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BOOK REVIEWS

C. Huber-Carol, N. Balakrishnan, M. C. Nikulin, and M. Meshbach (eds.): GOODNESS-OF-FIT TESTS AND MODEL VALIDITY. Birkhäuser-Verlag, Basel-Berlin-Boston, 2002, xxxiv+508 pages, 69 Tab's, 44 Fig's. ISBN 3-7643-4209-9, price EUR 127.10.

An International Conference on Goodness-of-Fit and Model Validity (Paris, May 2000) was organized in order to commemorate the famous χ-squared paper entitled *"On the criterion that a given system of deviations from the probable in the case of correlated system of variables is such that it can be reasonably assumed to have risen from random sampling"* published by Karl Pearson in Philosophical Magazine *5*(1990), 157–175. The reviewed book has the standard form, size and cover of Proceedings published in the series *Statistics for Industry and Technology*. 37 articles are divided into eight sections the names of which are as follows: History and Fundamentals, Chi-Squared Test, Goodness-of-Fit Tests for Parametric Distributions, Regression and Goodness-of-Fit Tests, Goodness-of-Fit Tests in Survival Analysis and Reliability, Graphical Methods and General Goodness-of-Fit Tests, Model Validity and Quality of Life, Tests of Hypotheses and Estimation with Applications.

The first part joins three papers of a more general importance. "Karl Pearson and the Chi-Squared Tests" (by D. R. Cox) is a biographic sketch of KP followed by an outline of the historical paper and a discussion of its influence. "Karl Pearson Chi-Squared Test— The Dawn of Statistical Inference" (by C. R. Rao) reviews the early work on the chi-square statistic, its derivation from the general theory and recent contributions to alternative tests. "Approximate Models" (by P. J. Huber) discusses the role of models in contemporary and future statistics and the need for change in approach forced by the steadily increasing size and complexity of data sets.

In order to acquaint the reader shortly with the content of the remaining 34 papers partly characterized by the section names, the most frequent key words are presented in what follows.

"*Test*" or "*testing*" appear in connections: adaptive, Bolshev, chi-square, Cramer-von-Mises type, Fisher, goodness-of-fit, likelihood ratio, Monte-Carlo, minimax hypothesis, most powerful invariant, Neyman smooth, nonparametric, of fit, of independence, of monotonicity, Rao's score, regression goodness-of-fit, Shapiro-Wilk, Wald, Wilcoxon.

"*Estimator*" or "*estimation*" are interrelated with: adaptive, Kaplan-Meyer, kernel density, maximum likelihood, minimum chi-square, minimum distance, nonparametric, projective density, whereas "*model*" or "*modeling*" with: Bayesian, complementary log-log, Cox regression, frailty, logistic regression, measurement, selection, Rasch, Sedyakin's.

The book contains a great number of the most recent references, is full of new ideas and approaches, original test proposals, graphical representations, examples of real data (mainly from medical science) and useful tables, and it demonstrates clearly how inspiring can the celebrated KP's paper be even after 100 years.

Ivan Saxl

J. W. Dauben, Ch. J. Scriba (eds.): WRITING THE HISTORY OF MATHEMATICS—ITS HISTORICAL DEVELOPMENT. Birkhäuser-Verlag, Boston-Basel-Berlin, 2002, xviii+690 pages, 25 Fig's. ISBN 3-7643-6166-2, price EUR 119.63 (softcover ISBN 3-7643-6167-0, price EUR 73.83).

The book is a result of the project of the International Commission on History realized after more than ten years of collaboration of a team of 32 experts and written by 42 specialists from 24 countries. They wrote 19 chapters covering the historiography of mathematics in individual countries (France, Italy, Switzerland, Germany, Poland, Austria, Greece, Spain, Portugal, Japan, China, India) or in larger regions (Benelux, Scandinavia, the British Isles, Russia and the U.S.S.R., Bohemian countries, the Americas, Arab countries & Turkey & Iran). The most extensive chapters—about 40 pages—are devoted to France, Italy, Germany and the Americas, about 20 pages cover historiographies of the British Isles and Russia, and the standard length of the remaining chapters is about ten pages. The survey of national developments is supplemented by the Postscriptum summarizing the main relevant ideas. The importance of writing its history for further progress of mathematics is examined and the frequent engagement (or is it abuse?) of mathematical historiography in the service of political and social ends and national interests is mentioned. Its recent progress is attributed to the stimulation by many scientific institutions, by the growing interest in the mathematical education, and by cooperation efforts of many closely linked websites concerned with the history of mathematics.

In the second part of the book, the biographies of 300 historians of mathematics are gathered. Some of them have only few lines, whereas other cover several pages. The longest are the biographies of M. Cantor, Gino Loria, H. G. Zeuthen, van der Waerden and, obligatorily, of the slightly controversial father of the western mathematical historiography J.-E. Montucla. The biography of each historian is accompanied by the list of his main works and by several references to the relevant secondary literature, the length of which is sometimes well comparable with the length of the biography itself. The total number of these references amounts to several thousands.

The third part of the book provides a comprehensive bibliography of the most important literature concerning the history of mathematics and an index of names and institutions (about 1000 entries!).

It is impossible to comment on individual "national" chapters but at least a short note can be made on the Bohemian chapter written by Luboš Nový. The study opens with Tadeáš Hájek of Hájek, then the works by M. Pelzel, S. Vydra, J. Smolík and V. V. Tomek are quoted. A greater attention is devoted to F. J. Studnička and especially to Q. Vetter, which is the sole Czech historian included in the biographical section. Comments are also made on the efforts of V. Jarník and K. Rychlík, directed to the edition and significance of Bernard Bolzano's unpublished papers. The Slovak historiography is represented by J. Tibenský and K. Koutský. In the postwar period, only the names of L. Nový, J. Folta and J. Bečvář are cited, and the outbreak of activity in the last ten years is thus not reflected.

