BOOK REVIEWS

H.M. Antia, *Numerical Methods for Scientists and Engineers*, Birkhäuser Verlag, Boston–Basel–Berlin, 2002, 864 pages, Hardcover, ISBN: 3-7643-6715-6.

This book is a comprehensive exposition (almost 900 pages) of numerical methods usable in science and engineering. It is intended to fulfill the difficult task to cover all elementary topics in numerical computations and to discuss them such that to enable their practical implementation.

The first two chapters are on errors in numerical computation.

The third chapter is dedicated to methods for solving linear algebraic systems (direct methods and iterative stationary methods). Chapter 4 deals with interpolation. An advanced topic of this chapter is interpolation of more dimensions. The next chapter is on (numerical) differentiation. Numerical integration (including multivariate) is the subject of chapter 5. Nonlinear equations in $\mathbb{R}$ and $\mathbb{R}^n$ are treated in the seventh chapter. Chapter 8 is on optimization. Chapter 9, "Functional approximation", presents various least square approximations, FFT and Laplace transform, Cebyshev, Padé and L_1-approximation. Algebraic eigenvalue problem is the subject of chapter 10. Chapter 11 treats ordinary differential equations – numerical methods for initial value problems and two-points boundary value problems. In chapter 12 one finds an advanced topics – integral equations – not too present in older classical books. The last chapter, 13, is dedicated to the numerical methods for partial differential equations.

Bibliographies accompany each chapter.

The book contains also over 500 exercises and problems, whose answer and hints are in appendix A. Over 100 well-chosen worked out examples, which illustrate the usability of the methods and their pitfalls are also included. The accompanying CD contains good quality Fortran and C programs and tests (appendix B and C, only on CD).

Intended audience: students, computer scientists, researchers in science and engineering, practicing engineers.

Radu T. Trîmbiţaş

Roger Godement, *Analyse Mathématique,* Springer, Berlin - Heidelberg - New York.
I. *Convergence, fonctions elementaires,* (1998), 2éme édition corrigé 2001, xx+458 pp, ISBN 3 540 42057-6 ;
II. *Calcul différentiel et intégral, séries de Fourier, fonctions holomorphes,* (1998), 2éme édition corrigé 2003, viii+490 pp, ISBN 3 540 00655-9;
III. *Fonctions analytiques, différentielles et variétés, surfaces de Riemann,* 2002, ix+338 pp, ISBN 3 540 66142-5;
IV. *Intégration et théorie spéctrale, analyse harmonique, le jardin des délices*

modulaires, 2003, xii+599 pp, ISBN 3 540 43841-6.

This four volume book is an unusual treatise on mathematical analysis, in the sense that the main target of the author is not to present the results in their strict logical connections with shortest proofs possible (called *Blitzbeweise* by the author), but rather to emphasize the historical evolution of mathematical ideas. Due to this nonlinear character of the exposure, there are some repetitions, but each new approach to a subject sheds a new light on it, revealing new faces and opening new perspectives. These repetitions lead to the increase of the size of the book but, as a former member of Bourbaki group, the author adopted one of their basic principles : "don't spare paper". By the numerous comments and footnotes spread through the four volumes, the author put in evidence the sinuous way the notions and results travelled before reaching the clarity and logical rigor of the 20th century. The volumes contain a lot of examples of miscalculations and wrong reasonings (*derapages* or *acrobatie sans filet*) of great mathematicians as Newton, the Bernoullis, Euler, Cauchy, Fourier, a.o., leading to correct or to false results. This shows that many notions and results were often seized by the intuition of the great creators of mathematical analysis (*les Fondateurs*), initially in an obscure and confusing manner. For us many of these thinks look very simple and clear, but this took sometimes fifty or even hundred of years years of evolution, discussions, or arguments. Beside these comments of mathematical character there are a lot of political and social considerations concerning pure and applied mathematics (mainly its military and social applications), and on the responsibility of scientists and governs for the use of the research for military purposes. In the last 25 years the author was deeply involved in such questions, and some of his ideas and conclusions are collected in a *Postface* at the end of the second volume, with special references to armament race and the construction of A and H bombs by the USA and SSSR.

