Book reviews

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BOOK REVIEWS

G. R. Krause, T. H. Lenagan: GROWTH OF ALGEBRAS AND GELFAND-KIRILLOV DIMENSION. Graduate Studies in Mathematics vol. 22, American Mathematical Society, Providence, Rhode Island, 1999, 212 pages, ISBN 0-8218-0859-1, $ 39.–.

This is the second edition of the fundamental monograph on the Gelfand-Kirillov dimension. The first edition was published in 1985 (Research Notes in Mathematics 116, Pitman, Boston, Mass.). There are practically no changes in the original text, only errors have been corrected. In order to cover the progress of the last fifteen years in this field, the authors have added Chapter 12 which sketches the development and provides the reader with the relevant references. (As compared with the first edition the number of references has increased twice. They comprise even preprints and papers which were to appear at the time of publishing, and go up to 1999.) In most cases the appearance of the second edition signals that the book is good, and that there is interest in it. This is really the case with the monograph under review. We can say that it is very carefully and clearly written. It can be recommended not only to specialists, but to everybody who either intends to start working in this interesting field or only needs some information concerning the Gelfand-Kirillov dimension. From the point of view of a student it requires only minor prerequisites, mainly from algebra. From the point of view of specialists in other fields, we can say that it is quite easy to find there the required information. The book reads well, the authors often mention the historical development of the subject, and provide the text with many very interesting examples. They present various applications, most of them in algebra. Therefore, we point out that there is also a chapter on the growth of groups, the notion which has been applied in differential geometry.

Jiří Vanžura, Brno

R. E. Gompf, A. I. Stipsicz: 4-MANIFOLDS AND KIRBY CALCULUS. Graduate Studies in Mathematics, vol. 20, American Mathematical Society, Providence, 1999, xv+558 pages, ISBN 0-8218-0994-6, $ 65.–.

This book represents an excellent introduction into the 4-manifolds theory, and can be strongly recommended to beginners in this field. It is very carefully and clearly written. The authors evidently paid a great attention to the presentation of the material. Their requirements concerning the prerequisites are not too high. A postgraduate student most probably will not have to look very often into other sources. The exposition is amended with really pretty many interesting examples and a great number of exercices. The last chapter is then devoted to solutions of some of them. I think that this type of presentation makes the study easier and also makes the subject more attractive. For young mathematicians let us add that the theory of 4-manifolds is very quickly developing during the last two decades, and at present can be considered a very perspective field of interest.

Jiří Vanžura, Brno

D. Howard, J. Stachel (eds.): EINSTEIN—THE FORMATIVE YEARS (1879–1909). Einstein Studies, vol. 8, Birkhäuser, Basel, 2000, 258 pages, DM 128.–.

The eighth volume of *Einstein Studies* presents eight papers concerning Albert Einstein's early life and work from a variety of perspectives—personal, scientific, historical, and philosophical. This volume covers the first thirty years of his life, before he obtained his first academic position, especially his young student growing up in Munich, his subsequent studies at the Aargau Cantonal School and the Federal Polytechnic Institute in Zurich, and his work as a clerk in the Swiss Federal Patent Office in Bern. Einstein's early views on scientific methods and philosophical influences (Mach, Helmholtz, Poincaré, Hume, Duhem, Spinoza) shaping those views are also included. This book is accessible to a broad general readership.

Vojtěch Pravda, Praha

Ethan D. Bloch: PROOFS AND FUNDAMENTALS. A First Course in Abstract Mathematics. Birkhäuser, Basel, 2000, 448 pages, DM 108.–.

It is a known fact that people can be partitioned into two classes: The "mathematicians", more accurately people who understand the strange language of axioms, definitions, theorems and proofs, and the "standard people" who think that mathematicians are a kind of deviants and who, if necessary, use mathematics only in the form of algorithmically described applied computations. The book Proofs and Fundamentals is an attempt to answer the fundamental question: What should one do to convert from the second into the first class? Or, which is more usual, what should a teacher do to give a student a possibility to enter the first group.

It must have been a unique author's experience which helped him to create a book excelent in the following three directions:

The union of good motivation and informal exploration of all topics with subsequent perfectly rigorous mathematical presentation.