However, also statisticians will not be quite satisfied. The complete omission could be, perhaps, forgiven of names like S. M. Stiegler, I. Hacking, A. Held, or G. Shafer. But the long-standing attention of M. G. Kendall to the history of mathematics, resulting in a whole series of substantial articles in "Studies in the history of probability and statistics" appearing from 1956 in Biometrika and revealed also in his Statistical Sources in the United Kingdom and Bibliography of Statistical Literature, should not be overlooked, unless statistics is still Cinderella in mathematics as well as in its history.

In spite of this oversight, the book is an extremely inspiring manual which will certainly be highly appreciated by all historians and students of mathematics and which should not be missing in any mathematical library.

Ivan Saxl

W. S. Slaughter: THE LINEARIZED THEORY OF ELASTICITY. Birkhäuser-Verlag, Boston, 2002, xxv+543 pages, hardcover. ISBN 0-8176-4117-3, price EUR 98,–.

The book presents classical parts of the linearized theory of elasticity in a selfcontained way that seems to be a fine compromise between the necessity of a deep mathematical insight and the accessibility of exposition. The author points out that the book is intended as a text for a first-year graduate course in mechanical or civil engineering. As a consequence, this partly limits the choice of the mathematical tools in more advanced subjects of the linearized theory of elasticity, which the author builds up step by step and presents in details.

Chapter 1 is elementary and, by examining special bodies (beams, cylinders), serves as an introduction to or a review of some fundamental notions of the mechanics of materials, e.g., stress, strain, shear force, bending, torsion, etc.

To build a more advanced theory of elasticity, at least the essentials of tensor analysis and calculus in different coordinate systems are necessary. These are covered in Chapter 2.

The next chapter deals with the displacement field and the related deformation and strain tensors in both the Lagrangian and the Eulerian descriptions. Similarly, Chapter 4 links forces with stresses (Cauchy, first and second Piola-Kirchhoff), again in the Lagrangian and the Eulerian descriptions. The relationship between stress and strain tensors is explained in Chapter 5, where materials exhibiting various degree of symmetry and the constitutive equations modeling their behavior are also presented. The rest of the book concerns above all linear elastic, isotropic, and homogeneous materials.

The field equations of linearized elasticity (Lamé-Navier, Michell, Beltrami), boundary value problems in a classical setting, as well as important principles (superposition, Saint-Venant principle, Clapeyron theorem, Betti-Rayleigh reciprocity relations) are introduced in Chapter 6. Next, particular problems come.

Antiplane strain, plane strain and stress, and the Airy stress function are subjects of Chapter 7. The torsion of noncircular cylinders is treated in Chapter 8. Also in this line, Chapter 9 focuses on three-dimensional problems assuming infinite or semi-infinite domains. Attention is paid to dislocations and inclusions.

Chapter 10 starts with a brief introduction to the calculus of variations, and then switches to variational principles in elasticity: principle of virtual work, principle of minimum potential energy, and principle of minimum complementary energy. To find approximate solutions, the Rayleigh-Ritz method is outlined and illustrated by a few examples. Structured as the foregoing section, Chapter 11 first presents the basics of the complex-valued functions of the complex variable, and then applies complex variable methods to linear elasticity problems, namely problems arising from antiplane strain and plain stress/strain in bodies with holes or cracks.

The final section, the Appendix, can be considered as an extension of Chapter 2 because it deals with general curvilinear coordinates. Two pages of references and a five page index finish the book.

It is worth mentioning that, in all relevant chapters, special attention is paid to formulating the linearized theory of elasticity in spherical and cylindrical coordinates. Also, many figures and solved examples contribute to the clarity of exposition. Moreover, each chapter finishes with a subsection of unresolved problems, hints being often given.

The material in the book is well organized, presented in a lucid way, and can reach a fairly broad audience spanning from advanced undergraduate students to graduate students. Professionals and researchers may enjoy this book for its clarity and instructive examples, as well as as a refreshing reminder of the classical results of the linearized theory of elasticity.

Jan Chleboun

R. C. Dalang, M. Dozzi, and F. Russo (eds.): SEMINAR ON STOCHASTIC ANALYSIS, RANDOM FIELDS AND APPLICATIONS III. Progress in Probability, Vol. 52. Birkhäuser-Verlag, Basel, 2002, xvii+302 pages. ISBN 3-7643-6721-0, price EUR 91,59.

The first Seminar on Stochastic Analysis, Random Fields and Applications took place in Ascona in 1993; since then, the seminar has been organized each third year. The book under review contains the proceedings of the third seminar, held at the Centro Stefano Franscini in Ascona in September 1999. The volume is dedicated to Sergio Albeverio on the occasion of his sixtieth birthday and opens with his short biography written by P. Blanchard. Twenty refereed articles are included into the book, most of them being full-length papers containing new results with proofs, the remaining ones providing an informal introduction into their authors' recent research. The seminar focused on three topics: stochastic partial differential equations and associated infinite dimensional Kolmogorov equations (7 papers), mathematical finance (5 papers) and physical modelling. Among the participants of the seminar one may find the leading specialist in the field, which is also reflected by the high standard of the contributions to the proceedings, as it is already traditional for Ascona seminars. (Let us note that the proceedings of the first and the second Seminars were published also by Birkhäuser in the same series as volumes 36 and 45, respectively.)

