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BOOK REVIEWS *RECENZII*

G.V. MILOVANOVIĆ (ed.): - *Recent Progress in Inequalities,* Mathematics and Its Applications, 430, Kluwer Academic Publishers, Dordrecht. Boston. London, 1998, ISBN 0–7923–4845–1.

From the back cover presentation of the book: "This volume is dedicated to the late Professor Dragoslav S. Mitrinović (1908–1995), one of the most accomplished masters in the domain of inequalities. Inequalities are to be found everywhere and play an important and significant role in almost all subjects of mathematics as well as in other areas of science. Professor Mitrinović used to say: "There are no equalities, even in human life inequalities are always encountered."

This volume provides an extensive survey of the most current topics in almost all subjects in the field of inequalities, written by 85 outstanding scientists from twenty countries. Some of the papers were presented at the International Memorial Conference dedicated to Professor D.S. Mitrinović, which was held at the University of Niš, June 20–22, 1996.

The papers here included fall in the domain of real, complex and functional analysis, special functions, approximation theory, numerical analysis. The book can be very useful to researchers and graduate students, interested in this field.

The wide diversity of the topics approached, although all of them are related to inequalities, make difficult a more detailed presentation of the contents. We only outline that some of the contributions are rather selfcontainted (hence close to small monographs), and a couple of them: (1) *Table of Inequalities in Elliptic Boundary Value Problems*, p.97–125 by C. Bandle and M. Flucher. (2) *A Catalogue of Help and Help–type Integral and Series Inequalities*, p.127–160 by nine authors. (3) *Properties of Isometries and Approximate Isometries,* p. 341–379 by Th. M. Rassias.

Let us mention that the lack of contributions related to integral inequalities is somehow curious. Certainly, this is not an essential objection; all the contributions have a high scientific level and a large diversity of their subject matter, which is also very up-to-date and treated in a rich range of

references. In fact, the integral inequalities have been throughly studied in another monograph edited by Kluwer Academic Publishers, namely *Integral Inequalities and Applications* (1992) by D. Bainov and P. Simeonov.

It is almost superfluous to mention the excellent editing and printing conditions of this monograph (shared by all the volumes published by Kluwer).

A. Corduneanu

L.I. PITERBARG, A.G. OSTROVSKII, *Advection and Diffusion in Random Media: Implication for Sea Surface Temperature Anomalies,* Kluwer Academic Publishers, Dordrecht, Boston, London, 1997, XII+330p., ISBN 0-7923-4450-2.

The present book gives a mathematical foundation for the sea surface temperature variability. A statistical description is used for a passive scalar (tracer) under given velocity statistics by means of a stochastic advection–diffusion equation. The statistical estimation for the heat anomaly transport in the upper ocean is treated as a statistical problem in stochastic partial differential equations. This statistical estimation has the advantage of powerful maximum likelihood and autoregressive techniques.

The book is organized as follows. Chapters 1–8 present the general mathematical results on the advection and diffusion of a passive scalar (tracer) in random media, some important physical effects which follow from the obtained equations for the statistical characteristics of the tracer, and the inverse problem of extracting the velocity and diffusivity from passive scalar observations. The chapters 9 and 10 use the obtained results and the developed statistical techniques in order to analyse anomalous heat processes in the upper ocean.

The intended audience is for graduate students and researchers in mathematics, fluid dynamics and physical oceanography.

Stan Chiriţă

R. SOLOMON (ed.), *Representation Theory of Finite Groups*, Ohio State Univ. Math. Research Institute Publications 6, Walter de Gruyter, Berlin, New York 1997, ISBN: 3-11-015806-X.

These proceedings of a special research quarter at the Ohio State Uni-

versity (Spring 1995) include contributions from leading researchers in the field of representation theory.

The researchers and students specialized in this field will find the latest results and research trends and problems concerning topics such as: representations of the symmetric group, the finite group of Lie type, the Lusztig conjecture, the Alperin–McKay–Dade conjectures, the $k(GV)$–problem, the theory of infinite–dimensional modules for finite groups, Rickard equivalences of module categories, canonical induction formulae, conjectures in block theory.

This is highly rewarding reading for anyone interested in to–date developments in representation theory and its applications.

C. Volf

ALEKSEI D. KORSHUNOV (ed.), *Operations Research and Discrete Analysis*, Kluwer Academic Publishers, Dordrecht, Boston, London, 1997, VII+331p, ISBN 0-7923-4334-4.

This book contains translations of some papers published in the Sibirskii Zhurnal Issledovaniya Operatsii, since 1995 named Discretnii Analiz i Issledovanie Operatsii (Discrete Analysis and Operations Research). The research papers contained in this volume covers the areas of discrete mathematics and computer sciences in the following fields: Discrete Structures and Extremal Problems, Combinatorics, Graphs, Coding Theory and Scheduling Theory.

C. Smadici

K.T. ARASU et al. (eds.), *Groups, Difference Sets, and the Monster*, Ohio State University Mathematical Research Institute Publications 4. Walter de Gruyter, Berlin, New York 1996. ISBN 3-11-014791-2.

This volume contains articles by participants at the special research quarter on groups, difference sets, and the Monster, held at the Ohio State University in Spring 1993. The contributions of the authors are divided into three parts. The first part, Groups and Geometry, contains articles on the structure, representation and cohomology of finite simple groups; finite geometries with large automorphism groups; group actions on simplicial complexes; sporadic geometries; the conjecture of Guralnick and Thompson

on the composition factors of certain Galois groups.

The second part, called Difference Sets, contains articles on finite difference sets, notably on the emerging field of non–abelian difference sets, techniques involving the representation theory of nonabelian groups applied to difference sets, the Hadamard group order problem, Paley–type partial difference sets.