The key role of demonstrating and teaching how mathematical proofs should be written, as the main contents of excercises for an advanced mathematics student.

The excellent choice of material which gradually puts down the building stones of mathematical thinking in most branches of mathematics.

In this way, a serious question is implied for the organization of university studing plans of mathematics: Should one not include a special transition course (called, e.g., Introduction to abstract mathematics) before starting any specialized courses like linear algebra, abstract algebra, real analysis etc.?

The book can be used as an inspiring material for all university teachers of basic mathematical courses (over 400 included excercises, which range from straightforward examples to challenging proofs, offer an excellent source of ideas) and can also be used by tallented students for their own study.

Zdeněk Vavřín, Praha

Richard H. Enns, George C. McGuire: NONLINEAR PHYSICS WITH MAPLE FOR SCIENTISTS AND ENGINEERS. 2nd ed., Birkhäuser, Basel, 2000, xiii+661 pages, DM 138.–.

Nonlinear physics is an area of modern research, with applications to physics, engineering, chemistry, etc.

In the first theoretical part of the book elements of nonlinear analysis are described.

Nonlinear mechanics and nonlinear phenomena in various parts of science are analysed, topological methods, singular points, analytic methods of solving differential equations, numerical methods, the analysis of limit cycles, oscillators with forcing, general nonlinear maps, partial differential equations, possibilities to simulate the phenomena numerically, solitons, etc. are presented in this part. The authors have provided many Maple files on a CD-ROM and Maple worksheets which may be used both to solve and to explore the text's 400 problems. Experimental activities are included to deepen and broaden the reader's understanding of nonlinear physics.

The book is well written and can be used for teaching as well as for "playing" with nonlinearities in many fields of science.

Štefan Schwabik, Praha

W. D. Wallis: A BEGINNER'S GUIDE TO GRAPH THEORY. Birkhäuser, Basel, 2000, 248 pages, DM 78.–.

In this very well written introduction to graph theory a graph means a finite nonoriented graph without loops and multiple edges. Graphs are dealt with in the first nine (out of thirteen) chapters. Chapter 5 (Linear Spaces Associated with Graphs) has a special position among them: it is devoted primarily to two important vector spaces connected with graphs, namely, the cycle subspace and the cutset subspace. From the other eight chapters devoted to graphs let me mention at least some of the results proved there: characterization theorem for degree sequences, two sufficient conditions for the existence of a Hamilton cycle (G. A. Dirac; O. Ore), necessary and sufficient condition for the existence of a closed (open) Euler walk (it is formulated for multigraphs, which otherwise are considered only marginally in the book); necessary and sufficient condition for the existence of a 1-factor (W. T. Tutte); theorem on an upper bound of the chromatic number (R. L. Brooks); theorem on the edge chromatic number (V. G. Vizing and—as the author mentions—independently R. P. Gupta); Euler's formula for the planar representation of a connected planar graph; Five Color Theorem (P. J. Heawood); a formula for the tree-complete graph Ramsey number (V. Chvátal).

Chapter 10 is devoted to digraphs. Let me mention from it at least the theorem on cycles in strong tournaments (J. W. Moon). The topics of the last three chapters are well characterized by their titles: Critical Paths, Flows in Networks, Computational Considerations. In the middle one of them, the max flow min cut theorem is proved among other results. Chapters 11 and 13 are oriented primarily at applications. However, the author mentions applications in other chapters as well, e.g. the traveling salesman problem is presented in Chapter 2.

The exposition of each of the 51 sections in which the book is divided, is supplemented by exercises. For some of them the reader finds some hints in a special section, for some others the answer or solution is found in another section. The text is appropriately amended by numerous diagrams. A bibliography of a fairly large extent of 109 items is another advantage of the book. (Under #59 one paper of V. Havel is given; it evidently concerns Theorem 1.2 (characteristic of degree sequences), however, other references are by mistake given at the theorem.

As is apparent from the title, the book is intended as an introductory course to the graph theory. I wish to point out that in this sense it exhibits very goo quality. Moreover, I believe that the book can offer much even to those who know one or two things about the graph theory. I mean e.g. some theorems in Chapter 6 Factorization, sections 7.5 Class 2 Graphs (in Chapter 7 Graph Coloring) and last but not least Sections 9.2 Ramsey Multiplicity and 9.3 Application of Sum-Free Sets in Chapter 9 Ramsey Theory.