Jan Seidler

A. Lorenzi, B. Ruf (eds): EVOLUTION EQUATIONS, SEMIGROUPS AND FUNCTIONAL ANALYSIS. Progress in Nonlinear Differential Equations and Their Applications, Vol. 50. Birkhäuser-Verlag, Basel-Boston-Berlin, 2002, xii+397 pages, hardcover. ISBN 3-7643-6791-1, price EUR 119.63.

The volume under review is dedicated to the memory of Brunello Terreni. It comprises twenty papers contributed by his friends and collaborators, many of whom were speakers who met in a conference in his honour, held on September 27 and 28, 2000 in Milano.

These expository articles, written by distinguished and accomplished mathematicians, reflect the wide-ranging interest of Brunello Terreni, and his influence in evolution equations, control theory and functional analysis. Various topics of current interest are addressed in this book, among others: Equations of parabolic and hyperbolic type, qualitative properties of solutions, theory of semigroups, optimal control and identification problems, degenerate equations, dynamical systems, abstract Cauchy problems, integrodifferential equations, well-posedness and asymptotic behaviour of solutions, sums of operators, inverse problems as well as applications to nonlinear elasticity, materials with memory, nonlinear laser optics, electrocardiology.

Hana Petzeltová

C. Cercignani, G. M. Kremer: THE RELATIVISTIC BOLTZMANN EQUATION: THEORY AND APPLICATIONS. Progress in Mathematical Physics, Vol. 22. Birkhäuser-Verlag, Basel, 2002, 394 pages. ISBN 3-7643-6693-1, price EUR 82.24.

This book provides well arranged accounts of theory and applications of the relativistic Boltzmann equation. The book is written in a self-contained manner and is thus accessible even for those readers who are not experienced in special and general theory of relativity. The book contains several chapters covering basics of special and general relativity, differential geometry and relativistic kinetic theory, but its focus is in applications of the relativistic Boltzmann equation which are discussed in detail with emphasis on explicit calculations. The book may be used as a textbook for an adavanced course as well as a reference book for physicists and mathematicians interested in the relativistic Boltzmann equation.

Vojtěch Pravda

G. A. Losa, D. Merlini, T. F. Nonnenmacher, and E. R. Weibel (eds.): FRACTALS IN BIOLOGY AND MEDICINE, VOL. III. Mathematics and Biosciences in Interaction. Birkhäuser-Verlag, Boston-Basel-Berlin, 2002, x+362 pages, 141 Fig's. ISBN 3-7643-6472-2, price EUR 91.59.

Third International Symposium on "Fractal 2000 in Biology and Medicine" was held in Ascona, Switzerland, in March 2000. The book contains 33 presented contributions grouped according to their topic in four sections entitled Design of Biological Structures and Functions, Fractal Structures in Tumours and Diseases, Organization and evolution of living Systems and, finally, Modelling.

In the last paper on rather non-standard topic "Fractals in Architecture" the author quotes an opinion of Galileo stating that the universe cannot be understood without mathematical objects like triangles, circles and other geometric figures; "without these, one is wandering about in a dark labyrinth." The present book can be considered a vast and detailed antithesis to this assertion. The inability of Euclidean geometry combined with the linear time scale to reflect correctly biological structures and their development is mentioned in many papers included in the book. The most important reasons of the extreme complexity of natural structures are growth and branching rules, interaction of their components, non-linearity of their development dynamics etc. Another feature neglected until now is the formation of self-organized structures of higher order, such as cords, bundles, plaques or glands. The complicated structure is sometimes a consequence of the basic biological functions; e.g. the mammalian oxygen transport proceeds through more than 20 generations of airways terminated by highly packed alveoli. It should be stressed that the quantitative description of biological structures is extremely important not only in order to understand their functions but also for diagnostic and prognostic; many pathological processes are announced in their early stages by distinct structural changes in living tissues.

Fractal geometry offers such new and suitable concepts and methods that it can be called "the design principle in biology". It introduces attractive properties like self-similarity, scaling, lacunarity and characteristics of which the fractal dimension—"representing the space-filling capacity of biological structures"—is the most important. Its estimation is the topic of the majority of contributions covering e.g. human airway tree, patterns in organogenesis and carcinogenesis, studies of breast cancer, analyses of bone architecture, bone loss and marrow tissue etc. Because of its origins in signal analysis, fractal geometry is also convenient for quantitative ECG and EEG evaluation and to the analysis of human voice and voice diseases. Some other related methods like random walk and neural networks also occur in some contributions.

The book presents an interesting overview of contemporary trends in the structural description of biological objects and can be of interest to students and researchers in mathematical biology.

However, after going through all the papers, a suspicion arises in the reader's mind: can it be really so simple? Can a rather clear theory with its simple limiting formulae and one universal characteristic—the fractal dimension—be so successful in the description of complex natural phenomena? Fractal geometry in its present form, is it not only a starting step to a much more advanced approach? The contribution entitled "The Universal Dynamic Complexity as Extended Fractality" (written by A. P. Kirilyuk) offers beside a criticism of the recent oversimplified "canonical" fractal geometry also some proposals for its far reaching generalization.

Ivan Saxl

S. Klainerman, F. Nicolo: THE EVOLUTION PROBLEM IN GENERAL RELATIVITY. Progress in Mathematical Physics, Vol. 25. Birkhäuser-Verlag, Boston, 2003, 387 pages. ISBN 0-8176-4254-4, price EUR 107.00.

