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BOOK REVIEWS

BERNARD DACOROGNA and PAOLO MARCELLINI, *Implicit Partial Differential Equations*, Progress in Nonlinear Partial Differential Equations and their Applications, Birkhäuser Verlag, Basel-Boston-Berlin, 1999, XII+273 pp., ISBN 3-8176-4121-1 and 3-7643-4121-1.

The main purpose of the book is to study the Dirichlet problem

$$F_i\left(x, u\left(x\right), Du\left(x\right)\right) = 0 \ a.e. \ x \in \Omega, \ i = 1, ..., I, \ u\left(x\right) = \varphi\left(x\right), \ x \in \partial\Omega,$$

where $\Omega \subset \mathbb{R}^n$ is open, u:$\Omega \longrightarrow \mathbb{R}^m$ and $F_i : \Omega \times \mathbb{R}^m \times \mathbb{R}^{m \times n} \longrightarrow \mathbb{R}$. The prescribed boundary condition is either continuously differentiable or only Lipschitz continuous. The quasilinear case (i.e. equations where the derivative appears linearly) is excluded since, as it is well known, in this case the solutions cannot satisfy a Dirichlet boundary condition. In the case $m = 1$ the problem is called scalar, otherwise it is called vectorial. This class of equations has important applications to the calculus of variations, nonlinear elasticity, problems of phase transitions and optimal design. For this new class of nonlinear partial differential equations (called implicit partial differential equations) the authors devise new functional analytic methods of solving, based on the Baire category theorem and on the weak lower semicontinuity of convex and quasi convex integrals, allowing to handle the existence of a.e. solutions. Comparisons with other methods, such as the methods of viscosity solutions and of convex integration are also discussed.

The book starts with a chapter called *Introduction* containing a detailed statement of the problems and the presentation of the methods used for their solution. Some open problems are discussed at the end of this chapter. The rest of the book is divided into four parts. The first one is concerned with the scalar case for first order (Ch. 2) respectively second order equations (Ch. 3). Chapter 4 gives a comparison with the celebrated viscosity solutions. Part II is devoted to the vectorial case (i.e. systems of equations). Chapter 5 in this part is concerned with some generalized notions of convexity and to lower semicontinuity theorems in the calculus of variations, which are then used in Chapter 6 to prove the main existence results. The third part is devoted to applications, including the singular values case, the case of potential wells and the complex eikonal equation (used in geometrical optics). The fourth part is an Appendix, containing proofs of some Vitali-type covering theorems and results on piecewise affine and piecewise polynomial approximations in Sobolev classes of smooth functions.

The book is carefully written and contains many results which appear for the first time in a book form, or even not being published elsewhere. The included background material makes it almost self-contained, so that it can be used as a textbook for advanced

graduate students as well as a reference text by the researchers in nonlinear analysis and its applications. By numerous examples from material sciences, treated as applications of theoretical results, the book will be of interest for people working in these fields, too.

Ştefan Cobzaş

Analysis of Divergence–Control and Management of Divergent Processes, William O. Bray and Časlav V. Stanojević (Editors), Applied and Numerical Harmonic Analysis, Birkhäuser Verlag, Boston-Basel-Berlin, 1999, XX+567 pp., ISBN 3-7643-4058-4 and 0-8176-4059-4.

The first International Workshop in Analysis and its Applications (IWAA) took place in 1984 in Kupuri, Yugoslavia, at the initiative of Professor Časlav V. Stanojević. Starting with the third one, each meeting had a principal theme. These themes were: Karamata's Regular Variation (Kuruti 1989), Inner Product and Convexity Structures in Analysis, Mathematical Physics and Economics (Kuruti 1990), Analysis and Foundations (University of Missouri – Rolla 1995), Contemporary Aspects in Fourier Analysis (University of Maine 1995). Remark that the fifth meeting was planned to be held in 1991 in Kupuri, too, but it was postponed and was reorganized in 1995 at the University of Maine, so that it took place three years after the sixth meeting.

The present book contains the proceedings of the seventh meeting held at the University of Maine from 1 to 6 June, 1997, having as principal theme the control and management of various divergence processes of analysis-summability of divergent series, singular integrals, Fourier and wavelet expansions etc.