Ladislav Nebeský, Praha

Rolando Rebolledo (ed.): STOCHASTIC ANALYSIS & MATHEMATICAL PHYSICS. ANESTOC '98, Proceedings of the Third International Workshop. Trends in Mathematics, Birkhäuser, Boston 2000, x+166 pages, ISBN 3-8176-4185-8, DM 128.–.

The proceedings under review comprise eleven papers which were presented at the Third International Workshop on Stochastic Analysis and Mathematical Physics, held in Santiago, Chile, in October 1998. All contributions have been refereed and most of them are full-length research papers with complete proofs. The papers are denoted as chapters of the book, but in fact they are completely independent, being joined only by a common inspiration by problems of quantum physics. Several papers address various topics in quantum (non-commutative) probability theory, particular attention being paid to quantum Markov semigroups. The reader, however, may find in the book also two interesting articles on (classical) Feller semigroups and a paper devoted to Bernstein processes which arise in the Euclidean quantum mechanics.

Ivo Vrkoč, Praha

A. V. Balakrishnan (ed.): SEMIGROUPS OF OPERATORS: THEORY AND APPLICATIONS. International Conference in Newport Beach, December 14–18, 1998, Birkhäuser, PNLDE 42, Basel, 2000, v+367 pages, ISBN 3-7643-6310-X, DM 178.–.

These *Proceedings* contain a collection of refereed papers originating from the International Conference on Semigroups of Operators: Theory and Control. One of the Conference aims was to bring together experts in the abstract theory and applications, so the papers in this volume reflect recent advances in the theory of semigroups of operators of various types, integrated semigroups, cosine families, operator equations, perturbation and approximation problems, spectral theory of operators, as well as applications to initial value problems and boundary value problems for partial differential equations, functional equations and stochastic systems.

Hana Petzeltová, Praha

Michael Demuth, Jan A. van Casteren: STOCHASTIC SPECTRAL THEORY FOR SELFADJOINT FELLER OPERATORS. A functional integration approach. Probability and its Applications, Birkhäuser, Basel, 2000, ISBN 3-7643-5887-4, xii+463 pages, DM 198.–.

Let B be a d-dimensional Brownian motion, and $f \in C_\infty(\mathbb{R}^d)$, i.e., a continuous function vanishing at infinity. Then the function $u(t,x) = \mathbf{E}_x f(B_t)$ solves the heat equation $\partial_t u = \frac{1}{2}\Delta u$ with the initial condition $u(0,\cdot) = f$ on $\mathbb{R}^d$. The classical Feynman-Kac formula shows that the solution to a perturbed heat equation $\partial_t u = \frac{1}{2}\Delta u + Vu$, $u(0,\cdot) = f$ may be represented in a similar manner by means of a suitable multiplicative functional. Namely, the solution is given by

$$u(t,x) = \mathbf{E}_x \left(\exp\left\{ -\int_0^t V(B_s)\,\mathrm{d}s \right\} f(B_t) \right). \tag{1}$$

The right-hand side of (1) defines a semigroup on the space C_∞ (or on L^p) the infinitesimal generator of which coincides with the operator $\frac{1}{2}\Delta - V$, when the latter is suitably interpreted. From the well-developed theory of Schrödinger semigroups we know that the formula (1) may by employed to define the semigroup generated by $\frac{1}{2}\Delta - V$ even if the potential V is rather singular and applying analytic tools one faces serious difficulties.

The book under review develops this probabilistic approach to perturbations of semigroup generators for a fairly general class of semigroups, covering many interesting examples. A second countable locally compact state space E endowed with a Radon measure m is considered. The authors start with a "free" semigroup $\exp(-tK_0)$ on $L^2(m)$ which satisfies a few basic hypotheses: It is self-adjoint, leaves the space $C_\infty(E)$ invariant and is pointwise continuous on it as $t \searrow 0$, and admits an integral representation

$$\exp(-tK_0)f(x) = \int_E p_0(t,x,y)f(y)\,\mathrm{d}m(y)$$

with a continuous kernel p_0. By using Feynman-Kac formulae they introduce two classes of perturbed semigroups. First, if V is a function from the Kato class, they define a semigroup $\exp(-t(K_0 \dot{+} V))$ by an expression analogous to (1), where the Brownian motion is replaced with the Markov process corresponding to the free semigroup. Second, potentials that may be singular on some set Γ are treated and the semigroup $\exp(-t(K_0 \dot{+} V)_\Sigma)$, $\Sigma = E \setminus \Gamma$, is given again by a formula like (1), where the integration is now taken only over the set $\{S > t\}$, S being the penetration time of Γ.