The first two volumes of the book (Chapters I through VII) are concerned with the differential and integral calculus of the functions of one variable (real or complex), including elements of Fourier analysis and holomorphic functions. Some results on differential calculus in $\mathbb{R}^n$ are treated (including the implicit function theorem in $\mathbb{R}^2$). An appendix to Chapter III contains some results on metric, normed and inner product spaces. A specific feature of the book is the early treatment of some topics considered as advanced - summable families (*convergence en vrac*), analytic functions, Radon measures, Schwartz distributions, Weierstrass theory of elliptic functions. A more advanced treatment of some of these results can be found in the third volume of the book.

The third volume contains three chapters: VIII. *La théorie de Cauchy,* IX. *Différentielles et intégrales à plusieurs variables,* and X. *La surface de Riemann d'une fonction algébrique.* In Chapter VIII one continues the study of holomorphic functions, started in the second volume, with the Cauchy integral formula and its applications to the calculus of residues, to complex Fourier transform (including the Paley-Wiener theorem) and to Mellin transform. Chapter IX contains a discussion on tensors, differential varieties, differential forms and their integration, culminating with Stokes theorem. The last chapter of this volume contains a brief introduction to

Riemann surfaces, a subject that was yet touched at the end of the first volume when dealing with the functions $\operatorname{Arg} z$ and $\operatorname{Log} z$.

The last volume of the treatise contains two chapters: XI. *Intégration et transformation de Fourier*, and XII. *Le jardin des délices modulaires ou, l'opium des mathématiciens.* The chapter on integration, based on the famous course taught for a long period by the author at the University Paris VII, develops the integration theory following Daniell's approach, like Bourbaki. One constructs the spaces L^p, including completeness and duality results, and one proves Lebesgue-Fubini and Lebesgue-Nikodym theorems. The author insists on the notion of Polish space, a term suggested by him to Bourbaki when he was a member of the group, a that was adopted immediately by Bourbaki and by the mathematical community as well. The construction of Haar invariant measure on a locally compact group G, with applications to Fourier transform on $L^1(G)$ and $L^2(G)$, is included. This chapter contains also an introduction to operators on Hilbert space, and to unitary representations of locally compact topological groups.

The last chapter of the treatise is devoted to more specialized topics related to modular functions - theta and L series, elliptic functions and integrals, the Lie algebra SL(2). It can be used as an introduction to this area of research with very reach possibilities of generalization.

Reflecting author's encyclopaedic knowledge of mathematics and written in a live and attractive style (a perfect illustration of the famous "French spirit"), the book will be a valuable help for those teaching mathematical analysis or desiring to be acquainted with the evolution of the mathematical ideas. The historical, social and ethical comments accompanying the main text, reflects the complex personality of the author and his broad interests.

S. Cobzaş

Robert L. Ellis and Israel Gohberg, *Orthogonal Systems and Convolution Operators*, Operator Theory: Advances and Applications, Vol. 140, Birkhäuser Verlag, Basel-Boston-Berlin 2003, xvi+236, ISBN: 3-7643-6929-9.

The Szegö polynomials are polynomials that are obtained by the Gramm-Schmidt orthogonalization process from $1, z, z^2, ...$ in the space $L^2(\mathbb{T})$, $\mathbb{T}$ the unit circle, that are orthogonal with respect to the inner product

$$< f, g >_\omega = \frac{1}{2\pi} \int_{-\pi}^{\pi} \overline{g(e^{it})}\omega(e^{it}) f(e^{it}) dt. \tag{1}$$

Here ω is a positive integrable weight function. G. Szegö proved that all the zeros of the Szegö polynomials lie inside the unit circle. M. G. Krein extended Szegö's theorem to the case of a not necessarily positive weight function ω, when the inner product (1) need not to be positive definite, and the corresponding space is called a space with indefinite inner product. In this case the distribution of the zeros of orthogonal polynomials is much more complicated than in the definite case, and is connected with the numbers of positive and negative eigenvalues of some Toeplitz matrices associated with the orthogonal polynomials. Krein investigated also the continuous analogues of orthogonal polynomials, by replacing the Toeplitz matrix by a convolution operator on $L^2(0,a)$. Together with H. Langer, he proved an analogue of Krein's theorem.

Based on the research done by the authors and their colleagues for nearly fifteen years, the book is devoted to a unified and thorough presentation of these results, along with many extensions and generalizations. These extensions are concerned with matrix- and operator-valued polynomials, functions and operators, considered both in the discrete and continuous case. The unifying theme is that of the orthogonalization with invertible squares in modules over C^*-algebras. One of the main features of the book is the interplay between polynomials and operator theory – the theory of Toeplitz matrices, Wiener-Hopf operators, Fredholm operators and their indices.