In the Preface, the authors state that "The main goal of this work is to revisit the proof of the global stability of Minkowski space by D. Christodoulou and S. Klainerman". The preceding book (D. Christodoulou and S. Klainerman, The global nonlinear stability of the Minkowski space, Princeton Mathematical Series, 41, 1993) contained a very important result but it was well known in the relativity community that it was very difficult to follow the proof. In this book the authors present a new significantly different proof of the main part of that result which is now based on a double null foliation of a spacetime which is more appropriate to the radiation features of Einstein's field equations and consequently leads to substantial simplifications.

In Chapter 1 the authors summarize the basic concepts of differential geometry. Chapters 2 to 7 are dedicated to the statement and proof of the main theorem. In the final Chapter 8 important consequences of the theorem (e.g. simple derivation of the connection between the Bondi mass and the ADM mass of an asymptotically flat spacetime) are presented.

Important results in this book are presented in a more "digestible" form that in the preceding book and thus scientists and graduate students working in relativity are recommended to read at least the introduction and the conclusions.

Vojtěch Pravda

P. Grabner, W. Woess (eds.): FRACTALS IN GRAZ 2001. ANALYSIS—DYNAMICS—GEOMETRY—STOCHASTICS. Trends in Mathematics. Birkhäuser-Verlag, Basel, 2003, vii+283 pages. ISBN 3-7643-7006-8, price EUR 92,–.

Not so long ago, most mathematicians used to meet fractals only in a form of charming pictures, which resulted from computer simulations. The situation has changed dramatically and nowadays a rigorous study of fractal structures turned into a well-established field of research, intertwined with measure theory, harmonic analysis, probability theory and many other branches of mathematics. This is testified also by the book under review, which contains the proceeding of a conference held in June 2001 at Graz University of Technology. It comprises twelve papers that, according to Preface, were written upon an explicit invitation of the editors and underwent a refereeing process. Most of the papers are surveys, some of them providing mainly an overview of their authors' recent results, while others are intended more as topic reviews. Choosing randomly, we would like to mention e.g. a

survey by L. Bartholdi, R. Grigorchuk and V. Nekrashevych, almost a hundred pages long, aimed at presenting ideas, notions and results connected to self-similarity of groups, semigroups and their actions; or T. Coulhon and A. Grigor'yan's paper on pointwise estimates for transition probabilities of random walks on infinite graphs.

To conclude, the book is warmly recommended to everybody interested in "fractals-related" mathematical problems.

Ivo Vrkoč

O. Hernández-Lerma, J. B. Lasserre: MARKOV CHAINS AND INVARIANT PROBABILITIES. Birkhäuser-Verlag, Basel, 2003, 205 pages, hardcover. ISBN 3-7643-7000-9, price EUR 58,–.

The book is about discrete time-homogeneous Markov chains with an invariant probability measure, and their ergodic behavior. Namely, various types of convergence of expected and pathwise occupation measures and ergodic decompositions of the state space are presented. An important example, for instance, is a dynamical system $(\xi_n)_n$ which satisfies an equation $\xi_{n+1} = F(\xi_n, \psi_n)$, $n \geqslant 0$ for some function F and a sequence of independent identically distributed random variables $(\psi_n)_n$ independent of the initial state ξ_0, such that the law of ξ_n coincides with the law of ξ_{n+1} for every $n \geqslant 0$.

The book is divided into three thematical parts: Markov Chains and Ergodicity (chapters 1 to 6), Further Ergodicity Properties (chapters 7 to 9), and Existence and Approximation of Invariant Probability Measures (chapters 10 to 12).

The first chapter concerns measure-theoretical and topological prerequisities such as different types of weak topologies and convergences of measures. Chapter 2 contains basic definitions, examples of Markov chains and various ergodic theorems such as the Chacon-Ornstein, Birkhoff, mean ergodic, dual ergodic, pathwise ergodic and Hopf's decomposition theorems. Chapter 3 concerns discrete Markov chains with countable state space, classification of states and limit theorems. Chapter 4 is devoted to Harris Markov chains which are an uncountable state space analogue of a recurrent countable state space Markov chain. The notion of the positive Harris recurrence is defined and characterized via the n-step transition probabilities or their averages (expected occupation measures). Furthermore, sufficient conditions for the Markov chain to be positive Harris recurrent are given, and Hopf's and Doeblin's decompositions of the state space are introduced. Chapter 5 deals with the identification of the limit function in the ergodic theorems from Chapter 2 for Markov chains in locally compact separable metric spaces. Chapter 6 is about classification of Markov chains via occupation measures rather than via the classical notions of transience and recurrence.

In Part 2, Chapter 7, weak, strong and quasi Feller Markov chains are studied. In particular, sufficient conditions for a weak Feller Markov chain to have an invariant probability measure, and relation between positively Harris recurrent and strong Feller Markov chains are given. Chapter 8 concerns necessary and sufficient conditions for the existence of solutions for the probabilistic multichain Poisson equation $g = Pg$ and $g + h - Ph = f$ where f is a given "charge" function and P is a transition probability function. The existence conditions are derived via different approaches such as canonical pairs, Cesàro averages, and resolvents. In Chapter 9, different types of ergodicity for Markov chains, such as strong, uniform, weak or weak uniform ergodicity, are studied, compared and related to the concept of stability of a transition kernel and to the solvability of the Poisson equation.

In Part 3, Chapters 10 and 11 deal with necessary and sufficient conditions for a Markov chain to have (a unique) invariant measure having, possibly, a density with respect to the Lebesgue measure, using tools of functional analysis, and viewing the transition probability

measure as a Markov operator on the space of measures. Chapter 12 concerns two numerical approximation schemes for invariant probability measures based on an infinite dimensional programming approach and on a moment approach.

