

## BOOK REVIEWS

SLAUGHTER, William S. – *The Linearized Theory of Elasticity*, Birkhäuser, Basel-Boston-Berlin, 2002, XXV, 543 pp., ISBN 0-8176-4117-3 (sFr. 158/EUR 98.13).

Această carte de *Teoria linearizată a Elasticității* își are originea în lecțiile ținute de autor studenților, *graduate level*, de la Departamentul de Mecanică Inginerească a Universității din Pittsburg, Pa, USA, și se constituie într-o tratare modernă a teoriei lineare a Elasticității, teorie prezentată ca o particularizare a teoriei generale a Mecanicii Continuului. Cartea de față se adresează studenților în inginerie mecanică și în inginerie civilă, conținutul ei poate fi aprofundat fără a fi urmărit în prealabil un curs general de Mecanică a Mediilor continue și formează o bază necesară însușirii cursurilor de Elasticitate neliniară, Plasticitate, etc. Pentru cei care au urmărit un curs general de Mecanică a Mediilor continue, volumul de față conține suficient material pentru un curs special de Elasticitate lineară. Cartea este la fel de necesară și studenților matematicieni care se specializează în mecanică.

În mare, în volumul de față sunt tratate următoarele subiecte: 1. Prezentarea unor elemente de Rezistența materialelor (ceea ce americanii numesc *Mechanics of Materials*), 2. Introducere succintă a elementelor de bază ale Analizei Tensoriale, 3. Deducerea riguroasă a ecuațiilor ce guvernează teoria elasticității lineare, precizându-se ipotezele și aproximațiile care conduc la aceste ecuații, 4. Examinarea amănunțită a condițiilor la limită, 5. Analizarea metodelor de rezolvare a unor clase de probleme, 6. Studiul unor probleme bidimensionale și tridimensionale de elasticitate lineară, 7. Torsiunea cilindrilor necirculari, 8. Metode variaționale, 9. Metoda funcțiilor complexe în studiul problemelor bidimensionale de elasticitate lineară.

O imagine mai precisă asupra acestei cărți, frumos scrise și cu un conținut bogat și riguros tratat, va rezulta din Tabla de Materii pe care o prezentăm prescurtat: Preface, XV, List of Figures, XIX, List of Tables, XXV, 1. *Review of Mechanics of Materials* (1.1 Forces and Stress, 1.2 Stress and Strain, 1.3 Torsion of Circular Cylinders, 1.4 Bending of Prismatic Beams, Problems) pp. 1-21, 2. *Mathematical Preliminaries* (2.1 Scalars and Vec-

tors, 2.2 Indicical notations, 2.3 Tensors, 2.4 Tensor Calculus, 2.5 Cylindrical and Spherical Coordinates Problems), pp. 23-95, 3. *Kinematics* (3.1. Configurations, 3.2 Strain Tensors; Referential Formulation, 3.3 Strain Tensors; Spatial Formulation, 3.4 Kinematic Linearization, 3.5 Cylindrical and Spherical Coordinates, Problems), pp. 97-155, 4. *Forces and Stress* (4.1 Stress Tensors; Referential Formulation, 4.2 Stress Tensors; Spatial Formulation, 4.3 Kinematic Linearization, 4.1 Cylindrical and Spherical Coordinates, Problems), pp. 157-192, 5. *Constitutive Equations* (5.1 Elasticity, 5.2 Constitutive Linearization, 5.3 Material Symmetry, 5.4 Isotropic Materials, 5.5 Cylindrical and Spherical Coordinates, Problems), pp. 193-220, 6. *Linearized Elasticity Problems* (6.1 Field Equations, 6.2 Boundary Conditions, 6.3 Useful Consequences of Linearity, 6.4 Solution Methods, Problems), pp. 221-254, 7. *Two Dimensional Problems* (7.1 Antiplane strain, 7.2 Plane Strain, 7.3 Plane Stress, 7.4 Airy Stress Function, Problems), pp. 255-303, 8. *Torsion of Noncircular Cylinders* (8.1 Warping Function, 8.2 Prandtl Stress Function, Problems), pp. 305-329, 9. *Three-Dimensional Problems* (9.1 Field Theory Results, 9.2 Potentials in Elasticity, 9.3 Dislocation Surface, 9.4 Eshelby's Inclusion Problems, Problems), pp. 331-386, 10. *Variational Methods* (10.1 Calculus of Variations, 10.2 Energy Theorems in Elasticity, 10.3 Approximate Solutions, Problems), pp. 387-429, 11. *Complex Variables* (11.1 Functions of a Complex Variable, 11.2 Antiplane Strain, 11.3 Plane strain/Stress, Problems), pp. 431-512, *Appendix: General Curvilinear Coordinates* (A.1 General Vector Bases, A.2 Curvilinear Coordinates, A.3 Tensor calculus) pp. 513-532, References, pp. 533-535, Index, pp. 537-543.