The workshop was attended by approximately 60 mathematicians and the volume contains 29 contributed or/and survey papers, headed and numbered as chapters and grouped in four parts. The first part, I. *Convergence and Summability,* contains eight papers dealing with topics as Tauberian theorems for Abel summability (Č. V. Stanojević, I. Canak, V. B. Stanojević), summability of biorthogonal systems in sequence spaces (W. H. Ruckle), Cesàro means for double Vilenkin-Fourier series (W. R. Bade), summability for wavelet expansions (G. G. Walter, X. Shen). The second part, II. *Singular Integrals and Multipliers,* contains seven papers concerned with Caldéron-Zygmund singular integral operators (L. Grafakos, A. Stefanov), Haar multipliers (N. H. Katz, M. C. Pereyra), multipliers on H^p spaces over Vilenkin groups (J. E. Daly, K. L. Phillips), estimates for oscillatory Fourier transforms (B. Walther). The third part, III. *Integral Operators and Functional Analysis,* contains seven papers dealing with wavelets on hypergroups (K. Trimèche), Hardy type inequalities (G. Sinnamon, T. Ostrogorski), extremal problems in generalized Sobolev classes (S. K. Bagdasarov), statistical convergence (J. Connor). The final part of the book, IV. *Asymptotics and Applications,* contains seven papers on optimal control of divergent control systems (D. A. Carlson), surface minimizing of divergent integrals (H. R. Parks), spline summability (W. R. Madych), B-splines in Paley-Wiener space (A. J. Zayed), quasiasymptotics in the framework of Colombeau generalized functions (S. Pilipović, M. Stojanović).

The papers included in the present volume cover a broad variety of topics, related mainly with regularization of divergent processes of analysis. The book will be of great

interest for researchers in pure and applied mathematics interested in functional analysis, harmonic analysis, wavelet analysis, singular integrals as well as in their applications in technics (e.g. in signal processing).

Damian Trif

FLUCHER, MARTIN, *Variational Problems with Concentration,* Progress in Nonlinear Differential Equations and Their Applications; Vol. 36, Birkhäuser, Basel-Boston-Berlin 1999, VIII+163 pp., ISBN 3-7643-6136-0 and 0-8176-6136-0.

This specialized monograph is concerning with semilinear Dirichlet problems involving the Laplacean or more generally the p-Laplacean. The problems are solved via constraint variational methods and the focus is on the properties of low energy solutions corresponding to the vanishing viscosity limit.

The main contributions are as follows: (1) It is shown that the low energy solutions concentrate at a single point, i.e. they form a spike near the concentration point and are small elsewhere. (2) It is described the shape of this spike. (3) The concentration point is identified in geometric terms. The author deals with the zero mass case which in contrast with the positive mass case is less studied in literature. In this respect the results are new and complement the existing literature. The principal applications of the theory are: Bernoulli's free boundary problem and the plasma problem. For them several numerical methods approximating the concentration point and the free boundary are obtained and implemented. The corresponding plots are the object of some figures.

The contents are as follows: 1. Introduction; 2. P-capacity; 3. Generalized Sobolev inequality; 4. Concentration compactness alternatives; 5. Compactness criteria; 6. Entire extremals; 7. Concentration and limit shape of low energy extremals; 8. Robin functions; 9. P-capacity of small sets; 10. P-harmonic transplantation; 11. Concentration points, subconformal case; 12. Conformal low energy limits; 13. Applications; 14. Bernoulli's free boundary problem; 15. Vortex motion; Bibliography (132 titles); Index.

The book does not propound to provide a step-by-step introduction nor a complete overview of the subject. Consequently, the book is not easy to read. This, however, dŏes not affect the value of the book as a reference for PDE theorists interested in variational methods and asymptotic analysis of solutions. The book could be also recommended to young mathematician who may be able to grip with this modern interesting subject.

Radu Precup

PHILLIP I. GOOD, *Resampling Methods. A Practical Guide to Data Analysis,* Birkhäuser, Boston-Basel-Berlin, 1999, XXII+269 pp., ISBN 0-8176-4091-6 and 3-7643-4091-6.

This book is a practical guide to data analysis using resampling methods – permutation, cross-validation and bootstrap. It is intended mainly to those teaching and studying statistics, but can be used also by everyone who applies statistical methods: physicians, biologists, psychologists, sociologists, economists. The book is written in an informal style,

places its emphasis on presenting practical examples with intuitive explanations, figures, and discussions.

