript: Infinite versus finite dimensions,* in which case the results involve deeper geometric properties of Banach spaces. The last section of this chapter contains notes on previous chapters, explaining which results extend to infinite dimension and which not, as well as sources where these extensions can be found.

The authors adopted a succint style, avoiding as much as possible complicated technical details, their goal being "to showcase a few memorable principles rather than to develop the theory to its limits". The book consists of short, self-contained sections, each followed by a rather extensive set of exercises grouped into three categories: examples that illustrate the ideas in the text or easy expansions of sketched proofs (no mark); important pieces of additional theory or more testing examples (marked by one asterisk); and longer, harder examples or peripheral theory (marked by two asterisks). Some bibliographical comments are also included along with these exercises, an approach which allow the authors to cover a large variety of topics. A good idea on the included material is given by the headings of the chapters and the presentation of some topics included in the main text or in exercises.

Ch. 1, *Background* - Euclidean spaces, symmetric matrices, in the main text, and Radstrom cancellation, recession cones, affine sets, inequalities for matrices, in exercises.

Ch. 2, *Inequality constraints* - optimality conditions, theorems of alternative, max-functions, in the main text, and nearest points, coercivity, Carathéodory's theorem, Kirchoff's law, Schur convexity, steepest descent, in exercises.

Ch. 3, *Fenchel duality* - subgradients and convex functions, the value function, the Fenchel conjugate, in the main text, and normal cones, Bregman distances, Log-convexity, Duffin's duality gap, Psenichnii-Rockafellar condition, order-convexity and order subgradients, symmetric Fenchel duality, in exercises.

Ch. 4, *Convex analysis* - continuity of convex functions, Fenchel biconjugation, Lagrangian duality, in the main text, and polars and polar calculus, extreme and exposed points, Pareto minimization, von Neumann minimax theorem, Kakutani's saddle point theorems, Fisher information function, in exercises.

Ch. 5, *Special cases* - polyhedral convex sets and functions, functions of eigenvalues, duality, convex process duality, in the main text, and polyhedral algebra, polyhedral cones, convex spectral functions, DC functions, normal cones, order epigraphs, multifunctions, in exercises.

Ch. 6, *Nonsmooth optimization* - generalized derivatives, regularity and strict differentiability, tangent cones, the limiting subdifferential, in the main text, and Dini derivatives and subdifferentials, mean value theorem, regularity and nonsmooth calculus, subdifferentials of eigenvalues, contingent and Clarke cones, Clarke's subdifferentials, in exercises.

Ch. 7, *Karush-Kuhn-Tucker theory* - metric regularity, the KKT theorem, metric regularity and the limiting subdifferential, second order conditions,in the main text, and

Lipschitz extension, closure and Ekeland's principle, Liusternik theorem, Slater condition, Hadamard's inequality, Guignard optimality conditions, higher order conditions, in exercises.

Ch. 8, *Fixed points* - the Brouwer fixed point theorem, selection and the Kakutani-Fan fixed point theorem, variational inequalities, in the main text, and nonexpansive mappings and Browder-Kirk fixed point theorem, Knaster-Kuratowski-Mazurkiewicz principle, hairy ball theorem, hedgehod theorem, Borsuk-Ulam theorem, Michael's selection theorem, Hahn-Katetov-Dowker sandwich theorem, single-valuedness and maximal monotonicity, cuscos and variational inequalities, Fan minimax inequality, Nash equilibrium, Bolzano-Poincaré-Miranda intermediate value theorem, in exercises.

There is a chapter, Chapter 10, containing a list of named results and notation, organized by sections. Beside this, the book contains also an Index.

The bibliography counts 168 items.

Written by two experts in optimization theory and functional analysis, the book is an ideal introductory teaching text for first-year graduate students. By the wealth of highly non-trivial exercises, many of which are guided, it can serve for self-study too.

Stefan Cobzaş

Andreas Juhl, *Cohomological Theory of Dynamical Zeta Functions,* Progress in Mathematics, Vol. 194 Birkhäuser Verlag, Boston-Basel-Berlin 2001, x+709 pp., ISBN 3-7643-6405-X.

Dynamical zeta functions are associated to dynamical systems with a countable set of periodic orbits. The dynamical zeta functions of the geodesic flow of locally symmetric spaces of rank one are known as the generalized Selberg zeta functions.

The present book is concerned with these zeta functions from a cohomological point of view. Originally, the Selberg zeta functions appeared in the spectral theory of automorphic forms and were suggested by an analogy between Weil's explicit formula for the Riemann zeta function and Selberg's trace formula. The purpose of the cohomological theory is to understand the analytical properties of the zeta functions on the basis of suitable analogs of the Lefschetz fixed point formula in which periodic orbits of the geodesic flow take the place of fixed points. According to geometric quantization the Anosov foliations of the sphere bundle provide a natural source for the definition of the cohomological data in the Lefschetz formula. The Lefschetz formula method can be considered as a link between the automorphic approach (Selberg trace formula) and Ruelle's approach (transfer operators). It yields a uniform cohomological characterization of the zeros and poles of the zeta functions and

a new understanding of the functional equations from an index theoretical point of view. The divisors of the Selberg zeta functions also admit characterizations in terms of harmonic currents on the sphere bundle which represent the cohomology classes in the Lefschetz formulas in the sense of Hodge theory. The concept of harmonic currents to be used for that purpose is introduced here for the first time. Harmonic currents for the geodesic flow of a noncompact hyperbolic space with a compact convex core generalize the Patterson-Sullivam measure on the limit set and are responsible for the zeros and poles of the corresponding zeta function.

The book is not a textbook but describes the present state of the art of the research in a new field on the cutting edge of global analysis, harmonic analysis and dynamical systems. The majority of results suggest generalizations and raise new questions, some open problems being emphasized explicitly throughout the text. It should be appealing not only to specialists on zeta functions which will find their objects of favorite interest connected in new ways with index theory, geometric quantization methods, foliation theory and representation theory. In this way the book will attract specialists in geometric quantization methods. From the point of view of smooth hyperbolic dynamics the Lefschetz formula method is a link between the automorphic method and the method of Perron-Frobenius operators, relations which are far from being fully understood.

Paul A. Blaga

Flávio Ulhoa Coelho, Héctor A. Merklen (editors): *Representations of algebras, proceedings of the conference held in São Paulo*, Lecture notes in pure and applied mathematics, Volume 224, Marcel Dekker, 2001, xvii+282 pp., ISBN 0-8247-0733-8.

Seventy-two researchers from 17 different countries attended the Conference on Representations of Algebras-São Paulo (CRASP), held at the Instituto de Matemática e Estatística of the Universidade de São Paulo. There were 14 invited talks and 32 contributions.

This book is a valuable collection of these contributions covering almost every research topic belonging to the large domain called Representation Theory of Algebras. We can find new results related with Hopf, derived tubular, tame tilted, symmetric quasi-Schurian, wild hereditary, concealed-canonical, Koszul, coil, quasitilted and Brauer star algebras. A complete classification of the representation-infinite connected tame tilted algebras with almost regular connecting component is given. The existence of almost split morphisms and

sequences in some special categories is discussed and we have a combinatorial characterization of hereditary categories containing simple objects. The concept of twisted Hopf algebra is introduced following the constructions which appeared in the theory of Ringel-Hall algebras and quantum groups.

The collection proves to be an excellent guide for getting familiarized with the newest developments in Algebra Representations Theory.

Andrei Mărcuş