Gh.Gr. Ciobanu

ANDREESCU, T., GELCA, R. – *Mathematical Olympiad Challenges*, XV +260pp., ISBN 3-8176-4155-6 (sFr.49.50 Softcover/sFr. 118 Hardcover).

This work is an excellent problem-solving book addressed to everyone which loves beautiful "elementary" problems. We quote from the Preface: "The problems we selected are definitely not exercises". Our definition of an exercise is that you look at it you know immediately how to complete it. It is just a question of doing the work, whereas by a problem, we mean a more question for which at first one has probably no clue to how to approach it, but by perseverance and inspired effort one can transform it into a sequence of exercises. We have chosen mainly Olympiad problems, because they are beautiful, interesting, fun to solve, and they best reflect mathematical ingenuity and elegant arguments". There are three sections: geometry and trigonometry, algebra and analysis, number theory and combinatorics. Each

section starts with a discussion of basic facts, one or two representative examples discussed in detail and a list of problems. The second part of the book is devoted to the solutions given in detail of all the problems from the first part. Many problems have multiple solutions and many solutions link together areas of mathematics that are not apparently related. A glossary of definition and fundamental results is presented as Appendix. This book is a must for preparing mathematical competitions (self-study, resource for teachers and instructors) and, in general, for teacher professional development.

Ovidiu Cârjă

DIJKSMA, A., KAASHOEK, M.A., RAN, A.C.M. (Eds.) – *Recent Advances in Operator Theory*, The Israel Gohberg Anniversary Volume. International Workshop in Groningen, June 1998, Birkhäuser Verlag, Basel-Berlin-Boston, 2001, LVIII+558pp., ISBN 3-7643-6573-0, (sFr. 198 Hardcover).

This book contains 25 papers, most of which were presented, for the first time, at the International Workshop on Operator Theory and its Applications held in Groningen, the Netherlands, from June 30-July 3, 1998. The topics include dilation and interpolation problems, reproducing kernel spaces, numerical ranges of operators, Riccati equations, harmonic analysis, spectral theory of differential operators and analytic operator functions to scattering of waves. All papers deal with operators in Banach or Hilbert spaces, or in spaces with an indefinite metric. This volume is dedicated to Israel Gohberg, one of the founding fathers of the IWOTA workshops and an outstanding leader in operator theory. His work had a deep influence on the field and its range of applications. The IWOTA Groningen 1998, the tenth in its series, was a good occasion for a pre-celebration of his 70th birthday. This book also contains the speeches held at the workshop dinner, a review of Israel Gohberg's contributions to mathematics and a complete list of his publications. The book is of interest to a wide audience of pure and applied mathematicians.

ALTMAN, E, POURTALLIER, O. (Eds.) – *Advances in Dynamic Games and Applications*, Annals of the International Society of Dynamic Games, Birkhäuser Verlag, Boston-Basel-Berlin, 2001, XII+345pp., ISBN 0-8176-4202-1 (sFr.198/EUR130).

The book offers an ideal survey of recent developments and advances in dynamic games, models and their applications. It is an essential resource for all dynamic game researchers and professionals in fields of systems and control engineering, operations research, and applied mathematics.

The new book focuses on various aspects of dynamic game theory and provides authoritative, state-of-the-art information. *Frontiers of Dynamic Games* presents the most current research on dynamic games as well as some survey papers. The book covers a wide area of applications and thus offers game theory tools useful for researchers who use game theory to model in many disciplines. The select, peer-reviewed chapters are based upon presentations at the 8th International Symposium of Dynamic Games and Applications held in Maastricht, the Netherlands, July 5-8, 1998. "This conference took place under the auspices of the International Society of Dynamic Games (ISDG), established in 1990. Every paper that appears in this volume has passed through a stringent reviewing process, as is the case with publications for archival journals".