The book book is of interest for analysts but, as the developed theory has many applications to some engineering problems (mainly in signal processing and prediction theory), the engineers and physicists will find a lot of interesting things in it too.

P. T. Mocanu

Writing the History of Mathematics: Its Historical Development, Editors: Joseph W. Dauben and Christoph J. Scriba, Historical Studies-Science Networks, Birkhäuser Verlag, Basel-Boston-Berlin 2002, xxxvii+689 pp, ISBN: 3-7643-6167-0.

"History of mathematics' is concerned with the development in time of the unfolding of mathematics, whereas "historiography of mathematics" deals with scholarly research, reconstruction and description of the past development of the history of mathematics. The aim of the present book is to provide a perspective on how and why history of mathematics has developed in various countries and at different times.

The idea to initiate a study of the history of history of mathematics was settled down at a meeting in Oberwolfach, Germany, in the early 1990s. Subsequently J. Dauben and Ch. Scriba accepted the editorial responsibility of the project, and the task was accomplished with the help of more than forty collaborators, and with support from several institutions and organizations.

The first part of the book, *Countries*, contains 20 chapters, the first 19, written by different authors, deals with the history of history of mathematics in different countries. The last chapter, *Postscriptum*, discusses some connections of the history of mathematics with teaching and society, the impact of electronic media, and the humanism of mathematics.

The second part of the book contains three hundred short biographies of prominent contributors to the history of mathematics, including some great names of contemporary mathematics – J. Dieudonné, A. N. Kolmogorov, D. J. D Struik, B. L. van der Warden, A. Weil. Some portraits are also included.

The third part contains a list of abbreviations, the bibliography and an index.

All the included material was drafted and circulated, being revised and rewritten several times, and finally reconsidered in the context of the entire project by the team of scholars overseeing the project.

The result is this monumental book, that is of great interest not only to mathematicians but also to people interested in the history of science in general.

Paul A. Blaga

Philippe Blanchard and Erwin Brüning, *Mathematical Methods in Physics–Distributions, Hilbert Space Operators and Variational Methods,* Progress in Mathematical Physics, Vol. 26, Birkhäuser Verlag, Boston-Basel-Berlin 2002, pp. xxii+463, ISBN: 3-7643-4228-5 and 0-8176-4228-5.

The book contains a detailed exposition of the basic mathematical facts and tools needed in quantum mechanics and in classical and quantum field theory. The book is divided into three parts: I, it Distributions, II, *Hilbert space operators* and III, *Variational methods.*

The first part contains a fairly complete presentation of Schwarz theory of distributions, including the necessary elements of locally convex spaces. The emphasis is on the analytical aspects of the theory as: Fourier transform, convolution and approximation of distributions by regularizing sequences, holomorphic functions and the relations of distributions with boundary values of analytic functions. Many carefully chosen and very interesting examples, as the distribution δ of Dirac, the principal value distribution, the Sokhotski-Plemelji formula, give a strong motivation for the developed topics and make the lecture more attractive. Applications of the theory of distributions to ODEs and PDEs are given. This part ends with a discussion of other classes of generalized functions – Gelfand-Shilov generalized functions and Komatsu hyperfunctions.

In the second part, after some introductory results on the geometry of Hilbert spaces and orthonormal bases, one passes to the study of linear operators on Hilbert space and their spectral theory. The focus is on properties needed for the study of Schrödinger operator in quantum mechanics. The authors consider the principal classes of bounded and unbounded operators on Hilbert space: self-adjoints, symmetric, closable, unitary, trace operators, Hilbert-Schmidt operators. One insists on the C^*-algebra properties of the space $\mathcal{B}(\mathcal{H})$ of bounded linear operators on the Hilbert space $\mathcal{H}$. As application one considers the interpretation of the spectrum of self-adjoint Hamiltonian.

The last part of the book is concerned with direct methods in the calculus of variations and constrained minimization, with applications to boundary and eigenvalue problems. A short presentation of the Hohenberg-Kohn variational principle is included. The authors have written another book *Variational methods in mathematical physics. A unified approach*, Springer Verlag, Berlin 1992, devoted to variational methods.