The main objective of the book is to study spectral and scattering properties of the semigroups $\exp(-t(K_0 \dot{+} V))$ and $\exp(-t(K_0 \dot{+} V)_\Sigma)$, which in turn requires obtaining precise estimates of corresponding resolvent and semigroup differences in various operator norms (uniform, Hilbert-Schmidt, or nuclear). Demuth's and van Casteren's treatise is a research monograph, based to a great extent on the authors' own results; many of them appear here for the first time. Nonetheless, both the results presented in the book and the methods used to obtain them may address a rather wide range of readers: specialists in probability, operator theory, partial differential equations or in mathematical physics. The exposition is systematic and complete, and the authors tried to keep the book relatively self-contained. Some preliminary material on spectral theory, semigroups and Markov processes is reviewed in five extensive appendices, however, the reader should have a good background in all these topics to follow the book successfully.

Bohdan Maslowski, Praha

V. Maz'ya, S. Nazarov, B. Plamenevskij: ASYMPTOTIC THEORY OF ELLIPTIC BOUNDARY VALUE PROBLEMS IN SINGULARLY PERTURBED DOMAINS I, II. Operator Theory: Advances and Applications, vol. 112, Birkhäuser, Basel, 2000, ISBN 3-7643-2964-5, DM 478.–.

This book is devoted to the development and applications of asymptotic methods to boundary value problems for elliptic equations in singularly perturbed domains. The first volume contains parts I–IV, in which boundary value problems with perturbations near isolated singularities of the boundary of the domain are studied. The second volume contains parts V–VII, which deal with other kinds of perturbations (problems with perturbations of the boundary of singular manifolds, problems in thin domains, and problems with rapid oscillations of the boundary of the domain or coefficients of differential operators). In part I the authors discuss boundary value problems for the Laplace operator. Part II is devoted to the study of general elliptic boundary value problems. Part III and part IV deal with

expansions of functionals over solutions of boundary value problems and eigenvalues in the asymptotic series. In part V the authors study boundary value problems in domains perturbed near multidimensional singularities of the boundary. Behaviour of solutions of bondary value problems in thin domains is investigated in part VI. Part VII deals with elliptic boundary value problems with oscilating coefficients or boundary of the domain.

Dagmar Medková, Praha

Jean-Paul Pier (ed.): DEVELOPMENT OF MATHEMATICS 1950–2000. Birkhäuser, Basel, 2000, x+1372 pages, DM 298.–.

This monumental volume describes the dramatic growth of mathematics in the second half of the twentieth century. 36 articles on various parts of mathematics are presented by prominent mathematicians. Overviews are given, historical aspects are described, personal views on the development in geographical regions in various mathematical fields are presented in the form of interviews.

The exponential growth of the quantity of mathematical publications, the growth of many new and fine ideas in mathematics mark the mathematical sciences in our times. It will be an extremely difficult task for historians of science to map all the aspects of the development of mathematics in the past century. Surely this book will help them to have at least some basic information.

At the end of the book a list of Field medailists and R. Nevanlinna prize winners is given, there is a list of International Congresses of Mathematicians including the lists of main lectures. The main survey articles from Bulletin of the American Math. Society and from the journal Uspehi Matematičeskich Nauk are listed and these lists give a nice overview of the main streams in mathematics in the period 1950–2000.

The book is an extremely interesting reading for mathematicians and surely all active mathematicians will find information in the book reflecting the frame in which they live and work.

Štefan Schwabik, Praha

H. Kwatny, G. L. Blankenship: NONLINEAR CONTROL AND ANALYTICAL MECHANICS. A Computational Approach. Birkhäuser, Boston, 2000, xv+317 pages, DM 128.–.