CHIPOT MCHEL –  *$\ell$  goes to plus infinity*, Birkhäuser Advanced Texts (Basler Lehrbücher), Birkhäuser Verlag, Basel-Boston-Berlin, 2002, VIII+181pp., ISBN 3-7643-6646-X, (sFr.78/EUR 52).

Pornind de la mai multe probleme fizice care au loc in domeniul cilindric, apare în mod natural cazul asimptot în care generatoarea tinde la infinit, situația specială fiind cea pentru care soluția este aceeași în toate secțiunile cilindrului.

Monografia de față are la bază rezultate originale ale autorului, unele din acestea fiind publicate aici pentru prima dată. Conținutul este grupat în următoarele 9 capitole: 1. Introducere în Problemele Eliptice Liniare. 2. Anumite Modele de Tehnici. 3. O teorie Asimptotică Generală pentru Probleme Eliptice Liniare. 4. Probleme Eliptice Neliniare. 5. Comportarea Asimptotică a anumitor Probleme Eliptice Neliniare. 6. Sisteme Eliptice. 7. Comportarea Asimptotică a Sistemelor Eliptice. 8. Ecuații Parabolice. 9. Comportarea Asimptotică a Problemelor Parabolice. Primul capitol are un caracter introductiv amintindu-se Teorema Lax-hilgram în spații Hilbert reale, iar cel de al doilea capitol punctează pentru situații simple ideile de bază care generează întreaga problematică a monografiei. Cazul neliniar studiat începând cu Capitolul 4 este axat pe probleme de existență și unicitate având în vedere teoria inegalităților variaționale în  $H^1(\Omega)$  ce oferă metode utile în studiul problemelor qvasiliniare. În situația asimptotică prezentată în Capitolul 5, spre deosebire de cazul liniar unicitatea poate să nu aibă loc întrucât limita în general a soluției nu mai este unică. Autorul consideră

atunci numai situația în care este asigurată unicitatea limitei soluției, punctând condiții ce asigură convergența în  $L_1$ , respectiv  $H_1$ . Sunt abordate apoi sistemele eliptice cu aplicații în teoria elasticității. Existența și unicitatea soluției în cazul parabolic face obiectul ultimelor capitole. Menționăm că pe parcursul întregii monografii sunt prezentate estimări ale soluției, iar fiecare capitol se încheie cu o serie de probleme deschise interesante .

Intregul material al lucrării este prezentat cursiv, cu demonstrații clare conduse în mod natural. Considerăm că va fi de un real folos specialiștilor și cercetătorilor în matematici aplicate și științe inginerești.

Theodor Precupanu

BECCHI, A., CORRADI, M., FOCE, F., PEDEMONTE, O. – *Essays on the History Mechanics*, In Memory of Clifford Ambrose Truesdell and Edoardo Benvenuto, Birkhäuser Verlag, Basel-Boston-Berlin, 2003, 256 pp., ISBN 3-7643-1476-1, (CHF68/EUR42).

Istoria mecanicii a fost domeniu predilect de cercetare pentru mulți savanți ca Saint-Venant, Todhunter și Pearson în secolul XIX, Duhem, Mach, Dugas, Timoshenko, Truesdell, Heyman, Szabo, Charlton, Benvenuto și Di Pasquale în secolul XX. Lucrările fundamentale ale acestora au favorizat apariția unei noi generații de cercetători care au abordat domenii variate ale istoriei mecanicii aplicate în construcții de la matematică la construcții, de la arhitectură la geometrie, de la rezistența materialelor la mecanica solidelor și a structurilor. Toate acestea au condus la lansarea proiectului de cercetare *Between Mechanics and Architecture* inițiat de către Edoardo Benvenuto (1940-1998) și Patricia Radelet-de Grave la al XIX-lea Congres International de Istoria Științei de la Saragoza din 1993 și continuat la simpozioanele de la Genoa din 1996, Liege și Louvian-la-Neuve din 1997 și Pescara din 1998.