The Monster is the theme of the third part, which includes papers on the Monster sporadic simple groups, Moonshine properties, conformal field theories.

The book addresses the specialists in finite simple groups, finite geometries, combinatorial design and coding theories; connections to other fields like number theory, Lie theory, quantum physics are outlined. The problems and techniques contained in the book can be a stimulating introduction to research for graduate students.

C. Volf

M. PREDELEANU, P. GILORMINI, *Advanced Methods in Materials Processing Defects*, Elsevier, Amsterdam, New York, Tokyo, 1997.

Some years ago, Professor Mircea Predeleanu held at the Faculty of Mathematics, University of Iaşi, a conference concerning the problems in researching of materials with defects. With this occasion he presents a future book in which this question will be treated in details. Now, we are in possession of this very interesting work published in "Studies in Applied Mechanics, 45".

This volume contains the contributions of the Third International Conference on Material Processing Defects which follows of some predecessory international meetings held in France, Germany etc.

The main purpose of this Conference, was focused on advanced methods for predicting and avoiding the occurence of defects in manufactured materials, as well as, the influence of the processing–induced defects on the structure in the study. The book has the following topics: 1. Damage modeling. 2. Damage evaluation and rupture. 3. Strain localization and instability analysis. 4. Formability characterization. 5. Prediction of shape inaccuracies. 6. Influence of defects on structural integrity.

It is worth noting that damage theory is used increasingly both for estimating the soundness of the formed product and for defining the workability of a given material. Moreover, new damage models were proposed. High–rate loading conditions which occur, for instance in maching or explo-

sive forming, were also considered. Finally, numerical simulations were used extensively to predict and avoid the shape inaccuracies arising in the most forming processes.

This book is of a real interest for researches in the theory of behaviour of materials (engeenering) as well as, for mechaniciens which deal with the mathematical modeling of the response of structures with processing defects.

A. Manolachi

LIVIU I. NICOLAESCU, *Lectures on the Geometry of Manifolds*, World Scientific, Singapore, 1996, xvii+481p., ISBN 9810228368.

We are very pleased to review this book of Liviu I. Nicolaescu, a 1987 graduate of "Al.I. Cuza" University of Iaşi. The book, which is an extended version of a course given by the author at the University of Michigan is addressed to beginning graduate students and it covers many areas of the geometry of smooth manifolds in over 480 pages!!! Another important feature is the large number of exercices which complement the theory. It consists of ten chapters, a significant bibliography and a very useful index.

The first chapter, "Manifolds" introduces the definitions of fundamental geometric objects. The second chapter, "Natural constructions on Manifolds", presents the main objects associated to a smooth manifold, namely tangent bundle, tensor bundles, tensor fields etc. The author uses this chapter as a pretext for introducing at this early stage the more general concept of fiber bundle. Chapter 3, "Calculus on Manifolds", extends the classical (euclidean) differential and integral calculus to the manifolds context: the Lie derivative, the exterior derivation, connections on vector bundles, integration on manifolds. A very important example of a manifold with additional structure is that of a Riemannian space and chapter 4, "Riemannian geometry", is devoted to it. In this chapter the local and global methods are combined to proved celebrated results. Only two famous examples: Gauss' Theorema Egregium and the Gauss–Bonnet theorem. One of the powerful tools in the study of nonlinear phenomena is the calculus of variations. Chapter 5, "Elements of Calculus of Variations", provides a nice image of this theory. Chapter 6, "The Fundamental Groups and Covering Spaces", is the background of algebraic topology's aplications in geometry which continued in chapter 7, "Cohomology" which is, in the author's words "the topological core of the book". The next chapter, "Characteristic Classes", finishes the algebraic approach with the most important examples: Chern classes, Pontryagin classes, Euler classes. Chapter 9, "Elliptic Equations on

Manifolds", and the last one, "Dirac Operators", are, again in the author's words: "the analytical core of the book". Here we find the personal view of the author with respect to the frontiers between geometry, analysis and differential equations.

In conclusion, it is a very stimulating book with many research subjects. We strongly recommend it to any person willing to enter the complex world of global analysis.

M. Crâşmăreanu, Gh. Ionesei

L. DI MARTINO, W.M. KANTOR, G. LUNARDON, A. PASINI, M.C. TAMBURINI (eds.), *Groups and Geometries,* Siena Conference, September 1996, Trends in Mathematics, Birkhäuser Verlag, Basel, Boston, Berlin, 1998, xii, 261 pp. ISBN 3-7643-5881-5, 0-8176-5881-5.

Cartea conţine o parte din lecţiile şi comunicările prezentate la o conferinţă (workshop) dedicată interdependenţei dintre metodele teoriei grupurilor şi metodele geometrice şi combinatoriale, desfăşurată la Universitatea din Siena, Italia, în perioada 1–7 septembrie 1996. Aspectele abordate în lecţiile ţinute de experţi invitaţi şi în comunicările scurte prezentate de tineri cercetători se referă la: clasificarea grupurilor finite simple, structura şi proprietăţile grupurilor de tip Lie peste corpuri finite şi algebric închise având caracteristică finită, construcţia şi geometria spaţiilor proiective şi polare, geometria grupurilor simple sporadice. Pe lângă contribuţiile unora dintre editorii volumului, se pot semnala articolele semnate de: B. Baumeister, G. Stroth, F. Buekenhout, M. Dehon, D. Leemans, H. Gottschalk, C. Huybrecths, A.A. Ivanov, N.L. Johnson, A. Shalev, E. Shult, A.I. Steinbach, J.A. Thas, J. Van Bon, H. Cuypers, S. Yoshihara ş.a. Este o carte utilă pentru cercetătorii în domeniu.