Concerning the structure of the book, known theorems are stated without proofs, yet with sufficient references to the literature, and proofs of recent results are gathered at the end of the chapters so that the reader can easily follow the stream of the results. On the other hand, many abbreviations for frequently used expressions complicate the first time reading.

The book combines an overview of known results with many results published in a book form for the first time, and is intended for graduate students and researchers in theoretical and applied probability, operations research, engineering and economics.

Martin Ondreját

M. Iannelli, G. Lumer (eds): EVOLUTION EQUATIONS: APPLICATIONS TO PHYSICS, INDUSTRY, LIFE SCIENCES AND ECONOMICS. Progress in Nonlinear Differential Equations and Their Applications, Vol. 55. Birkhäuser-Verlag, Basel-Boston-Berlin, 2003, viii+423 pages, hardcover. ISBN 3-7643-0374-3, price EUR 124.–.

The volume under review is based on the material presented at the conference held in Levico Terme (Trento, Italy), 2000. The contributions, submitted up to the fall of 2002, contain also many results obtained after the conference by continuing research. In addition, some up to date surveys are incorporated. The interaction of established scientists and young promising researches as well as of pure and applied scientists was emphasized.

New developments in areas covered by the participants include, among others, moving boundary problems, asymptotics of solutions, maximal regularity, Poincaré inequality on stratified sets, stochastic aspects in Hamilton-Jacobi-Bellman equation, Ornstein-Uhlenbeck operators, quasilinear PDEs with memory operators, semigroup approach in economics and other problems, convolution-evolution equations in aeroelasticity, and age-structured models.

Hana Petzeltová

U. Çapar, A. S. Üstünel (eds.): STOCHASTIC ANALYSIS AND RELATED TOPICS VIII. Silivri Workshop in Gazimagusa (North Cyprus), September 2000. Progress in Probability, Vol. 53. Birkhäuser-Verlag, Basel, 2003, 205 pages, hardcover. ISBN 3-7643-6998-1, price EUR 92.–.

The proceedings contain ten papers of 20–30 pages on stochastic control and game theory, metrics for tangent processes on the path space, approximations for stochastic semilinear evolution equations, controllability and observability of linear stochastic systems in Hilbert spaces, computations of spectral densities for Langevin dynamics, quasi-invariance for Lévy processes under anticipating shifts, behavior of the density for jump processes with singular Lévy measures, Gaussian correlation conjecture, and one digest paper on stochastics in Colombeau related algebras.

Researchers in stochastic analysis, stochastic control and systems theory, SPDE, stochastic geometry, game theory, and theoretical biology may be interested in the present book.

Martin Ondreját

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"*Estimator*" or "*estimation*" are interrelated with: adaptive, Kaplan-Meyer, kernel density, maximum likelihood, minimum chi-square, minimum distance, nonparametric, projective density, whereas "*model*" or "*modeling*" with: Bayesian, complementary log-log, Cox regression, frailty, logistic regression, measurement, selection, Rasch, Sedyakin's.

The book contains a great number of the most recent references, is full of new ideas and approaches, original test proposals, graphical representations, examples of real data (mainly from medical science) and useful tables, and it demonstrates clearly how inspiring can the celebrated KP's paper be even after 100 years.

Ivan Saxl

J. W. Dauben, Ch. J. Scriba (eds.): WRITING THE HISTORY OF MATHEMATICS—ITS HISTORICAL DEVELOPMENT. Birkhäuser-Verlag, Boston-Basel-Berlin, 2002, xviii+690 pages, 25 Fig's. ISBN 3-7643-6166-2, price EUR 119.63 (softcover ISBN 3-7643-6167-0, price EUR 73.83).

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In spite of this oversight, the book is an extremely inspiring manual which will certainly be highly appreciated by all historians and students of mathematics and which should not be missing in any mathematical library.

Ivan Saxl

W. S. Slaughter: THE LINEARIZED THEORY OF ELASTICITY. Birkhäuser-Verlag, Boston, 2002, xxv+543 pages, hardcover. ISBN 0-8176-4117-3, price EUR 98,–.

The book presents classical parts of the linearized theory of elasticity in a selfcontained way that seems to be a fine compromise between the necessity of a deep mathematical insight and the accessibility of exposition. The author points out that the book is intended as a text for a first-year graduate course in mechanical or civil engineering. As a consequence, this partly limits the choice of the mathematical tools in more advanced subjects of the linearized theory of elasticity, which the author builds up step by step and presents in details.

Chapter 1 is elementary and, by examining special bodies (beams, cylinders), serves as an introduction to or a review of some fundamental notions of the mechanics of materials, e.g., stress, strain, shear force, bending, torsion, etc.

To build a more advanced theory of elasticity, at least the essentials of tensor analysis and calculus in different coordinate systems are necessary. These are covered in Chapter 2.

The next chapter deals with the displacement field and the related deformation and strain tensors in both the Lagrangian and the Eulerian descriptions. Similarly, Chapter 4 links forces with stresses (Cauchy, first and second Piola-Kirchhoff), again in the Lagrangian and the Eulerian descriptions. The relationship between stress and strain tensors is explained in Chapter 5, where materials exhibiting various degree of symmetry and the constitutive equations modeling their behavior are also presented. The rest of the book concerns above all linear elastic, isotropic, and homogeneous materials.

The field equations of linearized elasticity (Lamé-Navier, Michell, Beltrami), boundary value problems in a classical setting, as well as important principles (superposition, Saint-Venant principle, Clapeyron theorem, Betti-Rayleigh reciprocity relations) are introduced in Chapter 6. Next, particular problems come.