Clifford Ambrose Truesdell (1919-2000) a inițiat profunde și vaste cercetări de istorie a mediilor continue începând cu anul 1950. Lucrările lui de istorie a mecanicii care au vizat mai ales secolele XVII și XVIII se disting în primul rând printr-o cercetare amănunțită a surselor istoriografice și prin originalitatea și ascuțimea stilului de prezentare. Aceste cercetări se sprijineau pe o erudită cunoaștere a limbilor clasice greacă și latina și a principalelor limbi europene -italiana, franceza și germana - pe care le vorbea curent. Truesdell era de asemenea un avizat cunoscător și rafinat iubitor al muzicii preclasice, picturii, sculpturii și arhitecturii, fiind pasionat mai ales de arhitectura Goticului și Renașterii. Când Truesdell a început să publice lucrări de istoria mecanicii continuului era deja un creator pe deplin afirmat în acest domeniu. Împreună cu Walter Noll formulase principiile mecanicii mediilor continue. Ei au fost cei care folosind tehnica axiomatică

a lui Hilbert au făcut ca Termodinamica mediilor continue să devină un domeniu de sine stătător, complet unificat, parte a matematicii și generator de probleme complexe, multe din ele, cele neliniare mai ales, urmând a fi rezolvate în viitor. Truesdell este printre pușinii istorici ai mecanicii care venea din interiorul domeniului, creator profund în acest domeniu.

Eduardo Benvenuto are contribuții importante la istoria mecanicii structurale în spiritul și standardele impuse de Truesdell. Unele din aceste contribuții sunt expuse în monografia *La scienza delle costruzioni e il suo sviluppo storico*, Florence, 1981, pp. 893. Benvenuto a creat o nouă școală de istoria mecanicii în Italia care, începând cu 1993 s-a impus prin seria de simpozioane sub titlul generic *Between Mechanics and Architecture* și prin publicarea, sub același titlu, a unei colecții de articole în cooperare cu Patricia Radelet de Grave.

Relațiile strânse dintre C. Truesdell și E. Benvenuto, ocazionate de publicarea cărții lui Benvenuto *An Introduction to the History of Structural Mechanics* (Part I: Statics and Resistance of Solids, XXI, 306 pp., Part II: Vaulted Structures and Elastic Systems, XXI, 554 pp.), Springer Verlag, New York, 1991, a cărei *Forward*, extrem de frumos și interesant, este scris de către Truesdell au determinat *Associazione Edoardo Benvenuto per la ricerca sulla scienza e l'arte del costruire nel loro sviluppo storico*, fondată în 1999, să dedice un simpozion internațional celor doi mari istorici ai mecanicii. Simpozionul a avut loc la Genoa în perioada 30.XI.-1.XII.2001 la Facultatea de Arhitectură unde E. Benvenuto a funcționat, până la moartea sa, ca profesor de Mecanică Structurală timp de 18 ani.

Prezenta carte conține lucrările acestui simpozion. Iată Tabla de Materii a acestei cărți: Preface, Jaques Heyman - *Truesdell and the Theory of Structures*, Gleb Mikhailov - *Development of Studies in the History of Elasticity Theory and Structural Mechanics*, Louis L. Bucciarelli - *Coping with Error in the History of Mechanics*, Karl-Eugen Kurrer - *The Development of the Deformation Method*, Santiago Huerta - *The Mechanics of Timbrel Vaults: a Historical Outline*, Patricia Radelet - De Grave - *The Use of a Particular Form of the Parallelogram Law of Forces for the Building of Vaults (1650-1750)*, Jaques Heyman - *Rose Windows*, Sandro Caparrini - *Early Theories of Vectors*, Giulio Maltese - *The Ancients' Inferno: The Slow and Tortuous Development of "Newtonian" Principles of Motion in the Eighteenth Century*, Piero Villaggio - *A Historical Survey of Impact Theories*, David Speiser - *What Can the Historian of Science Learn from the Historian of fine Arts*, Index of Names.

Citirea acestei cărți este prilej de încântare și reflecție pentru orice inginer constructor sau matematician preocupat de probleme ale mecanicii mediilor continue.

Ghe.Gr. Ciobanu

GOHBERG, I., MENNICKEN, R., TRETTER, C. (Eds.) - *Differential and Integral Operators*, Operator Theory Advances and Applications, Vol. 102, Birkhäuser Verlag, Basel-Boston-Berlin, 1998, xv+324pp., ISBN 3-7643-5890-4 (Basel-Boston-Berlin), ISBN 0-8176-5890-4 (Boston).