V. Oproiu

J. HURTUBISE, F. LALONDE (eds.), *Gauge Theory and Symplectic Geometry,* Kluwer Academic Publishers, 1997, NATO ASI Series, Series C: Mathematical and Physical Sciences, vol. 488, xvii, 212, pp. USD 120. ISBN 0-7923-4500-2.

În volum sunt adunate unele din lecţiile prezentate la Seminarul de Matematici Superioare, Universitatea din Montreal, Canada, 1995, dedicat

legăturilor existente între topologia varietăţilor 4-dimensionale, din punctul de vedere al teoriilor gauge şi topologia şi geometria simplectică. În primul capitol sunt prezentate notele unui curs predat de M. Audin despre sisteme integrabile şi spaţii de moduli. Se studiază două sisteme integrabile pe spaţiile de moduli ale fibratelor vectoriale pe o suprafaţă Riemann şi sunt prezentate rezultatele lui Goldman, Jeffrey, Weitsman, Fock şi Roslyi. În notele cursului predat de Ya. Eliashberg se face o trecere în revistă a unor rezultate din teoria varietăţilor Stein precum şi a unor concepte legate de J–convexitate şi funcţii plurisubharmonice, din punctul de vedere al geometriei simplectice. În continuare, N. Hitchin se ocupă de varietăţile Frobenius, introduse de Dubrovin în legătură cu teoria invarianţilor Gromov–Witten în coomologia cuantică. J. Hurtubise se ocupă de relaţia dintre spaţiile de moduli privite ca mulţimi extremale pentru diverse probleme variaţionale şi diversele spaţii de funcţii în care acestea sunt situate. În particular, sunt abordate probleme de stabilitate topologică pentru astfel de spaţii. În ultimele două contribuţii, de F. Lalonde şi Dusa Mc Duff, sunt considerate curbele pseudoolomorfe şi aplicaţiile lor în topologia simplectică. F. Lalonde se ocupă de curbele J–olomorfe şi invarianţii simplectici iar Dusa McDuff de invarianţii Gromov–Witten pentru 4–varietăţi simplectice. Volumul reuneşte rezultate şi aspecte deosebit de interesante din topologia 4-dimensională şi topologia simplectică. Este o carte utilă atât pentru matematicieni cât şi pentru fizicieni.

V. Oproiu

B.R. IYER, C.V. VISHVESHWARA (eds.), *Geometry, Fields and Cosmology, Techniques and Applications,* Kluwer Academic Publishers, 1997, Fundamental Theories of Physic 88, xiv, 554 pp., USD 248. ISBN 0-7923-4725-0.

Materialul din acest volum este bazat pe cursurile predate la The First Inter University Graduate School on Gravitation and Cosmology, organizat la IUCAA–Pune, India în 1989. Se intenţionează realizarea unei solide baze teoretice pentru pregătirea viitorilor cercetători în domeniul metodelor geometrice în fizica teoretică, metodelor teoriei generale a câmpului şi ale cosmologiei relativiste. Pentru aprofundare, au fost selectate numeroase probleme mai mult sau mai puţin aplicative cu soluţiile sau indicaţiile aferente. În primul capitol, intitulat "Metode geometrice în fizică", elaborat de N. Mukunda, au fost selectate diverse probleme din matematici, în general, şi din geometria diferenţială, în special, destinate să constituie baza

pe care se vor construi teoriile fizice avute în vedere. Se pleacă de la teoria mulţimilor, a spaţiilor vectoriale cu tensori definiţi pe ele, a spaţiilor topologice, pentru a se ajunge la definiţia noţiunii de varietate diferenţiabilă. Pentru acestea se discută elementele uzuale de calcul diferenţial pe varietăţi, după care se abordează conexiunile liniare, structurile riemanniene, subvarietăţile, elemente de teoria formelor armonice etc. Se trece la teoria grupurilor Lie, a fibratelor diferenţiabile, cu cazurile importante ale fibratelor vectoriale şi principale. Rezultatele obţinute sunt folosite pentru prezentarea unor aspecte deosebit de profunde din topologia diferenţială şi geometria diferenţială globală. Capitolul de probleme de geometrie diferenţială a varietăţilor diferenţiabile şi soluţiile lor a fost redactat de R. Kulkarni. În continuare, S.V. Dhurandhar prezintă principalele probleme şi rezultate din teoria tetradelor, formalismul Newman–Penrose şi teoria spinorilor. Problemele practice legate de aceste aspecte şi soluţiile lor au fost redactate de B.R. Iyer. În capitolul următor sunt discutate aspecte din teoria cuantică a câmpului de către T. Padmanabhan. Sunt descrise aspectele uzuale legate de integrala acţiunii în general şi pentru diverse câmpuri particulare, renormalizare etc. În continuare, Urjit Yajnik se ocupă de metode ale teoriei cuantice a câmpurilor, ecuaţia Dirac şi teoria perturbării. La sfârşit, J.V. Narlikar tratează probleme ale cosmologiei relativiste iar P. Dasgypta discută diverse aspecte ale constantei cosmologice. Este o carte deosebit de utilă pentru tinerii cercetători, dornici să se iniţieze în problematica metodelor geometriei diferenţiale şi ale teoriei grupurilor în teoria câmpurilor fizice, clasică şi cuantică.

V. Oproiu

J.P. WARD, *Quaternions and Cayley Numbers; Algebra and Applications,* Mathematics and Its Applications, 403, Kluwer Academic Publishers, 1997, xi, 237 pp, pp. USD 120. ISBN 0-7923-4513-4.