This book starts with a short account of basic concepts concerning dynamical systems (ordinary differential equations, stability, manifolds) and differential geometry (tangent spaces, vector fields, Lie brackets, Lie groups, etc.). These topics are used in contemporary approaches to mechanics and control.

Kinematics of tree structures concerns composite systems of rigid bodies from the point of view of mechanics.

Dynamics including Poincaré's equations, smooth affine control systems, robust and adaptive control systems and variable structure control are the main topic of the book.

The book is a modern description of mathematics and mechanics which can be used for modeling and designing control systems.

The book is accompanied by a CD-ROM with extensive examples and computational tools using Mathematica notebooks and programs.

Štefan Schwabik, Praha

Arno van den Essen: POLYNOMIAL AUTOMORPHISMS AND THE JACOBIAN CONJECTURE. Progress in Mathematics, vol. 190, Birkhäuser, Basel, 2000, xviii+329 pages, IBSN 3-7643-6350-9, DM 118.–.

The famous Jacobian Conjecture is the following algebraic assertion. Let k be a field of characteristic zero. If a polynomial map $F\colon k^n \to k^n$ has non-zero constant Jacobian, then there exists the inverse polynomial map of E. This conjecture appeared as Problem 16 on a list of 18 famous open problems in the paper "Mathematical problems for the next century" by S. Smale, Math. Intelligencer, 20 (1998), No. 2, 7–15. The book under review is devoted to the algebraic geometry of polynomial maps treated from the viewpoint of this conjecture, with special attention to applications. The main subjects of the first part "Methods" are derivations and polynomial automorphisms, injective morphisms, the tame autormophism group of a polynomial ring, and stabilization methods. The second part "Applications" consists of three sections. The first deals with applications of polynomial maps to dynamical systems. The leading problem is the Marcus-Yamabe conjecture. The second section is devoted to algebraic group actions on affine algebraic varieties. The last one discusses some modifications of the Jacobian Conjecture for differentiable and analytic maps.

The book is essentially self-contained and aimed at the level of beginning graduate students. The material is well organized and exercises are included at the end of each section. At the end of the book there are appendices covering the necessary material from algebra, algebraic geometry, D-modules and Gröbner basis theory. The book can be recommended to every mathematician who has to use the powerful techniques developed in this domain.

Ivan Kolář, Brno

Michel Chipot: ELEMENTS OF NONLINEAR ANALYSIS. Birkhäuser Advanced Texts, Birkhäuser, Basel, 2000, vi+256 pages, DM 98.–.

The author presents some modern aspects of nonlinear analysis. The book consists of 13 chapters. In the first, an elementary theory of elasticity and a simple population model with diffusion are discussed as a motivation. The second completes the necessary standard material from analysis (distributions, integration on boundaries, elements of Sobolev spaces) so that the book is more or less selfcontained. Chapters 3–8 are devoted to elliptic problems, Chapters 9 and 10 deal with the calculus of variations and the last three chapters are concerned with parabolic problems.

The main exposition starts in Chapter 3 with classical linear problems (the Dirichlet problem, the Lax-Milgram theorem and applications). The next Chapter is devoted to elements of elliptic variational inequalities (a generalization of the Lax-Milgram theorem, applications). Some general aspects and methods of nonlinear elliptic problems are explained in Chapter 5 (a compactness method, a monotonicity method, a generalization of variational inequalities, multivalued problems). A simple theory of regularity for nonlocal variational inequalities is presented in Chapter 6. Further, the questions of uniqueness and nonuniqueness of solutions to quasilinear and monotone problems is studied (Chapter 7). Chapter 8 is concerned with the finite element method for elliptic problems (an abstract setting, simple finite elements, interpolation error, convergence results, approximation of nonlinear problems). Some modern aspects of the calculus of variations are discussed in the subsequent two chapters. The classical approach to minimizers is explained but mainly the situations when the convexity assumption is dropped and no minimizer exists are under consideration. Linear and nonlinear parabolic problems are studied in Chapters 11 and 12 (the tools of functional analysis for parabolic problems are described, local and nonlocal problems

are considered etc.) In the last chapter, the asymptotic behaviour of solutions to parabolic problems is discussed (the case of one and several stationary points, blow-up).

The whole exposition is understandable, simple situations and ideas are emphasized.