This book contains 22 papers of participants to the eighth International Workshop on Operator Theory and Applications, which was held at the University of Regensburg, Germany, July 31 to August 4, 1995.

"The conference covered different aspects of linear and nonlinear spectral problems, starting with problems for abstract operators up to spectral theory of ordinary and partial differential operators, pseudodifferential operators, and integral operators. The workshop was also focussed on operator theory in spaces with indefinite metric, operator functions, interpolation and extension problems. The applications concerned problems in mathematical physics, hydrodynamics, magnetohydrodynamics, quantum mechanics, astrophysics as well as the theory of networks and systems. The papers in the proceedings bring the readers up to date on recent achievements in these areas."

CASTELLINI, GABRIELE - *Categorical Closure Operators*, Birkhäuser, Basel-Boston-Berlin, 2003, XII+300 pp., ISBN 0-8176-4250-1, (CHF 130/EUR 88).

This book presents the general theory of categorical closure operators together with examples and applications to the most common categories, such as topological spaces, fuzzy topological spaces, groups, abelian and topological groups. The main aim of the theory, whose origin dates back to the 1980s, is to develop a categorical characterization of the classical basic concepts in topology via the newly introduced concept of categorical closure operator. This permits many topological ideas to be introduced in a topology-free environment and imported afterwards into a new category, which often yields interesting new insights into their structures.

The first part of the book deals with the general theory, starting with basic definitions and gradually moving to more advanced properties. The second part includes applications to the classical concepts of epimorphisms, separation, compactness and connectedness. Every chapter ends with exercises. A comprehensive list of references for the reader who wants to consult original works, and a good index complete the book.

Categorical Closure Operator is self-contained and can be considered as a graduate level text for topics courses in algebra, topology or category theory. The book appeals mainly to graduate students and researchers in categorical topology, and to those interested in categorical methods applied to the most common concrete categories. The reader is expected to have

some basic knowledge of algebra, topology and category theory, however, all recurrent categorical concepts are included in a preliminary chapter.

CORRY, LEO – *Modern Algebra and the Rise of Mathematical Structures*, Birkhäuser, Basel-Boston-Berlin, 2003, 472pp., ISBN 3-7643-7002-5 (CHF 98/EUR 65) .

In the context of the fact that the twentieth century mathematics, or at least considerable parts of it, is a "mathematics of structures", appears also the necessity of a book in which the origins, the historical development of the concept of "mathematical structure" are explained from the point of view of the fundamentals of mathematics or metamathematics, from the philosophical point of view, a.s.o. In other words, questions such as "What is indeed a mathematical structure?", "How can the structural approach to mathematics be characterized?", "When, and as a result of which process, did structures begin to be adopted in mathematical research and practice and what was their actual influence?", "In which ways have mathematicians attempted to elucidate this idea and its place in mathematics?" -have awaited answer. The present book is an attempt to answer some of these questions, and also to suggest a framework for a more comprehensive study of them. Thus the book is divided in two parts.

Part One of the book describes the development of ideal theory from Dedekind to Emmy Noether. This particular development transformed a theory, initially conceived in the context of accounting for factorization properties of algebraic numbers, into a paradigmatic structural theory of modern algebra. This transformation was accompanied by a process, through which the theory merged organically with what then constituted a separate domain, namely, the theory of factorization of polynomial forms. Two prominent milestones of this transformation (the impact of Hilbert's contributions and the early definitions and research of abstract rings by Fraenkel) are considered.

Part Two discusses various attempts to formulate mathematical theories of structure. The first of these attempts was led by Ore at Yale between about 1935 and 1945. Ore developed together with several collaborators a general concept of algebraic structure, based on lattice theoretical ideas. A second such attempt, the one advanced by Bourbaki (as a remarkable interplay between the general, non-formalized idea of a mathematical structure and the axiomatically formalized one) is also presented. The last attempt discussed in Part Two is the theory of categories and functors (as the most elaborate and successful instance of an axiomatized theory allowing for a systematic characterization and analysis of the different structures).

The book is intended for mathematicians interested in the development of algebra, historians of mathematics and/or of science interested in the role of heuristic and contextual factor in the development of scientific ideas, for



a wide audience attracted by history and philosophy of science.