The book is fairly self-contained, the prerequisites being advanced differential calculus (including Lebesgue integration) and familiarity with basic results in ODEs and PDEs Four appendices contain some supplementary material from topology, functional analysis and algebra.

By presenting in a rigorous way and with many historical comments the basic results needed for quantum mechanics, the book will be of great interest to physicists and engineers using the mathematical apparatus in their research. For mathematicians interested in an accurate presentation of non-trivial applications of relatively abstract areas of mathematics, the book is a valuable source of examples.

S. Cobzaş

Yves Nievergelt, *Foundations of Logic and Mathematics*, Birkhäuser Verlag, Boston, 2002, xvi + 416 pp., Hardcover, ISBN 0-8176-4249-8.

This book is a modern introduction to the foundations of Logics and Mathematics, written with a permanent care for the possible applications of some rather classical topics in modern fields of science and especially in Computer Science.

The present volume is structured into two main parts, namely *A. Theory*, containing Chapters 0-4, and *B. Applications*, containing Chapters 5-7.

Chapter 0 sets the fundamentals concerning Boolean algebraic logic, discussing logical formulae, logical truth and connectives, tautologies and contradictions, methods of proof and Karnaugh tables. Chapter 1 refers to logic and deductive reasoning, having as main topics propositional and classical implicational calculus, proofs by contraposition, proofs with connectives or quantifiers and predicate calculus. Chapter 2 contains the basic material of Set Theory, including operations for sets, relations, functions, equivalence and ordering relations. Chapter 3 deals with mathematical induction, definition and (arithmetic) properties of natural numbers, integers and rational numbers, also referring to finite and infinite cardinality and ending with some arithmetic in finance. Chapter 4 discusses decidability and completeness, the selected topics being on logics for scientific reasoning, incompleteness, automated theorem proving, transfinite methods, transitive sets and ordinals and regularity of well-formed sets.

Chapter 5 presents the relationship between Number Theory and Code Theory, containing the classical Euclidean Algorithm, digital expansion of integers, properties of primes and modular arithmetic as well as some very practical information on modular codes, such as the International Standard Book Number (ISBN) code, the Universal Product Code (UPC) and the Bank Identification Code, and Rivest-Shamir-Adleman (RSA) codes in public key cryptography. Chapter 6 deals with (cyclic) permutations, arrangements and combinations, elements of probabilities, the most of these with the finality of describing the ENIGMA machines. Chapter 7, which is mainly an introduction to Graph Theory, discusses several types of graphs (directed, undirected, path-connected, weighted or bipartite), Euler and Hamiltonian circuits, trees, but also some of their applications in science, concerning the shape of molecules and hydrocarbons or sequences of radioactive decays.

The book is well written, concise and organized and contains an impressive quantity of information on rather different topics. I should emphasize the numerous examples (more than 1000) and exercises (again more than 1000) throughout the text as well as the several projects at the end of each chapter, that propose some more difficult problems, sometimes suggesting further bibliographic sources.

I warmly recommend the volume to students in Mathematics and Computer Science, but also to those interested in the foundations of these sciences.

Septimiu Crivei

M. M. Rao, Z. D. Ren, *Applications of Orlicz Spaces*, Marcel Dekker, Inc., New York-Basel, 2002.

This book is written by well-known specialists in the theory of Orlicz spaces. Their book "Theory of Orlicz spaces", Marcel Dekker, New York 146, 1991 and the work of S.T. Chen "Geometry of Orlicz spaces", Dissertationes Math., 356 (1996), 1-204, together with the present volume cover a great part of the modern theory of Orlicz spaces and its applications.

In order to obtain complete solutions for some problems, the authors prefer to work in Orlicz spaces $L^{\phi}(S,\Sigma,\mu)$, where ϕ is an N-function (instead of a general Young function) and where the measure space (S,Σ,μ) is either purely atomic or diffuse and finite (σ-finite). On the other hand they consider both the cases when $L^{\phi}(S,\Sigma,\mu)$ is endowed with the Orlicz or Luxemburg norm. Exact values for several geometric constants of Orlicz spaces are computed in the case $\phi := \phi_s, s \in (0,1)$, where ϕ_s is an intermediate function between $\phi_0(u) = u^2$ and a given N-function.