Milan Kučera, Praha

S. S. Hecker, G.-C. Rota (eds.): ESSAYS ON THE FUTURE. In Honor of Nick Metropolis. Birkhäuser, Boston, 2000, xvi+276 pages, DM 128.–.

In honor of Nicholas C. Metropolis, until his death in 1999 an important member of the Los Alamos National Laboratory, some of the leading scientists an philosophers are presenting essays on the future development of the society, nuclear power, physics in general, computations, medicine, biology, etc.

The book is a contribution to the description of the present state of human knowledge at the starting point of the new millenium and presents an interesting reading for all interested in the view at the future presented by scientists of our times.

Štefan Schwabik, Praha

Evarist Giné, David M. Mason, Jon A. Wellner (eds.): HIGH DIMENSIONAL PROBABILITY II. Progress in Probability 47, Birkhäuser, Boston, 2000, x+510 pages, ISBN 0-8176-4160-2, DM 238.–.

Conferences on High Dimensional Probability are sequel to the well-known conferences on Probability in Banach spaces; the second of them took place at the University of Washington in August 1999. The thirty-two papers included in the proceedings under review are based on talks presented there or on topics covered by the conference. All contributions are research papers with full proofs. "Classical" topics like limit theorems for independent random vectors in Banach spaces or a general theory of Gaussian processes are still paid attention to, however, the techniques developed in this context proved themselves very useful also elsewhere, notably in the theory of empirical processes and statistical applications, as this book testifies.

The book is divided into ten sections; let us list their titles to give a rough idea of the contents: 1. Inequalities, 2. General empirical process theory, 3. Gaussian processes, 4. Strong approximation and embedding, 5. The law of the iterated logarithm, 6. Large deviations, 7. Sums of independent random variables in high dimensions, 8. Random vectors and processes, 9. Function estimation, and 10. Statistics in a multidimensional setting.

Ivo Vrkoč, Praha

F. Colonius, U. Helmke, D. Prätzel-Wolters, F. Wirth (eds.): ADVANCES IN MATHEMATICAL SYSTEMS THEORY. A Volume in Honor of Diederich Hinrichsen. Birkhäuser, Boston, 2001, 336 pages, hardcover, ISBN 0-8176-4162-9, DM 198.–.

This book, as indicated in the subtitle, is a tribute to the fundamental contributions and major achievements of Diederich Hinrichsen in the linear systems theory and the control theory. So, in the natural way, the topics of the expositions given by leading researchers in these fields are related to those of interest to D. Hinrichsen. In particular, the reader will get acquainted with the contemporary developments and results in linear and nonlinear systems theory, control theory and applications, robust stability of multivariate polynomials, stability radii of slowly time-varying systems, invariance radius for nonlinear systems, and parametrization of conditioned invariant subspaces. The book is divided into 14 chapters—each of them a self-contained treatise with a historical preface. Should we look for a common

link, it would be the stability and robustness of linear and nonlinear systems viewed under the concepts of stability radii and spectral value sets. In addition, the volume surveys recent advances in convolutional codes, complementary systems and hybrid systems as well as controllability and stabilization of infinite-dimensional systems (allowing hysteresis nonlinearities) with functional analytic and algebraic approaches.

Apart from mathematics, the reader will find the curriculum vitae of D. Hinirichsen accompanied with the list of his Ph.D. students and the list of his publications.

The book is a good resource for researchers and professionals in applied mathematics and control engineering who are interested in system theory and linear and nonlinear control theory.

Martin Ondreját, Praha

Takeyuki Hida, Rajeeva L. Karandikar, Hiroshi Kunita, Balram S. Rajput, Shinzo Watanabe, Jie Xiong (eds.): STOCHASTICS IN FINITE AND INFINITE DIMENSIONS. In Honor of Gopinath Kallianpur. Trends in Mathematics, Birkhäuser, Boston, 2001, xxxvi+410 pages, ISBN 0-8176-4137-8, DM 238.–.

In the book under review, a reader may find twenty-one papers on probability theory which were dedicated to Gopinath Kallianpur upon the occasion of his seventy-fifth birthday. In addition, a biography of G. Kallianpur (written by Bhamidi V. Rao) and a list of his publications are included. Amongst the contributors are many former Kallianpur's students, collaborators and coauthors, and most of the papers are devoted to topics closely related to Kallianpur's own research: filtering theory, control theory, Feynman integrals, stochastic partial differential equations.