Autorul studiază unele proprietăţi algebrice ale cuaternionilor, cuaternionilor complecşi şi ale octavelor (numere Cayley). De asemenea, sunt prezentate câteva elemente din teoria algebrelor Clifford şi un program de calcul simbolic în MAPLE pentru algebra Cayley. Materialul din carte poate fi considerat ca unul de referinţă pentru matematicienii ce folosesc cuaternionii şi octavele în preocupările lor, ca şi pentru fizicienii ce lucrează în electromagnetism şi gravitaţie (relativitate specială şi generală), teoria particulelor elementare, teorii gauge etc. În literatura matematică există şi alte cărţi despre cuaternioni şi octave dar volumul de faţă conţine unele as-

pecte inedite, legate, mai ales, de unele interdependenţe între cuaternioni şi octave cu aspecte din fizica teoretică modernă. Într-un prim capitol sunt prezentate principalele elemente din algebra liniară reală, utile pentru dezvoltarea subiectului: numere întregi, raţionale, reale, grupuri, inele, corpuri, spaţii vectoriale şi vectoriale euclidiene, algebre, numere complexe. În legătură cu cuaternionii, sunt prezentate aspecte istorice care au stat la baza introducerii lor, principalele proprietăţi ale cuaternionilor, cunoscuta teoremă a lui Frobenius privind algebrele reale asociative, legăturile cuaternionilor cu rotaţiile 3– şi 4–dimensionale, descrierea matricială a cuaternionilor, aplicaţii în trigonometria sferică şi în legătură cu axele de rotaţie în mecanică. Un studiu asemănător este făcut pentru cuaternionii complecşi, punându-se în evidenţă legătura cu matricele Pauli. Sunt studiate metricile euclidiană şi Minkowski şi legăturile cu spaţiu–timpul din relativitatea specială şi electromagnetism. Sunt discutate reprezentările cuaternionice ale bivectorilor, null–tetradele pentru spaţiu–timp, clasificarea bivectorilor complecşi şi tensorul Weyl. Pentru numerele Cayley sunt prezentate principalele proprietăţi legate, în special, de asociativitatea slăbită. Sunt stabilite legături cu algebrele normate şi teorema lui Hurwitz şi rotaţiile în spaţiile 7– şi 8–dimensionale.

Este o carte utilă pentru matematicieni şi fizicieni.

V. Oproiu

SUNDARAM THANGAVELU, *Harmonic Analysis on the Heisenberg Group,* Progress in Mathematics, vol. 159, Birkhäuser, Boston, Basel, Berlin, 1998, xii, 192 pp. ISBN 0-8176-4050-9, 3-7643-4050-9.

Cartea de faţă este o monografie dedicată diverselor aspecte ale analizei armonice pe grupurile Heisenberg. După cum se ştie, grupul Heisenberg este un grup Lie necomutativ, nilpotent, la care se pot extinde cu oarecare uşurinţă unele aspecte ale analizei armonice euclidiene. De asemenea, grupul Heisenberg joacă un rol important în numeroase ramuri ale matematicii: teoria reprezentărilor, ecuaţii cu derivate parţiale, geometria diferenţială, teoria funcţiilor de mai multe variabile complexe, teoria numerelor etc. Extinderile de la analiza armonică abeliană la cea necomutativă, vizate de autor, se referă la: teoremele Plancherel, Paley–Wiener, Wiener–Tauber, mediile Bochner–Riesz, multiplicatorii pentru transformata Fourier etc. În primul capitol sunt prezentate elemente de bază din teoria reprezentărilor şi transformatei Fourier. Autorul pune în evidenţă interdependenţa strânsă între teoria reprezentărilor pe grupul Heisenberg şi dezvoltările în funcţii

Hermite şi Laguerre. Se prezintă teorema lui Stone–von Neumann şi aspectele specifice ale teoremelor Paley–Wiener şi Hardy pentru transformata Fourier. În capitolul al doilea se dezvoltă teoria spectrală a sublaplacianului, obţinându-se autofuncţiile cu ajutorul funcţiilor Hermite speciale. Dezvoltările funcţiilor în astfel de autofuncţii conduc la o teoremă de tip Peter–Weyl pentru grupul Heisenberg. Alte rezultate sunt legate de teorema de restricţie Müller, mediile Bochner–Riesz asociate sublaplacianului, teoria de tip Littlewood–Paley–Stein. Algebra grupală $L^1(H^n/U(n))$ este studiată în capitolul al treilea. Grupul Heisenberg H^n şi grupul unitar $U(n)$ formează o pereche Ghelfand. Autorul studiază funcţiile sferice elementare asociate acestei perechi şi demonstrează versiunile Wiener–Tauber. Cu ajutorul acestor teoreme se studiază injectivitatea operatorului medie sferică şi teorema maximală pentru mediile sferice. În ultimul capitol se consideră grupul Heisenberg redus şi se rafinează unele rezultate obţinute în teoreme din capitolele precedente. Cartea constituie o introducere excelentă în analiza armonică necomutativă şi este recomandată, mai ales, pentru cercetătorii debutanţi în domeniu.

V. Oproiu

COOPER, JEFFREY M., *Introduction to Partial Differential Equations with MATLAB,* Applied and Numerical Harmonic Analysis, Birkhäuser, Boston, Basel, Berlin, 1998, xv, 540 pp. ISBN 0-8176-3967-5, 3-7643-3967-5.