Chapter 1 presents some basics of descriptive statistics: graphs, measures of location and dispersion, and the using of sample statistics to estimate the parameters of the population. The bootstrap method to determine the precision of estimates is considered. In Chapter 2 on cause and effect, the relationships between the deterministic and stochastic components with a view to linear model are presented. Chapter 3 covers resampling methods to perform permutation tests and bootstrap to test hypotheses regarding the locations and dispersions of two populations and the location parameter of a single population. Testing of parametric hypotheses to binomial, Poisson, Gaussian and exponential distributions is summarized in Chapter 4. In Chapter 5 the resampling methods (bootstrap and permutations) are used to estimate the precision of point estimates, to compare models in terms of both prediction error and goodness of fit and to make interval estimates. Chapter 6 introduces the fundamental concepts for testing the hypotheses (the two types of error, significance level, power, and exact, conservative and unbiased tests), resumes the links of the power, sample size and significance level, and presents the difference among test of hypotheses based on the bootstrap, the permutation test and parametric distribution test. Chapter 7 is dedicated to testing hypotheses on categorical and ordinal data: Fisher's exact, Freedman-Halton, chi-square, τ, Q, Pitman's correlation, and linear-by-linear association tests. Chapters 8 and 9 consider resampling methods to experimental design and analysis techniques, and some tests in multivariate analysis for one and two sample comparisons. Classification, density estimation, discrimination, validation, cross-validation methods are presented in chapter 10. Chapter 11 on survival analysis and reliability applies resampling methods to the analysis uncensored and censored data. Chapter 12 gives an expert system for use in choosing an appropriate estimation or testing technique. Such as questions are considered: Parametric or nonparametric? Normal distribution? Which resampling method? What type of data?

Four appendices entitled Program your own resampling statistics – C++, SC, and Stata Code for permutation tests – SAS and S-PLUS code for bootstraps – Resampling software, present aspects of the programming and using well-known computer programs for resampling methods.

The book is completed by a vast bibliography and an index.

The special structure of the book is that each chapter ends with a summary, a short section containing a bibliographical survey on the contents of the chapter, and a lot of carefully graded exercises.

There is no doubt that this book would be a valuable one on the bookshelf of anyone interested in scientific statistical computing.

Petru Blaga

GEORGE GRÄTZER, *First steps in LATEX*, Birkhäuser Verlag Boston and Springer-Verlag New York, 1999, XX+131 pp., ISBN 0-8176-4132-7, 3-7643-4132-7.

The book by the same author "Math into LATEX", whose third edition was published in 1999 by Birkhäuser Boston and Springer Verlag New York, has got a very large audience and received very favourable reviews. That book contains a comprehensive discussion on LATEX and, by a clever organization of the material, it can be used both as an introductory text by the beginners as well as an up-to-date reference by the experienced users.

The aim of this new book the "little brother" of the above one, is to provide a quick introduction to LATEX so that a first article can be typeset in a very short time after being acquainted with it. The author mentions in the Introduction the case of a friend who was able to do this from Friday to Monday. The book is devoted to mathematicians, physicists, engineers, scientists or technical typists who are in need to learn quickly to typeset mathematical formulas.

The book contains six chapters – 1. Typing text; 2. Typing math; 3. Formulas and user defined commands; 4. The anatomy of an article; 5. An AMS article; 6. Working with LATEX, and three appendices – A. Math symbol tables; B. Text symbol tables; C. LATEX and the Internet. A Quick Finder with the list of main topics using terminology common to word processing applications and an Index are also included.

The book is very well organized, contains many practical examples and, undoubtedly, will become an indispensable tool for a novice who is in a hurry to write his first LATEX paper. Recommendations for further reading are given by the author at pages 90–91.

Ştefan Cobzaş

R. J. STROEKER, J. F. KAASHOEK – *Discovering Mathematics with Maple, An Interactive Exploration for Mathematicians, Engineers and Econometricians*, Birkhäuser, Boston-Basel-Berlin, 1999, XVII+227 pp., Paperback, ISBN 0-8176-6091-7 and 0-7643-6091-7.

Teaching and learning mathematics it's not, let's face it, an easy task. And computers, when used properly, can make a significant contribution to easing the pain. That's what are good for such sophisticated, but quite friendly computer algebra systems as Maple or Mathematica. On the other hand, you need a motivation to learn how to use a computer program so, most probably, the solution is to learn Maple in the process of learning mathematics. Thus, computations are much easier, you can get a better insight in the material and, as a bonus, you become an "expert" in Maple, without such a big effort, step by step.

The present book records the lectures the authors gave for several years to students in economy. I should say, from the very beginning, that this is not a book of mathematics (in the sense that the reader will not find here any formal result of calculus or any other part of mathematics), but is a systematic introduction to using Maple to learn basic mathematics (calculus, linear algebra, a bit of statistics).

The book starts with a short tour of Maple V, describing the user interface and the basic commands. The main body includes chapters of functions and sequences, matrices and vectors, counting and summation, derivative and linear algebra. All the chapters have a main part, a second part that contains worksheets and assignment, some exercises, and end with a survey of the Maple expressions there where therein.

There are three appendices (exercises in experimentations, hints and answers to exercises and a quick guide to selected Maple commands).

The book would be an excellent auxiliary for anyone wishing to learn Maple and could serve as a textbook for special courses in computer algebra as applied to mathematics.

The book includes an index and a list of references.

Paul Blaga