Ivo Vrkoč, Praha

K.-H. Hoffmann, Q. Tang: GINZBURG-LANDAU PHASE TRANSITION THEORY AND SUPERCONDUCTIVITY. International Series of Numerical Mathematics, vol. 134, Birkhäuser, Basel, 2001, xii+384 pages, ISBN 3-7643-6486-6, DM 198.–.

The superconductivity phenomenon was discovered by Kamerlingh-Onnes in 1911. Since then, various mathematical models describing superconductivity have been developed. The authors examine a model of the superconductor in the presence of a magnetic field proposed by Ginzburg and Landau in 1950. It is defined by a nonlinear system of partial differential equations in complex variable.

The book consists of 10 chapters, which contain mathematical foundation, asymptotic analysis, investigation of steady state solutions as well as evolutionary solutions, phase transition and pinning theory, and many other important problems. For instance, the difference between 2d and 3d problems is shown, formal asymptotics and the validity of Ginzburg-Landau theory are also treated, a special attention is paid to the breakdown of superconductivity. The authors prove that a strong magnetic field, which is governed by the system of Maxwell's equation, indeed destroys super-conductivity properties.

Chapter 10 is devoted to numerical analysis, in particular to the Galerkin method. Numerical discretization of the Ginzburg-Landau system is done by means of a semiimplicit finite difference scheme in time and by a finite element scheme in space. Adaptive algorithms based on a posteriori error estimation are presented and a numerical implementation is described. Throughout this chapter, the symbol $\div$ for integer division is used instead of divergence.

The monograph contains recent research results in the complex Ginzburg-Landau theory with applications to the theory of superconductivity. It provides a good reference for researches who are interested in studying mathematical and physical problems in this field.

Michal Křížek, Praha

J. Elschner, I. Gohberg, B. Silbermann (eds.): PROBLEMS AND METHODS IN MATHEMATICAL PHYSICS. The Siegfried Prössdorf Memorial Volume. Operator Theory: Advances and Applications, vol. 121, 536 pages, DM 248.–.

The book represents the proceedings of the 11th Conference on Problems and Methods in Mathematical Physics, held in Chemnitz during the period March 25–28, 1999. The conference was originally prepared in honor of Professor Siegfried Prössdorf's 60th birthday. After his sudden death on July 19, 1998, his friends and colleagues decided that the conference should take place, now to honor the life and work of S. Prössdorf, a mathematician of high international reputation whose career was substantially influenced by his undergraduate and postgraduate studies at the Mathematics Department of Leningrad University and, in particular, by his supervisor Professor S. G. Mikhlin.

The book starts with Obituary by Professor B. Silbermann, the first postgraduate student of S. Prössdorf, and continues by V. Maz'ya's memory of S. Prössdorf and a short review of scientific career of S. Prössdorf (delivered by J. Sprekels) involving a list of publications (134 items) and a list of dissertations directed by S. Prössdorf (13 items).

The core of the book is formed by 24 original research papers. Their topics reflect Prössdorf's wide range of research interests and include integral and pseudodifferential equations, boundary value problems, operator theory, approximation theory, wavelet methods, direct and inverse scattering problems, an inverse problem to groundwater filtration, and application in physics and engineering.

Bohumír Opic, Praha

Kwok-Yan Lam, Igor Shparlinski, Huaxiong Wang, Chaoping Xing (eds.): CRYPTOGRAPHY AND COMPUTATIONAL NUMBER THEORY. Birkhäuser, Basel, 2001, 392 pages, ISBN 3-7643-6510-2, DM 196.–.

This volume is a selection of refereed papers originating from the Workshop on Cryptography and Computational Number Theory (CCNT'99) in Singapore in November 1999. There is no need to speak about practical importance of cryptography in computer science. In many respects, computational number theory serves as its theoretical foundation. Treating both areas simultaneously leads to a fruitful interaction, and enables the reader to understand the essential connections between them. Most valuable part of the book are probably several survey papers, while the remaining research papers give a good picture of the current state of the area.

Jiří Sgall, Praha