Cartea de faţă conţine materialul care s-ar putea preda într-un curs de ecuaţii cu derivate parţiale, pentru studenţii de la facultăţile de matematică, fizică, informatică sau pentru studenţii facultăţilor de la universităţile tehnice. Materialul este prezentat într-o ordine ce reflectă diversele proprietăţi din fizică, modelate de ecuaţiile cu derivate parţiale corespunzătoare. Pe lângă tratarea problemelor uzuale din teoria ecuaţiilor cu derivate parţiale, folosirea unor softuri performante a permis şi abordarea unor probleme care sunt discutate în mod obişnuit în cursuri speciale, cum ar fi aspectele numerice în rezolvarea ecuaţiilor cu derivate parţiale. Softul ales de autor este MATLAB, care oferă o anumită flexibilitate şi uşurinţă în programare, astfel că poate fi folosit fără ca studenţii să aibă o pregătire specială în legătură cu el. Cartea conţine exerciţii în care se foloseşte acest soft. Autorul indică şi adrese de unde se pot obţine diverse mfiles pentru construcţii grafice. Organizarea cărţii este următoarea. După un prim capitol, conţinând preliminarii uzuale, se trece la integrarea ecuaţiilor cu derivate

parţiale de primul ordin, liniare sau neliniare, pentru care se foloseşte metoda caracteristicilor. Mai departe, se discută un exemplu de lege de conservare neliniară şi se dau metode numerice pentru ecuaţiile de primul ordin. În continuare, se foloseşte aceeaşi manieră de lucru pentru ecuaţia căldurii, pentru care se discută şi probleme la limită. Mai departe, se studiază ecuaţia undelor, seriile Fourier şi transformata Fourier. Metoda fazei staţionare şi ecuaţiile dispersive sunt exemplificate pe cazul ecuaţiei Schrödinger. Probleme multidimensionale legate de ecuaţia căldurii şi ecuaţiile undelor sunt discutate în capitolul 8. Mai departe, sunt considerate ecuaţiile Laplace şi Poisson şi, în legătură cu acestea, sunt prezentate câteva exemple de probleme variaţionale neliniare. În încheiere, autorul descrie mai multe metode numerice, utile în cazul multidimensional, ajungând până la metoda elmentului finit şi metodele Galerkin. Cartea este deosebit de interesantă prin faptul că oferă o anumită panoramă asupra interdependenţei dintre problemele la limită standard şi tehnicile de separare a variabilelor şi metodele numerice de evaluare pentru unii coeficienţi Fourier, transformata Fourier şi metodele Galerkin. Exerciţiile existente în carte ajută enorm la consolidarea cunoştinţelor. Posibilitatea folosirii computerului în rezolvarea multora din aceste probleme, oferă un ajutor suplimentar în înţelegerea problematicii. Este o carte extrem de utilă pentru modernizarea predării cursului de ecuaţii cu derivate parţiale.

V. Oproiu

V.I. ARNOLD, G.–M. GREUEL, J.H.M. STEEBRINK (eds.), *The Brieskorn Anniversary Volume,* Progress in Mathematics, vol. 162, Birkhäuser, Boston, Basel, Berlin, 1998, xii, 458 pp. ISBN 3-7643-5913-7, 0-8176-5913-7.

Cartea de faţă conţine versiunile extinse ale unor contribuţii prezentate de diverşi specialişti în teoria singularităţilor la Conferinţa dedicată celei de a 60-a aniversări a lui Egbert Brieskorn, în iulie 1996 la Mathematische Forschungsinstitut Oberwolfach. Mulţi dintre autorii articolelor din acest volum au fost influenţaţi în mod considerabil de rezultatele lui Brieskorn în teoria singularităţilor sau, mai mult, sunt foşti elevi ai acestuia. Trebuie menţionată de asemenea prezenţa consistentă a matematicienilor ruşi din şcoala lui V.I. Arnold, unul dintre editorii acestui volum. După un articol al lui G.-M. Greuel, dedicat trecerii în revistă şi descrierii sumare a contribuţiilor matematice ale lui E. Brieskorn şi o listă de lucrări ale lui Brieskorn, contribuţiile specialiştilor sunt clasificate în patru domenii, core-

spunzătoare celor patru capitole ale volumului. În primul capitol, cu titlul "Clasificare şi invarianţi", găsim contribuţii ale lui Yu. A. Drozd, G.-M. Gruel, G. Pfister, H.A. Hamm, W. Huang, J. Lipman, A. Nemethi, M. Tibăr. În al doilea capitol, "Teoria deformărilor", sunt adunate rezultatele lui A.A. du Plessis, C.T.C. Wall, W. Ebeling, S.M. Gusein–Zade, C. Hertling, E. Shustin şi V.A. Vassiliev. În continuare, în capitolul despre "Rezoluţii", se găsesc articolele lui K. Altmann, A. Campillo, G. Gonzalez–Sprinberg, H. Cassens, P. Slodowy şi H. Hauser. Aplicaţii ale teoriei singularităţilor sunt prezentate în capitolul cu acelaşi nume de către E. Artal–Bartalo, P. Cassou–Nogues, A. Dimca, A.H. Durfee, J. Feldman, H. Knorrer, R. Sinclair, E. Trubowitz, V. Goryunov, C. Baines, M. Oka şi M. Polyak. Contribuţiile din acest volum sunt originale şi nu vor mai fi publicate în forma respectivă în altă parte. Cartea este extrem de utilă pentru cercetătorii din domeniul Teoriei Singularităţilor.

V. Oproiu

MEIRMANOV, A.M., PUKHNACHOV, V.V., SHMAREV, S.I., *Evolution Equations and Lagrangian Coordinates,* De Gruyter Expositions in Mathematics, 24, Walter de Gruyter, Berlin, New York, 1997, ISBN 3-11-014875-7.