Antiplane strain, plane strain and stress, and the Airy stress function are subjects of Chapter 7. The torsion of noncircular cylinders is treated in Chapter 8. Also in this line, Chapter 9 focuses on three-dimensional problems assuming infinite or semi-infinite domains. Attention is paid to dislocations and inclusions.

Chapter 10 starts with a brief introduction to the calculus of variations, and then switches to variational principles in elasticity: principle of virtual work, principle of minimum potential energy, and principle of minimum complementary energy. To find approximate solutions, the Rayleigh-Ritz method is outlined and illustrated by a few examples. Structured as the foregoing section, Chapter 11 first presents the basics of the complex-valued functions of the complex variable, and then applies complex variable methods to linear elasticity problems, namely problems arising from antiplane strain and plain stress/strain in bodies with holes or cracks.

The final section, the Appendix, can be considered as an extension of Chapter 2 because it deals with general curvilinear coordinates. Two pages of references and a five page index finish the book.

It is worth mentioning that, in all relevant chapters, special attention is paid to formulating the linearized theory of elasticity in spherical and cylindrical coordinates. Also, many figures and solved examples contribute to the clarity of exposition. Moreover, each chapter finishes with a subsection of unresolved problems, hints being often given.

The material in the book is well organized, presented in a lucid way, and can reach a fairly broad audience spanning from advanced undergraduate students to graduate students. Professionals and researchers may enjoy this book for its clarity and instructive examples, as well as as a refreshing reminder of the classical results of the linearized theory of elasticity.

Jan Chleboun

R. C. Dalang, M. Dozzi, and F. Russo (eds.): SEMINAR ON STOCHASTIC ANALYSIS, RANDOM FIELDS AND APPLICATIONS III. Progress in Probability, Vol. 52. Birkhäuser-Verlag, Basel, 2002, xvii+302 pages. ISBN 3-7643-6721-0, price EUR 91,59.

The first Seminar on Stochastic Analysis, Random Fields and Applications took place in Ascona in 1993; since then, the seminar has been organized each third year. The book under review contains the proceedings of the third seminar, held at the Centro Stefano Franscini in Ascona in September 1999. The volume is dedicated to Sergio Albeverio on the occasion of his sixtieth birthday and opens with his short biography written by P. Blanchard. Twenty refereed articles are included into the book, most of them being full-length papers containing new results with proofs, the remaining ones providing an informal introduction into their authors' recent research. The seminar focused on three topics: stochastic partial differential equations and associated infinite dimensional Kolmogorov equations (7 papers), mathematical finance (5 papers) and physical modelling. Among the participants of the seminar one may find the leading specialist in the field, which is also reflected by the high standard of the contributions to the proceedings, as it is already traditional for Ascona seminars. (Let us note that the proceedings of the first and the second Seminars were published also by Birkhäuser in the same series as volumes 36 and 45, respectively.)

Jan Seidler

A. Lorenzi, B. Ruf (eds): EVOLUTION EQUATIONS, SEMIGROUPS AND FUNCTIONAL ANALYSIS. Progress in Nonlinear Differential Equations and Their Applications, Vol. 50. Birkhäuser-Verlag, Basel-Boston-Berlin, 2002, xii+397 pages, hardcover. ISBN 3-7643-6791-1, price EUR 119.63.

The volume under review is dedicated to the memory of Brunello Terreni. It comprises twenty papers contributed by his friends and collaborators, many of whom were speakers who met in a conference in his honour, held on September 27 and 28, 2000 in Milano.

These expository articles, written by distinguished and accomplished mathematicians, reflect the wide-ranging interest of Brunello Terreni, and his influence in evolution equations, control theory and functional analysis. Various topics of current interest are addressed in this book, among others: Equations of parabolic and hyperbolic type, qualitative properties of solutions, theory of semigroups, optimal control and identification problems, degenerate equations, dynamical systems, abstract Cauchy problems, integrodifferential equations, well-posedness and asymptotic behaviour of solutions, sums of operators, inverse problems as well as applications to nonlinear elasticity, materials with memory, nonlinear laser optics, electrocardiology.

Hana Petzeltová

C. Cercignani, G. M. Kremer: THE RELATIVISTIC BOLTZMANN EQUATION: THEORY AND APPLICATIONS. Progress in Mathematical Physics, Vol. 22. Birkhuser-Verlag, Basel, 2002, 394 pages. ISBN 3-7643-6693-1, price EUR 82.24.

This book provides well arranged accounts of theory and applications of the relativistic Boltzmann equation. The book is written in a self-contained manner and is thus accessible even for those readers who are not experienced in special and general theory of relativity. The book contains several chapters covering basics of special and general relativity, differential geometry and relativistic kinetic theory, but its focus is in applications of the relativistic Boltzmann equation which are discussed in detail with emphasis on explicit calculations. The book may be used as a textbook for an adavanced course as well as a reference book for physicists and mathematicians interested in the relativistic Boltzmann equation.

Vojtěch Pravda

G. A. Losa, D. Merlini, T. F. Nonnenmacher, and E. R. Weibel (eds.): FRACTALS IN BIOLOGY AND MEDICINE, VOL. III. Mathematics and Biosciences in Interaction. Birkhäuser-Verlag, Boston-Basel-Berlin, 2002, x+362 pages, 141 Fig's. ISBN 3-7643-6472-2, price EUR 91.59.