In Chapter II one obtains lower and upper bounds for James constant and for von Neumann-Jordan constant of Orlicz spaces endowed equally with Orlicz and Luxemburg norms. Exact values for these constants are obtained for $L^{\phi_s}([0,1]), L^{\phi_s}(\mathbb{R})$ and ℓ^{ϕ_s} endowed with both norms. In chapters III-V similar estimates are given for other geometric constants as: the normal structure coefficient, weak convergent sequence coefficient, Jung constant, Kottman constant and for the packing constant of Orlicz spaces. All such estimates are expressed in terms of quantitative indices of N-functions. In chapter VI the authors consider some problems of Fourier Analysis in Orlicz and generalized Orlicz spaces. So, they present conditions implying the almost everywhere convergence of Fourier or conjugate Fourier series of all $f \in L^{\phi}([0,1])$, or that the Haar system of functions forms an unconditional basis in $L^{\phi}([0,1])$. In the next chapter applications to prediction theory are presented – for instance a necessary and sufficient condition for a prediction operator (with respect to a Chebyshev subspace of $L^{\phi}(\mu)$) to be linear. Other applications in the field of stochastic analysis and of partial differential equations with solutions in Orlicz-Sobolev spaces are also presented.

The book is well-written, self-contained, with many bibliographical comments, suggestive examples and a rich list of references (from old ones to very recent titles). Many of the results in the book were not yet known thirty years ago and some were even not known ten years ago. The book is recommended to graduate students and research workers in the field of Banach space theory, probability, partial differential equations, approximation theory etc.

Ioan Şerb

Hrushikesh N. Mhaskar and Devidas V. Pai, *fundamentals of Approximation Theory,* Alpha Science International Ltd., 2000, xv+541 pp., Hardcover, ISBN 1-84265-016-5.

Understood in a broad sense, approximation is one of the major themes of mathematics – approximate mathematical objects with simpler ones, easier to handle. The development of the computers made it even more important – the numerical algorithms are based on discretization techniques that are, in fact, approximation procedures.

The book under review is dedicated to a comprehensive presentation of basic tools and results in approximation theory, understood as a mathematical discipline.

Its characteristic features are the clarity of the exposure, a careful choice of the included topics and the permanent interplay between classical and abstract (meaning functional analytic) tools.

The best idea on its content can be given by a short presentation of the chapters. Ch. I, *Density theorems*, deals with Weierstrass type theorems for both trigonometric polynomials and algebraic (of Fejér's and Bernstein), Korovkin's theorems, Stone-Weierstrass theorem.

In Ch. II, *Linear Chebyshev approximation*, after presenting some results on the existence and uniqueness of best approximation in abstract normed spaces, the authors pass to the concrete case of uniform approximation by polynomials, including existence, Chebyshev alternation theorem, Haar spaces and uniqueness, strong uniqueness and continuity of the metric projection operator. A special attention is paid to discretization and algorithms for computing the best approximation polynomials (Remes algorithms).

Ch. III, *The degree of approximation*, is concerned with quantitative aspects of approximation theory, emphasizing the the connections between the smoothness properties (expressed in terms of some moduli of continuity and smoothness) and the degree of approximation. The chapter contains both direct and converse deep theorems, belonging to Jackson, Favard, Markov, Bernstein. Bernstein's theorem on the approximation by analytic functions is included too.

Ch. IV, *Interpolation*, is an introduction to various interpolation procedures – Lagrange, Taylor, Abel-Gonchearov, Hermite. Evaluations of the errors are included.

Ch. V, *Fourier series,* contains a brief introduction to the subject, with emphasis on convergence and summability.

Ch. VI, *Spline functions*, aims to give a short but thorough introduction to spline functions, viewed as a new tool of approximation, and showing how the ideas developed in the first four chapters look like in this case.

Ch. VII, *Orthogonal polynomials*, introduce the reader to this very important area of mathematical analysis.

The last chapter of the book, Ch. VIII, *Best approximation in normed linear spaces*, is concerned with best approximation in abstract setting. The authors put in evidence the deep relations between the geometry of the normed space and its approximation properties - existence and uniqueness of best approximation, continuity of the metric projection, convexity of Chebyshev sets. The last section is concerned with optimal recovery problems.

Each chapter ends with a section of historical notes and a set of exercises. Some of these are routine, completing the main text, but there also challenging exercises, taken from current research papers. For these ones detailed hints are included.

A comprehensive bibliography of 302 items is included.