Această monografie este dedicată prezentării unor rezultate de dată recentă cu privire la studiul ecuaţiilor de evoluţie pe calea utilizării coordonatelor lagrangiene. Spre deosebire de metoda lui Euler de a descrie mişcarea unui mediu continuu exprimând caracteristicile mişcării prin funcţii de variabila timp şi coordonatele spaţiale faţă de un reper nelegat de mediu, metoda lui Lagrange constă în a exprima aceste caracteristici prin funcţii de variabila timp şi coordonatele spaţiale (iniţiale) ale punctelor faţă de un reper legat de mediu. Fiecare din cele două metode are avantajele şi dezavantajele proprii.

Pe parcursul celor patru capitole ale cărţii autorii demonstrează că o abordare paralelă a studiului mişcării unui mediu continuu prin metoda lui Euler şi respectiv lui Lagrange, poate fi reciproc profitabilă şi complementară pentru ambele metode.

Primul capitol este consacrat prezentării problemei lui Verigin din modelarea matematică a mişcării a două fluide imiscibile într-un mediu poros. În acest model studiul evoluţiei frontierei libere (de separaţie a celor două fluide) este de mare interes practic.

Capitolul al doilea conţine mai multe rezultate referitoare la pro-

prietăţile algebrice şi geometrice ale transformărilor de coordonate utilizate care leagă coordonatele euleriene de cele lagrangiene. Sunt studiate mai multe probleme de simetrie pentru diverse clase de ecuaţii parabolice.

Capitolul al treilea este dedicat unei analize sistematice a unor probleme Cauchy pentru ecuaţii de tip mediu poros sau pentru sisteme de tip advecţie–difuzie, insistându-se asupra proprietăţilor de regularitate ale interfeţei.

Capitolul al patrulea prezintă studiul detaliat a mai multor probleme cu frontieră liberă de tip parabolic şi multi–dimensional incluzând problema de tip Stefan cu o fază şi ecuaţia Boussinesq din teoria filtraţiei.

Cartea se încheie cu bibliografie conţinând 180 de titluri.

Prin expunerea clară şi elegantă a unor rezultate foarte recente din domeniul problemelor cu frontieră liberă această monografie se dovedeşte utilă atât specialiştilor în ecuaţiile cu derivate parţiale de tip parabolic neliniare cât şi altor categorii de cititori: fizicieni, ingineri şi chimişti.

Ioan. I. Vrabie

N.M. MARTIN, S. POLLARD, *Closure Spaces and Logic*, Mathematics and Its Applications, Kluwer Academic Publishers, vol. 369, Dordrecht/ Boston/London, 1996, XVI+230 p.

The book examines an abstract mathematical theory, placing special emphasis on result applicable to formal logic. If a theory is *especially* abstract, it may find a natural home within several of the more familiar branches of mathematics. This is the case with the theory of closure spaces. It might be considered part of topology, lattice theory, universal algebra or, no doubt, one of several other branches of mathematics as well. In this development it is treated, conceptually and methodologically, as part of topology, because of the basic structure involved (closure space), as a generalization of Fréchet's concept V-space. V-spaces have been used in some developments of general topology as a generalization of topological space. Indeed, in the early '50s, closure spaces, were thought generalizations of Fréchet V-spaces which come from not requiring the null set to be closed (as it is in V-spaces). This generalization has an extreme advantage in connection with application to logic, since the most important closure notion in logic, deductive closure, in most cases does not generate a V-space, since the closure of the null set typically consists of the "logical truths" of the logic being examined. One additional advantage of this notion is that all or virtually all things called "closure" in mathematics are closures in the sense of defining a clo-

sure space, and also a surprisingly large variety of standard theorems about T-space continue to hold if we weaken the basic concept to that of closure space. Having defined this notion, one quickly notices that a great many concepts of importance in logical theory come out to be identical or closey related to similar concepts in topology. For example, formal inconsistency turns out to be identical with the topological notion of denseness,equivalence between formal systems with homeomorphism, and so on. The book has 9 chapters: logic and topology, basic topological properties, some theorems of Tarski, continuous functions, homeomorphisms, closed bases and closure semantics (I), theory of complete lattices, closed bases and closure semantics (II), truth functions.

F.L. Ţiplea

G. WEAVER, *Henkin–Keisler Models*, Mathematics and Its Applications, vol. 392, Kluwer Academic Publishers, Dordrecht/Boston/London, 1997, XII+ 253p.

In this book the topics on Henkin-Keisler were chosen with the view to demonstrating enough of the potential of this theory.

The term "Henkin-Keisler model" is used to refer to those interpretations for first order languages which are constructed by a specialization of the method of constants. This specialization was introduced in Keisler (1965) to motivate the ultraproduct construction and to prove the Fundamental Theorem of Ultraproducts. It appears to have received little attention. It is mentioned in Vaught (1973), but not attributed to Keisler. A special case of the modification, in the theory of polyadic algebras, it found in the work of Daigenault. The method of constants was introduced in Heinkin (1949) to establish the strong completeness of first order logic. While Henkin's original method involved the deductive apparatus of first order logic, it is easily modified so as employ only model theoretic ideas. Given L, a first order logic with equality, the method of constants begins with a set of sentences in L every finite subset of which has a model. Such sets are said to be *finitely satisfiable*. Since the union of a chain of finitely satisfiable sets is finitely satisfiable, each finitely satisfiable set can be extended to a set which is *maximal* in the sense that it is finitely satisfiable and contains every sentence in L or its negation. Each maximal set in L induces an equivalence relation on the constant terms in L. The order pair (τ, τ') is in this relation provided $\tau = \tau'$ is a member of the maximal set. When the set of constant terms in L is not-empty, an interpretation for L can be