Third International Symposium on "Fractal 2000 in Biology and Medicine" was held in Ascona, Switzerland, in March 2000. The book contains 33 presented contributions grouped according to their topic in four sections entitled Design of Biological Structures and Functions, Fractal Structures in Tumours and Diseases, Organization and evolution of living Systems and, finally, Modelling.

In the last paper on rather non-standard topic "Fractals in Architecture" the author quotes an opinion of Galileo stating that the universe cannot be understood without mathematical objects like triangles, circles and other geometric figures; "without these, one is wandering about in a dark labyrinth." The present book can be considered a vast and detailed antithesis to this assertion. The inability of Euclidean geometry combined with the linear time scale to reflect correctly biological structures and their development is mentioned in many papers included in the book. The most important reasons of the extreme complexity of natural structures are growth and branching rules, interaction of their components, non-linearity of their development dynamics etc. Another feature neglected until now is the formation of self-organized structures of higher order, such as cords, bundles, plaques or glands. The complicated structure is sometimes a consequence of the basic biological functions; e.g. the mammalian oxygen transport proceeds through more than 20 generations of airways terminated by highly packed alveoli. It should be stressed that the quantitative description of biological structures is extremely important not only in order to understand their functions but also for diagnostic and prognostic; many pathological processes are announced in their early stages by distinct structural changes in living tissues.

Fractal geometry offers such new and suitable concepts and methods that it can be called "the design principle in biology". It introduces attractive properties like self-similarity, scaling, lacunarity and characteristics of which the fractal dimension—"representing the space-filling capacity of biological structures"—is the most important. Its estimation is the topic of the majority of contributions covering e.g. human airway tree, patterns in organogenesis and carcinogenesis, studies of breast cancer, analyses of bone architecture, bone loss and marrow tissue etc. Because of its origins in signal analysis, fractal geometry is also convenient for quantitative ECG and EEG evaluation and to the analysis of human voice and voice diseases. Some other related methods like random walk and neural networks also occur in some contributions.

The book presents an interesting overview of contemporary trends in the structural description of biological objects and can be of interest to students and researchers in mathematical biology.

However, after going through all the papers, a suspicion arises in the reader's mind: can it be really so simple? Can a rather clear theory with its simple limiting formulae and one universal characteristic—the fractal dimension—be so successful in the description of complex natural phenomena? Fractal geometry in its present form, is it not only a starting step to a much more advanced approach? The contribution entitled "The Universal Dynamic Complexity as Extended Fractality" (written by A. P. Kirilyuk) offers beside a criticism of the recent oversimplified "canonical" fractal geometry also some proposals for its far reaching generalization.

Ivan Saxl

S. Klainerman, F. Nicolo: THE EVOLUTION PROBLEM IN GENERAL RELATIVITY. Progress in Mathematical Physics, Vol. 25. Birkhuser-Verlag, Boston, 2003, 387 pages. ISBN 0-8176-4254-4, price EUR 107.00.

In the Preface, the authors state that "The main goal of this work is to revisit the proof of the global stability of Minkowski space by D. Christodoulou and S. Klainerman". The preceding book (D. Christodoulou and S. Klainerman, The global nonlinear stability of the Minkowski space, Princeton Mathematical Series, 41, 1993) contained a very important result but it was well known in the relativity community that it was very difficult to follow the proof. In this book the authors present a new significantly different proof of the main part of that result which is now based on a double null foliation of a spacetime which is more appropriate to the radiation features of Einstein's field equations and consequently leads to substantial simplifications.

In Chapter 1 the authors summarize the basic concepts of differential geometry. Chapters 2 to 7 are dedicated to the statement and proof of the main theorem. In the final Chapter 8 important consequences of the theorem (e.g. simple derivation of the connection between the Bondi mass and the ADM mass of an asymptotically flat spacetime) are presented.

Important results in this book are presented in a more "digestible" form that in the preceding book and thus scientists and graduate students working in relativity are recommended to read at least the introduction and the conclusions.

Vojtěch Pravda

P. Grabner, W. Woess (eds.): FRACTALS IN GRAZ 2001. ANALYSIS—DYNAMICS—GEOMETRY—STOCHASTICS. Trends in Mathematics. Birkhäuser-Verlag, Basel, 2003, vii+283 pages. ISBN 3-7643-7006-8, price EUR 92,–.

Not so long ago, most mathematicians used to meet fractals only in a form of charming pictures, which resulted from computer simulations. The situation has changed dramatically and nowadays a rigorous study of fractal structures turned into a well-established field of research, intertwined with measure theory, harmonic analysis, probability theory and many other branches of mathematics. This is testified also by the book under review, which contains the proceeding of a conference held in June 2001 at Graz University of Technology. It comprises twelve papers that, according to Preface, were written upon an explicit invitation of the editors and underwent a refereeing process. Most of the papers are surveys, some of them providing mainly an overview of their authors' recent results, while others are intended more as topic reviews. Choosing randomly, we would like to mention e.g. a

survey by L. Bartholdi, R. Grigorchuk and V. Nekrashevych, almost a hundred pages long, aimed at presenting ideas, notions and results connected to self-similarity of groups, semigroups and their actions; or T. Coulhon and A. Grigor'yan's paper on pointwise estimates for transition probabilities of random walks on infinite graphs.

To conclude, the book is warmly recommended to everybody interested in "fractals-related" mathematical problems.

Ivo Vrkoč

O. Hernández-Lerma, J. B. Lasserre: MARKOV CHAINS AND INVARIANT PROBABILITIES. Birkhäuser-Verlag, Basel, 2003, 205 pages, hardcover. ISBN 3-7643-7000-9, price EUR 58,–.