I. Tofan

AUDIN, M., CANNAS DA SILVA, A., LERMAN, E. – *Symplectic Geometry of Integrable Hamiltonian Systems*, Birkhäuser, Basel-Boston-Berlin, ISBN 3-7643-2167-9.

This book contains an expanded version of the lectures delivered by the authors at the Euro Summer School *Symplectic Geometry of Integrable Hamiltonian Systems*. The summer school took place at the Centre de Recerca Matemàtica, Barcelona, from the 10<sup>th</sup> to the 15<sup>th</sup> of July 2001.

The book has three parts. The first part by M. Audin is devoted to *special Lagrangian submanifolds*, the second part by A. Cannas da Silva deals with *symplectic toric manifolds* and the part C, by E. Lerman centers on *contact toric manifolds*. The book serves as an introduction to symplectic and contact geometry for graduate students and it is useful to research mathematicians interested in integrable systems.

A Hamiltonian system is a dynamical system that describes the motion of a mechanical system whose total energy is conserved. This is where symplectic geometry comes from but it has developed into an area of mathematics.

Among all the Hamiltonian systems, the *integrable* ones - those which have many conserved quantities - have special geometric properties; in particular, their solutions are very regular and quasi-periodic. The quasi-periodicity of the solutions of an integrable system is invariant under a (semi-global) torus action. It is thus natural to investigate the symplectic manifolds that can be endowed with a (global) torus action. This leads, in a natural way, to symplectic torus manifolds (part B of the book) which are examples of extremely symmetric Hamiltonian systems. Native to algebraic geometry, the theory of toric varieties has been around for about thirty years when Demazure used toric varieties for classifying some algebraic subgroups. Algebraic geometers and combinatorialists have found fruitful applications of toric varieties to the geometry of convex polytopes, resolutions of singularities, compactifications of locally symmetric spaces, critical points of analytic functions, and so on. For the last ten years, toric geometry became an important tool in physics in connection with mirror symmetry. Physics makes a surprising come-back in part A: to describe Mirror Symmetry, one looks for a special kind of Lagrangian submanifolds and integrable systems, to special Lagrangians. Furthermore, integrable Hamiltonian systems on punctured cotangent bundles are a starting point for the study of contact toric manifolds (the third part of the book). A punctured cotangent bundle

is a symplectic cone whose base is naturally a contact manifold. This observation leads to studying completely integrable systems on contact manifolds, what ever those are. The simplest (symplectic) completely integrable systems are the ones with global action-angle coordinates. The next simplest case is that of Hamiltonian torus action. If the phase space is compact one ends up with (compact) symplectic toric manifolds. The corresponding case in the contact category is that of compact toric manifolds.

Along the way, tools from many different areas of mathematics are brought to bear on the questions at hand, in particular, actions of Lie groups in symplectic and contact manifolds, the Delzant theorem, Morse theory, sheaves and Čech cohomology and aspects of Calabi-Yau manifolds.

Marian - Ioan Munteanu

MARKVORSEN, S., MAUNG MIN-OO – *Global Riemannian Geometry : Curvature and Topology*, Birkhäuser Verlag, Basel- Boston- Berlin, 2003, 96 p. ISBN 3-7643-2170-9.

This book contains a polished form of the lectures the two authors delivered at the Universitat Jaume I, in Cartelló de la Palma, the organiser being the Centre de Recerca Matemàtica, Barcelona.

The first author presents the last achievements in the comparison theory for distance functions in Riemannian manifolds which have well defined bounds on curvature. Two kinds of distances are considered : to a fixed point and to a fixed totally geodesic hypersurface. Using various theorems of comparison he obtains informations about diffusion processes, isoperimetric inequalities, transience and effective resistance of the manifold in question.

The second author presents a study of Gromov invariants to measure the  $K$ -theoretic size of a Riemannian manifold by using the famous Lichnerowicz formula for Dirac operators. There are three sections : Spinors and the Dirac operators - a comprehensive description, Gromov's  $K$ -area - invariants, estimates, AVafa- Witten inequality, Positive Mass Theorems- fresh results, conjectures and ideas for proofs. The text ends with a comment on mathematical aspects of correspondence between the supergravity or string theory of an asymptotically hyperbolic Einstein manifold and the conformal field theory on its boundary.