constructed on that partition of the constant terms induced by this relation. This interpretation is a model of the maximal set if the set is *term-complete* in the sense that it contains an instance of each existential sentence it contains. When a maximal set is term-complate, the resulting interpretation is called a *Henkin model*. Even when L contains constant terms there are finitely satisfiable sets in L which cannot be extended to maximal and term complete sets in L. In such cases, the construction proceeds by adding new individual constans to the non-logical vocabulary of L in such a way that the set can be extended to a maximal and term-complete set in the expanded language. Keisler modified the Heinkin construction at the point where the new constants are introduced and did so in a way that illuminates a connection between Henkin models and ultraproducts. Given a finitely satisfiable set of sentences in L, let I denote the collection of finite subsets of this set. For each member of I choose a model of that set and let $\mathcal{T}$ be the family (indexed by I) of such interpretations. Consider the direct product of the domains of the members of $\mathcal{T}$. Members of this set are functions, h, defined and I such that for each i in I, h(i) is a member of the domain of the i-th member of $\mathcal{T}$. Add the members of this direct product, as individual constants, to the non-logical vocabulary of L and extend the members of $\mathcal{T}$ to interpretations of the new language by letting h denode h(i) on the i-th member of $\mathcal{T}$. Let $\mathcal{T}^*$ denote the resulting family of interpretations for the new language. The theory of $\mathcal{T}^*$ is the set of sentences in the new language true on all members of $\mathcal{T}^*$. The original set of sentences together with the theory of $\mathcal{T}^*$ is also finitely satisfiable. Further, any maximal extension of this set in the new language is term complete in that language. Generalizing from the above, let I be any non-empty set and let $\mathcal{T}$ be any family of interpretations for L indexed by I. As above, form the product of the domains of the members of $\mathcal{T}$ and add this set (as individual constants) to the non-logical vocabulary of L. The set $\mathcal{T}^*$ is defined as above. Any maximal extension of the theory of $\mathcal{T}^*$ in the expanded language is term-complete in that language. The resulting Henkin model is called a *Henkin-Keisler model*. The text is divided into nime chapters. The first reviews the method of constants and the ultraproduct construction. The introduces Keisler's specialization of the method of constants and details the relationship between Henkin-Keisler models and ultraproducts. The third chapter presents techniques for constructing Henkin-Keisler models of prescribed cardinalities. The fourth introduces a classification of the maximal extensions of the theory of $\mathcal{T}^*$. The fifth and sixth chapters examine techniques for constructing elementary subsystems of Henkin-Keisler models. The seventh chapter investigates applications of Henkin-Keisler to the problem of constructing "small models". The eighth chapter uses Henkin-Keisler models to estab-

lishvarious forms of the keisler- Shelah Isomorphism Theorem (i.e. that elementarily equivalent interpretations have isomorphic ultrapowers). The last chapter develops techniques for constructing saturated Henkin-Keisler models.

The book is written at a level appropiate for the reader familiar with the Henkin proof of the completeness theorem for first ordin logic and the basics of set theory.

F.L. Ţiplea

J.MOCKUS, W.EDDY, A.MOCKUS, L.MOCKUS, G.REKLAITIS *Bayesian Heuristic Approach to Discrete and Global Optimization – Algorithms, Visualization, Software and Applications*, Nonconvex Optimization and Its Applications, vol. 17, Kluwer Academic Publishers, Dordrecht, Boston, London, 1997, XV+396p.

The main goal of the book is to describe different approaches and different heuristic techniques of optimisation, starting with the formal Bayesian Approach (BA), the semi-formal Bayesian Heuristic Approach (BHA) and then with the informal Dynamic Visualization Approach (DVA). All the theoretical results developed in this volume are applied in real-life or test problems. The application examples illustrate theoretical results. One of the real-life families of application examples, scheduling of batch operations, is described in detail because this family illustrates most of the theoretical results.

In Part I, Bayesian Approach, the results are discussed at several levels. At the first level (Chapter 1), only the general ideas are outlined. At the second level (Chapter 2), the Bayesian Heuristic approach is discussed using the terms of complexity theory and at the third level (Chapter 3), mathematical justification of BHA is considered.

In Part II, Global Optimisation, the theory and some application examples (the Disk Problem, estimation of Bilinear Time Series parameters, etc.) of BA to continuos global optimisation are described.

In Part III, Network Optimisation, the power of BHA for network problems is discussed.

In Part IV, Discrete Optimisation, the problem of reducing discrete optimisation to continuos stochastic, using BHA, is treated. As test problems are considered the traditional knapsack, travelling salesman and flow-shop problems.

In Part V, Batch Purcess Scheduling, the real scheduling problem

is considered as an examples of BHA applications using various heuristics (MRP heuristics, simulated annealing and genetic algorithms.)

Part VI contains the description of the global optimisation software (for both UNIX and MS- DOS environment). The book also contains two diskettes with GM software and a FORTRAN library. In Part VI, the Dynamic Visualization Approach is considered as a promising technique for solving ill-defined optimisation problems.

P. Coţofrei

W.K. KLEIN, O.J. VRIEZE, L.C.M. KALLENBERG (eds.), Ten years LNMB *Ph.D. research and graduate courses of the Dutch Network of Operations Research*, CWI Tract, vol. 122, Amsterdam, III+382p.

This is a very interesting volume containing contributiond of persons involved in the ten years activitity of *The Dutch Network of OR* (LNMB), a national graduate network witk an educational program based on courses, colloquia and workshops.

A review, due to *L.C.M. Kallenberg*, of all these very important activities concluded the volume. The origins of the network are explained in a short introduction by *W.K. Heneveld*, the first director of the network. The remaining 41 pages are grouped in five parts: *Combinatorial Optimisation and Discrete Mathematics, Stochastic Operations Research, Game Theory, Applications and Other contributions*. Each section starts with an expository paper given by distingueshed specialists, reviewing the results obtained in the corresponding field by the Ph.D. students or members of LNMB.