The book is about discrete time-homogeneous Markov chains with an invariant probability measure, and their ergodic behavior. Namely, various types of convergence of expected and pathwise occupation measures and ergodic decompositions of the state space are presented. An important example, for instance, is a dynamical system $(\xi_n)_n$ which satisfies an equation $\xi_{n+1} = F(\xi_n, \psi_n)$, $n \geqslant 0$ for some function F and a sequence of independent identically distributed random variables $(\psi_n)_n$ independent of the initial state ξ_0, such that the law of ξ_n coincides with the law of ξ_{n+1} for every $n \geqslant 0$.

The book is divided into three thematical parts: Markov Chains and Ergodicity (chapters 1 to 6), Further Ergodicity Properties (chapters 7 to 9), and Existence and Approximation of Invariant Probability Measures (chapters 10 to 12).

The first chapter concerns measure-theoretical and topological prerequisities such as different types of weak topologies and convergences of measures. Chapter 2 contains basic definitions, examples of Markov chains and various ergodic theorems such as the Chacon-Ornstein, Birkhoff, mean ergodic, dual ergodic, pathwise ergodic and Hopf's decomposition theorems. Chapter 3 concerns discrete Markov chains with countable state space, classification of states and limit theorems. Chapter 4 is devoted to Harris Markov chains which are an uncountable state space analogue of a recurrent countable state space Markov chain. The notion of the positive Harris recurrence is defined and characterized via the n-step transition probabilities or their averages (expected occupation measures). Furthermore, sufficient conditions for the Markov chain to be positive Harris recurrent are given, and Hopf's and Doeblin's decompositions of the state space are introduced. Chapter 5 deals with the identification of the limit function in the ergodic theorems from Chapter 2 for Markov chains in locally compact separable metric spaces. Chapter 6 is about classification of Markov chains via occupation measures rather than via the classical notions of transience and recurrence.

In Part 2, Chapter 7, weak, strong and quasi Feller Markov chains are studied. In particular, sufficient conditions for a weak Feller Markov chain to have an invariant probability measure, and relation between positively Harris recurrent and strong Feller Markov chains are given. Chapter 8 concerns necessary and sufficient conditions for the existence of solutions for the probabilistic multichain Poisson equation $g = Pg$ and $g + h - Ph = f$ where f is a given "charge" function and P is a transition probability function. The existence conditions are derived via different approaches such as canonical pairs, Cesàro averages, and resolvents. In Chapter 9, different types of ergodicity for Markov chains, such as strong, uniform, weak or weak uniform ergodicity, are studied, compared and related to the concept of stability of a transition kernel and to the solvability of the Poisson equation.

In Part 3, Chapters 10 and 11 deal with necessary and sufficient conditions for a Markov chain to have (a unique) invariant measure having, possibly, a density with respect to the Lebesgue measure, using tools of functional analysis, and viewing the transition probability

measure as a Markov operator on the space of measures. Chapter 12 concerns two numerical approximation schemes for invariant probability measures based on an infinite dimensional programming approach and on a moment approach.

Concerning the structure of the book, known theorems are stated without proofs, yet with sufficient references to the literature, and proofs of recent results are gathered at the end of the chapters so that the reader can easily follow the stream of the results. On the other hand, many abbreviations for frequently used expressions complicate the first time reading.

The book combines an overview of known results with many results published in a book form for the first time, and is intended for graduate students and researchers in theoretical and applied probability, operations research, engineering and economics.

Martin Ondreját

M. Iannelli, G. Lumer (eds): EVOLUTION EQUATIONS: APPLICATIONS TO PHYSICS, INDUSTRY, LIFE SCIENCES AND ECONOMICS. Progress in Nonlinear Differential Equations and Their Applications, Vol. 55. Birkhäuser-Verlag, Basel-Boston-Berlin, 2003, viii+423 pages, hardcover. ISBN 3-7643-0374-3, price EUR 124.–.

The volume under review is based on the material presented at the conference held in Levico Terme (Trento, Italy), 2000. The contributions, submitted up to the fall of 2002, contain also many results obtained after the conference by continuing research. In addition, some up to date surveys are incorporated. The interaction of established scientists and young promising researches as well as of pure and applied scientists was emphasized.

New developments in areas covered by the participants include, among others, moving boundary problems, asymptotics of solutions, maximal regularity, Poincaré inequality on stratified sets, stochastic aspects in Hamilton-Jacobi-Bellman equation, Ornstein-Uhlenbeck operators, quasilinear PDEs with memory operators, semigroup approach in economics and other problems, convolution-evolution equations in aeroelasticity, and age-structured models.

Hana Petzeltová

U. Çapar, A. S. Üstünel (eds.): STOCHASTIC ANALYSIS AND RELATED TOPICS VIII. Silivri Workshop in Gazimagusa (North Cyprus), September 2000. Progress in Probability, Vol. 53. Birkhäuser-Verlag, Basel, 2003, 205 pages, hardcover. ISBN 3-7643-6998-1, price EUR 92.–.

The proceedings contain ten papers of 20–30 pages on stochastic control and game theory, metrics for tangent processes on the path space, approximations for stochastic semilinear evolution equations, controllability and observability of linear stochastic systems in Hilbert spaces, computations of spectral densities for Langevin dynamics, quasi-invariance for Lévy processes under anticipating shifts, behavior of the density for jump processes with singular Lévy measures, Gaussian correlation conjecture, and one digest paper on stochastics in Colombeau related algebras.

Researchers in stochastic analysis, stochastic control and systems theory, SPDE, stochastic geometry, game theory, and theoretical biology may be interested in the present book.

Martin Ondreját