The authors are well known specialists in the domain and the book incorporates a lot of their original results.

Based on an over that 10 years teaching experience, the book can be used for special graduate or post-graduate courses. The chapters are relatively independent, so that parts of the book can be used for different courses. The prerequisites are advanced calculus and basic topology, measure theory and functional analysis.

Covering, in a clear and comprehensive manner, the basic results in approximation theory, both classical and abstract as well, I think the book will become a standard reference in the field.

S. Cobzaş

A. Brown and Ken R. Goodearl, *Lectures on Algebraic Quantum Groups*. Advanced courses in mathematics - CRM Barcelona, Birkhäuser Verlag, Basel-Boston-Berlin, 2002, ix+349 pp., Softcover, ISBN 3-7643-6714-8.

The term 'quantum groups' refers to a rapidly growing field of mathematics and mathematical physics which appeared in the 1980's theoretical physics and statistical mechanics. The volume under review is an expanded version of the lectures given by the authors in September 2000 at the Centre de Ricerca Mathemàtica in Barcelona, and it focuses on two types of algebras. First, there are the so called 'quantum coordinate rings' which are deformations of the classical coordinate rings of algebraic groups or related algebraic varieties. The second type consists of 'quantized enveloping algebras', which are deformations of universal enveloping algebras of semisimple Lie algebras or of affine Kac-Moody Lie algebras.

The book is divided into three parts. Part I contains the fundamental background material. The second part deals with generic quantized coordinate rings, while the third part focuses on quantized algebras at roots of unity. The presentation begins at a point accessible to a graduate student. Later, the style becomes more informal; only sketches of proofs are given, and some topics are presented in a survey manner. There are also many exercises aimed at the non expert reader. Some topics such as the nature of the prime spectrum of a generic quantized algebra, and the relationship between the Hopf algebra structure of the algebra and the Poisson algebra structure of the centre are covered for the first time in book form.

The authors are important contributors to the subject, and their book is a very useful addition to the literature. I warmly recommend it to anyone interested in quantum groups.

Andrei Marcus

Miklós Laczkovich, *Conjecture and Proof*, The Mathematical Association of America, Washington, DC, 2001, x+118 pp., Softcover, ISBN 0-88385-722-7.

The book under review is an extended version of the lectures given by the author at an one-semester course based on creative problem solving of the Budapest Semesters in Mathematics. This is a program for American and Canadian students initiated by Paul Erdős, László Lovász, Vera T. Sós, and László Babai. The book is divided into two parts (Proofs of Impossibility–Proofs of Nonexistence, Constructions–Proofs of Existence)and discusses questions from various fields of mathematics: number theory, algebra and geometry. It contains important and interesting results like the transcendence of e, the Banach-Tarski paradox, the existence of Borel sets of arbitrary finite class, while the necessary prerequisites are kept at the level of an introductory calculus course. All these features will make this volume into a valuable source of inspiration for students and teachers of mathematics.

Andrei Marcus

Nicolai N. Vorobiev, *Fibonacci Numbers*, Birkhäuser Verlag, Basel–Boston–Berlin 2002, x+176 pp, ISBN 3-7643-6135-2.

The book under review is translated from the Russian 6th edition by Mircea Martin and it presents the bearing of Fibonacci numbers on mathematics.

In Chapter 1 (The Simplest Properties of Fibonacci numbers) the basic properties of Fibonacci numbers are given, as *Binet's formula* and applications of this result. In Chapter 2 (Number-Theoretic Properties of Fibonacci Numbers) the main aim is the study of the divisibility of Fibonacci numbers. We mention here Theorem 11 saying that *any to consecutive Fibonacci numbers are relatively prime*, and the more general result Theorem 12, which says that $\gcd(u_m, u_n) = u_{\gcd(m,n)}$. In Chapter 3, entitled Fibonacci Numbers and Continued Fractions, the continued fractions are described using Fibonacci numbers. Legendre's Theorem, Vahlen's Theorem, Borel's Theorem, and Hurwitz's Theorem about continuous fractions are presented. In Chapter 4, "Fibonacci Numbers and Geometry", the author presents connection between Fibonacci numbers and results of classical geometry and graph theory. In Chapter 5 (Fibonacci Numbers and Search Theory) specific variants of minimum problems are discussed: "estimate the minimizing point $\overline{x}$ together with the minimum value $f(\overline{x})$ taken by f at this point" (Problem A) and "approximate the minimizing point $\overline{x}$".