The book is useful for the researchers in Riemannian Geometry, especially for those interested in the very advanced applications of this field.

Mihai Anastasiei

ANDRE, Y., BALDASSARI, F. – *De Rham Cohomology of Differential Modules on Algebraic Varieties*, Progress in Mathematics, vol. 189, Birkhauser Verlag, Basel, Boston, Berlin, 2001, vii, 214 pp.

The authors present a systematic treatment of the theory of differential modules on algebraic varieties over a field of characteristic 0. They obtain some deep results concerning the algebraic and p-adic analytic de Rham cohomologies of the considered differential modules. They use a purely algebraic treatment of the theory of regularity and irregularity in several variables, presents elementary proofs of some main results on the de Rham cohomology of differential modules and develop a new approach to the classical algebraic/analytic comparison theorems, unifying complex and p-adic situations and avoiding resolution of singularities.

In the first two chapters there are studied the regularity and irregularity in several variables. Then, by using the Gauss-Manin connection one studies the generic finiteness and generic base change for direct images, the coherence, regularity and exponents of the cokernel of a regular connection. In the last chapter one presents some complex and p-adic comparison theorems.

The book can be used as an introduction to the theory of differential modules on algebraic varieties. It is aimed to researchers and advanced graduate students in arithmetic-algebraic geometry and the theory of several complex variables and analytic spaces.

V. Oproiu

AGARWAL, A.K., BRUCE BERNT, C., CHRISTIAN KRATTENTHALER, F., MULLEN, G.L., RAMACHANDRA, K., WALDSCHMIDT, MICHEL (Eds) – *Number Theory and Discrete Mathematics*, Trends in Mathematics, Birkhäuser Verlag, Basel-Berlin-Boston, 2002, 332 pp., ISBN 3-7643-6720-2

The articles of this volume are an outgrowth of an International Conference on Number Theory and Discrete Mathematics in honour of Srinivasa Ramanujan. The Conference held at the centre of Advanced study in Mathematics, Panjab University, Chandigarh, India during October 2-6, 2000. This volume collects 29 articles written by some of the worldwide leading specialists. Most of the papers provide recent trends, problems and their current status. We shall present here a sample consisting of twelve contributed papers. In his article, M. Waldschmidt provides an introduction to the topic of multiple polylogarithms and their special values. C.Krattenthaler computes, in some special cases, the probability that a random tiling by rhombi of a hexagon with side lengths  $2n + a, 2n + b, 2n + c, 2n + a, 2n + b, 2n + c$ ,

contains the horizontal rhombus with coordinates  $(2n + x, 2n + y)$ . Starting from the quintuple product identity, G.E. Andrews deals with some new Rogers-Ramanujan type identities obtained from new Bailey lemmas. A. K. Agarwal and Padmavathamma obtained generating functions for two sets of infinite families of restricted Frobenius partition functions. I. Katai provides an up-to-date survey of results concerning  $q$ -additive and  $q$ -multiplicative functions which are defined either on the set of natural numbers or on the set of prime numbers. In their paper Antimagic Labeling of Complete  $m$ -ary Trees, P. D. Chawathe and Vijaya Krishna proved that every complete  $m$ -ary tree has antimagic labeling. S. S. Sane provides a broad survey on the recent developments in symmetric, quasi-symmetric and quasi-multiple designs. N. Robbins derives a recurrence for the number of  $t$ -core partitions of  $n$  with  $t > 3$ . M. Elia gives a collection of his observations about two equations introduced by Ramanujan. A good account of some Ramanujan-type rapidly convergent series for special values of Dirichlet  $L$ -functions was given by S. Kanemitsu, Y. Tanigawa and M. Yishimoto. Padmavathamma and R. Salestina bring a substantial contribution to a 25-year old Andrews conjecture about a partition identity. Some contributions are related to Ramanujan's mathematics.

Ilie Burdujan

BENCI, V., CERAMI, G., DEGIOVANNI, M., FORTUNATO, D., GIANNONI, F., MICHELETTI, A.M. (Eds.) – *Variational and Topological Methods in the Study of Nonlinear Phenomena*, Progress in Nonlinear Differential Equations and Their Applications, Volume 49, Birkhäuser Verlag, Boston-Basel-Berlin, 2002, 134 pp., ISBN 0-8176-4278-1, ISBN -7643-4278-1, SPIN 10851241.