This book represents an interesting report of the activity of an excellent organisation in research co-operation.

C. Croitoru

AUGUSTIN BANYAGA, *The Structure of Classical Diffeomorphism Groups.* Mathematics and Its Applications, vol. 400, Kluwer Academic Publishers, Dordrecht-Boston-London, 1997, XI + 198 p., ISBN 0-7923-4475-8.

The aim of this monograph is to give a fairly detailed proof of the following Smale's conjecture: the group $\mathrm{Diff}^r(M)_0$ of C^r diffeomorphisms, $r \geq 1$, of a smooth manaifold M, with compact supports, and isotopic to the

identity through compactly supported isotopies, is a simple group. This theorem was proved by M.R. Herman in the case M is the torus T^n in 1971; as a consequence of the Nash–Moser–Sergeraert implicit function theorem. W.P. Thurston, in the paper "Foliations and groups of diffeomorphisms" (Bull. Amer. Math. Soc. 80 (1974)) showed how Herman's result on T^n implies the general theorem for any smooth manifold M. The key idea was to vision an isotopy in $\mathrm{Diff}^r(M)$ as a foliation on $M \times [0,1]$. In fact he discovered a deep connection between the local homology of the group of diffeomorphisms and the homology of the Haefliger classifying space for foliations. This circle of ideas, called by the author "Thurston tricks" is discussed in chapter 2 of the monograph. It explains how in certain groups of diffeomorphisms, perfectness leads to simplicity. In connection with these ideas, the Epstein's theory ("The simplicity of certain groups of homeomorphisms", Compos. Math. 22 (1970)), which is applied to contact diffeomorphisms in chapter 6, is discussed.

A special role in the context of monograph is played by the flux homomorphism i.e. a homomorphism from the identity component in the group of diffeomorphisms preserving a closed p–form into a quotient of $H^{p-1}(M, IR)$, the $(p-1)$–de Rham cohomology of M.

An extensive study of this type of homomorphism is given in chapter 3, where several different constructions are given and its transgression is analysed.

In chapters 4 and 5 the theorems on the structure of volume–preserving and symplectic diffeomorphisms are proved.

In chapter 7, all the results in the preceeding chapters are applied to the study of a problem related to the Erlanger Program of Klein: to prove that "classical" structures are determined by their automorphism groups. Here, "classical" are called the following structures: the C^∞–structure, the simplectic structure, the unimodular structure (defined by a volume form), and the contact structures.

The main result of this chapter is the following: if the automorphism groups of two classical structures are isomorphic (as abstract groups), then the structures are isomorphic.

The proof is based on the works of Filipkiewicz, the author himself and McInerney and relies on the theorems on the structures of these classical groups of diffeomorphism studied in the previous chapters. The techniques used to prove the results above work also for the group of homeomorphisms preserving a "good" measure, the key fact being the structure theorem of Fahti which is the analogue of Thurston's theorem in the volume–preserving case. Although in the end of the monograph's introduction the author expresses your regret at "compiling all these wonderful results (about the dif-

feomorphism groups, of course) in one book would be a tour de force", I consider this monograph which deals only with the algebraic structure of diffeomorphism groups as a tour de force itself.

Liliana Răileanu (Iaşi)

BRADD T. HART, ALISTAR H. LACHLAN, MATTHEW A. VALERIOTE (Editors) - *Algebraic Model Theory,* NATO ASI Series, Series C: Mathematical and Physical Sciences, vol. 496, Kluwer Academic Publishers, Dordrecht-Boston-London, 1997, XVII + 277p., ISBN 0-7923-4666-1.

The NATO Advanced Study Institute on "Algebraic Model Theory" was held at the Fields Institute in Toronto, August 19–30, 1996. The format that was adopted for the institute was to highlight five separate topics: geometric stability theory, the model theory of analytic functions, the model theory of permutation groups, the spectra of countable theories and the structure of finite algebras.

The paper in this volume written by Bouscaren, Chatzidakis and Pillay constitutes the session on geometric model theory. Specifically the goal was to give a sketch of the model theoretic proof of the Manin–Mumford Conjecture by Ehud Hrushovski. Bouscaren's lectures provided much of the background stability theory necessary to understand the model theoretic content of the proof. Chatzidakis and Pillay provided specific details on the theory of algebraically closed fields with an automorphism, ACFA: the key theory where all the action takes place in Hrushorski's proof. Chatzidakis' paper includes the critical characterization of modular groups in ACFA. Finally, Pillay's paper gives an outline of Hrushorski's proof.

The session devoted to the model theory of analytic functions provided the most sensational talks of the institute. A.J. Wilkie announced and gave an outline of a proof that the real field expanded by all Pfaffian functions is 0–minimal. This long standing conjecture had been one of the goals of the subject and its proof was all the more remarkable in that it was proved without showing quantifier elimination or model completeness. It relied on Khovanskii's theorem that quantifier–free definable sets in the Pfaffian expansion of the rals have finitely many connected components and this number is bounded uniformly in parameters. Marker's paper of this volume contains a proof of this result and Wilkie's paper includes here a proof that the reals with exponentiation is decidable modulo Schanuel's conjecture.

The model theory of permutation groups session had two distinct threads. Lachlan, Macpherson adn Cherlin gave an exposition of work on

smoothly approximable structures providing both a historical perspective and an overview of the monumental, as unpublished, work of Cherlin and Hrushovski on this subject.

Hard and Laskonski give some history of the problem of the calculation of all the uncountable spectra of countable theories and the main ingredients of Hrushorski's proof.

Finally, the talks given by Kiss, Valeriote, Willard and Ziegler focussed on two major topics from the study of equationally definable classes of algebraic structures.

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