It is well know the fact that Fibonacci numbers have had an important impact on areas as art, architecture, political economy, and other domains, hence many specialists in other domains than mathematics should be interested by them. The book under review is very well written, the prerequisites for reading it are minimal hence it is easy to read. Also, the book will be useful for any student, teacher, and researcher.

Simion Breaz

Toma Albu, *Cogalois Theory*, Marcel Dekker, New York–Basel 2003, xii+341 pp, ISBN 0-8247-0949-7.

The classical Galois theory says that E/F is a finite Galois extension, then the lattice Intermediate(E/F) of all intermediate fields is anti-isomorphic to the lattice of subgroups of Gal(E/F). There are however field extensions which are not necessarily Galois, but have a dual property, that is, there is a lattice isomorphism between Intermediate(E/F) and the lattice of subgroups of a group Δ canonically associated to E/F. Such extensions are called extensions with Δ-Cogalois correspondence.

The book under review is the first which offers a systematic investigation of this concept. One should note that the term Cogalois appeared in literature in 1980 in a paper of C. Greither and D.K. Harrison, while the term extension with Cogalois correspondence was introduced by the author and F. Nicolae.

The volume is divided into two parts. The first part deals with finite extensions, and consists of 10 chapters. These chapters contain the necessary preliminaries and investigate the following aspects of the theory: G-radical extensions, Cogalois extensions, Cogalois connections associated to G-radical extensions, strongly

G-Kummer extensions (which are extensions with G/F^*-Cogalois correspondence), almost G-Cogalois extensions, finite Galois extensions which are Cogalois, radical, Kneser or G-Cogalois, Kummer extensions. Applications to Algebraic Number Theory and connections with graded algebras and Hopf algebras are also discussed.

The second part considers infinite extensions and has 5 chapters. The first problem here is to find suitable generalizations of the above concepts. The author discusses infinite G-Kneser extensions, infinite G-Cogalois extensions, infinite Kummer extensions, and infinite Galois G-Cogalois extensions, which involve profinite groups.

The author is an important contributor to the subject, and the volume contains many of his results. The book is carefully written and it is accessible to graduate students. Familiarity with basic abstract algebra, Galois theory and some Galois cohomology is assumed. Over 250 exercises, an up-to-date bibliography and an extensive index add to the value of the book.

This volume is especially recommended to students and researchers in Algebraic Number Theory, but any algebraist will find here interesting ideas and information.

Andrei Marcus

M. W. Wong, *Wavelet Transforms and Localization Operators*, Operator Theory: Advances and Applications, Vol. 136, Birkhäuser Verlag, 2002, pp. 156. ISBN: 3-7643-6789-X.

Wavelet analysis is an emerging mathematical discipline, that has begun to play a serious role in a broad range of applications, including signal processing, data and image compression, solution of partial differential equations, modeling multiscale phenomena, and statistics. In the present book, the author studies wavelet transforms and localization operators in the context of infinite-dimensional and square-integrable representations of locally compact and Hausdorff groups. At the same time, fruitful approaches have been developed as regards Daubechies operators on the Weyl-Heisenberg group, localization operators on the affine group, wavelet multipliers on the Euclidean space, the book providing the reader with the spectral theory of wavelet transforms and localization operators in the form of Schatten - von Neumann norm inequalities. The information is structured in 26 chapters as follows:

Introduction / Schatten - von Neumann Classes / Topological Groups / Haar Measures and Modular Functions / Unitary Representations / Square-Integrable Representations / Wavelet Transforms / A Sampling Theorem / Wavelet Constants / Adjoints / Compact Groups / Localization Operators / S_p Norm Inequalities / Trace Class Norm Inequalities / Hilbert-Schmidt Localization Operators / Two-Wavelet Theory / The Weyl-Heisenberg Group / The Affine Group / Wavelet Multipliers / The Landau-Pollak-Slepian Operator / Products of Wavelet Multipliers / Products of Daubechies Operators / Gaussians / Group Actions and Homogeneous Spaces / A Unification / The Affine Group Action on $\mathbb{R}$.

In order to sustain the above material, a good bibliography containing 108 titles is listed. The author offers clear explanations of every concept and method making the book accessible and valuable to researchers and graduate students alike.

Octavian Agratini