The International Conference entitled Variational and Topological Methods in the Study of Nonlinear Phenomena was held in Pisa in January-February 2000. This volume contains the refereed proceedings of this Conference and brings together nine articles written by some of the leading worldwide specialists. This volume covers recent advances in the field of nonlinear partial and ordinary differential equations, with particular emphasis on variational and topological methods. In his work, M. Clapp considers some functionals that are invariant under the action of an arbitrary group of symmetries and extends previous results of Bahri and Lions, and Tanaka for even functionals to more general group action. M. J. Esteban and E. Séré treat more realistic systems corresponding to atoms or molecules with several electrons. They succeed to show that, in the neighborhood of the nonrelativistic limit, the solution  $\Psi^1$  of Dirac-Fock equations minimizes

Dirac-Fock energy among all possible “electronic configurations“ and can be viewed as an electronic ground state for the Dirac-Fock equations. A. Ioffe and E. Schwartzman study the problem of critical points for the functional  $f(x) = 1/2(Lx|x) + H(x)$  and establish the relationship between convexity of  $H$  and conditions of Palais-Smale type. Periodic solutions of nonlinear problems with positive oriented periodic coefficients are analyzed by W. Marzantowicz, M. Mrozek and P. Pilarczyk sketch an approach to the existence of periodic solutions of differential equations based on the discrete Conley index and rigorous numerics of dynamical systems. The problem of the existence of a periodic solution for the nonlinear differential equation  $\ddot{x} + g(x) = f(t)$  is considered by R. Ortega. A substantial contribution to solving the spike patterns in the super-critical Bahri-Coron problem is given by M. del Pino, P. Felmer, and M. Musso. In their contribution, P. Sintzoff and M. Willem study the existence of localized solutions of a semi-linear elliptic equation on  $\mathbb{R}^N$  with unbounded coefficients. The paper of R. E. L. Turner deals with the traveling waves in natural systems. Several chapters deal with computational aspects and applications in biology. The volume is a valuable source for researchers working in the study of nonlinear phenomena.

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ROSE, HARVEY E. – *Linear Algebra*, A pure Mathematical Approach, Birkhäuser Verlag, Basel-Boston-Berlin, 2002, XIV+250 pages, ISBN 3-7643-6792-X.

This book is an introduction to one of the most important branches of mathematics - Linear Algebra. In contrast with the most very good books on linear algebra this book is a modern text taking the pure mathematicians viewpoint as its guideline. The material presented in this book is not a new one but it is a central part of pure mathematics. The main topics included in this book are: a) vector spaces and algebras, linear maps, direct sum and exact sequences, b) matrices, determinants and linear equations, c) Cayley-Hamilton and Jordan theorems and the spectrum of a linear map, d) Hermitian and inner product spaces, unitary and orthogonal maps and matrices, e) applications to finite fields, mathematical coding theory, finite matrix groups, the geometry of quadratic forms, quaternions and Cayley numbers, and some basic group representation theory. The book consists of seven Chapters, two Appendices, Bibliography, Notation index, Definition index, Theorem index and Subject index. Chapter 1 gives the definitions and basic properties of groups, rings and fields. A special attention is paid to permutation groups which are used to define determinants. In the second

chapter the author introduces the main objects of this study, namely the vector spaces and the maps between them and preserving their algebraic structures, the so-called linear maps. Matrices, determinants and linear equations and their each other connections are presented in Chapter 3. It is showed that a linear map between two finite-dimensional linear spaces can be represented by a matrix. In Chapter 4 is proved the Cayley-Hamilton theorem. It is also presented the Jordan form of a matrix as being the standard matrix associated with a linear map. Chapter 5 is dealing with finite fields. Author develops the basic theory and gives two applications: in coding theory and in matrix groups defined over finite fields. The Galois fields are introduced, too. Hermitian and inner product spaces are defined and analyzed in Chapter 6. Chapter 7 treats three unrelated applications of the previous work in pure mathematics, namely quadratic form theory, normed algebras and representation of finite groups. Every chapter ends with a large number of exercises and problems.

This book will be most useful for a "second course" in linear algebra, but it is self-contained so that it can be used for a "first course" for more advanced students.

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