Book reviews

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BOOK REVIEWS

Jean-Yves Béziau: LOGICA UNIVERSALIS—TOWARDS A GENERAL THEORY OF LOGIC. Birkhäuser, Basel, 2005, 228 pages, EUR 48.–.

Universal Logic is a term used by some authors (and notably by the editor of the current volume) for a particular area of logic. The researchers in this area try to formulate a formal framework for logic so universal that it would serve as a common framework for the variety of "logics" that model many various and disparate situations in reasoning, inspired often by problems in theoretical computer science (but also in philosophy and in mathematics). The name should suggest an analogy with universal algebra, and indeed many authors try to prove general results that would apply well to all logics, similarly as some results and constructions in universal algebra apply to categories of particular algebraic objects.

The proposed frameworks range from more familiar ones as proof theoretic calculi, closure operations related to consequence relation, Kripke structures or logical matrices, to more recent concepts as labelled deductive systems or abstract formulations of model theory, involving concepts of category theory (and algebra and topology).

The volume under review gives a good account of recent activity in the area. It is divided naturally into three parts. The first part collects five articles with different proposals for the universal framework. The three papers in the second part tackle the problem of identifying logical systems that are, despite being formulated differently, identical in "some" sense. The last part, containing also three papers, deals with particular constructions used in studying various logics.

It appears to this reviewer that a fourth part could have been interesting too, especially for outsiders; a part which would prove the usefulness of universal logic by giving solutions to problems that have been here before the universal logic came to the existence. This is a good and established test of a genuine contribution.

Jan Krajíček, Praha

Giuseppe Da Prato: KOLMOGOROV EQUATIONS FOR STOCHASTIC PDES. Advanced Courses in Mathematics, CRM Barcelona, Birkhäuser, Basel, 2004, softcover, ISBN 3-7643-7216-8, 189 pages, CHF 52.–/EUR 32.–.

Kolmogorov equations are second order parabolic or elliptic differential equations of finite or infinite number of variables. One way to approach such equations is to study Markov semigroups and their infinitesimal generators that are related to mild solutions of stochastic partial differential equations on Hilbert spaces. The cornerstone of this approach is the observation that the Kolmogorov differential operator and the infinitesimal generator of a Markov semigroup coincide.

The present book is conceived as a basis for a one year PhD course both in mathematics and physics, on relations between Kolmogorov equations and Markov semigroups of solutions to SPDEs. The reader gets acquainted with particular examples of SPDEs driven by cylindrical Wiener processes, existence, uniqueness and regularity of their solutions, the construction of the associated Markov semigroup, conditions yielding existence and uniqueness of invariant measures, and other notions of the Markov semigroup theory such as (strong) Feller property, irreducibility, hypercontractivity or Poincaré and log-Sobolev inequality.

The book is systematic and well organized. The core of all problems is presented first for linear SPDEs with an additive noise where the essence is notably transparent. Then, all results are proven for particular non-linear SPDEs (with Lipschitz coefficients, reaction-diffusion equations, Burgers equation and 2D Navier-Stokes equation).

Especially students and those who wish to find an elementary and self-contained introduction to the theory of Markov semigroups stemming from SPDEs will certainly find interest in this book.

Martin Ondreját, Praha

Angelo Guerraggio, Pietro Nastasi: ITALIAN MATHEMATICS BETWEEN THE TWO WORLD WARS. Birkhäuser, Basel, 2005, EUR 94.–.

Although the volume's main topic concerns the development of Italian mathematics between the two World Wars, the authors start with a brief recapitulation of the situation at the turn of the 19th and 20th centuries. This period was the golden age of Italian mathematics—after France and Germany, Italy was the third "mathematical power" in the world. The achievements of Italians in the fields of algebraic geometry, analysis and mathematical physics exerted a great influence.

The story of Italian inter-war mathematics, with some simplification, centers around six personalities. *Vito Volterra*, an undisputed leader of Italian mathematics during the first quarter of the 20th century, was interested mainly in analysis and mathematical physics; he contributed to the birth of functional analysis and mathematical biology. Volterra was elected senator in 1905, he also presided the Accademia dei Lincei and was the first chairman of Consiglio Nazionale delle Ricerche in the 1920's. *Federico Enriques* won fame for his researches in algebraic and differential geometry. An educated intellectual with aristocratic attitude, who would not demean himself to take part in politics, was also interested in the history of mathematics, its foundations and in the philosophy of science; he presided the Italian Philosophical Society in the period 1907–1913. *Tullio Levi-Civita* made an outstanding contribution to mathematical physics. He extended the theory of Ricci-Curbastro and laid the foundations of tensor calculus, which became the mathematical language of Einstein's gravitational theory. He also wrote important works on hydrodynamics and the n-body problem. Levi-Civita was a pacifist with socialist ideas, but did not involve himself in politics. *Francesco Severi* produced excellent results in algebraic geometry and devoted himself also to analysis. In the fascist period, Severi was the only mathematician being nominated to the new Accademia d'Italia. Although he originally held socialist ideas, he gradually began to sympathize with the fascist regime. The ambitious Severi was the one who eventually replaced Volterra in the lead of Italian mathematics. *Leonida Tonelli* was a first-rate expert in real analysis and one of the founders of modern calculus of variations. In 1930 he accepted the chair of director of Scuola Normale Superiore di Pisa, the second centre of Italian mathematical research after Rome. Originally a socialist and antifascist, but to dispel the insinuation of being anti-Italian Tonelli asked for a fascist membership card. *Mauro Picone* devoted himself to analysis, especially to constructive methods, approximate solutions and applications of mathematics. He directed the Instituto Nazionale per le applicazioni del Calcolo which cooperated with engineers and army on solving practical problems.

In 1931 the fascists imposed an oath on all professors, who had to swear loyalty to the king as well as to the fascist regime. Volterra, after refusing to take the oath, was dismissed from the university and the vacant chair was given to Picone who, in the meanwhile, became member of the fascist party. Also Levi-Civita protested against the oath, but finally decided to swear and prevent the "new barbarians" from taking his place.

The international isolation of Italy begins in 1935, when the League of Nations imposed economic sanctions as the response to Italian invasion in Ethiopia. Italy left the organization and strengthened the cooperation with the Nazi Germany. The government did not allow Italian mathematicians to take part in the 1936 International Congress of Mathematicians in Norway (which belonged to the sanctionisto countries) despite the fact that Severi had to chair the committee that would award the first Fields medals.

After enacting the racial laws in 1938, all people of Jewish descent had to leave universities, schools and other academic and cultural institutions. The mathematicians who were expelled from their posts included Levi-Civita, Enriques, Segre and Fubini (Volterra was Jewish, too). Levi-Civita was also forced to leave the editorial board of Zentralblatt für Mathematik.

The golden age of Italian mathematics was over. The Italians still produced important contributions, but it showed too difficult to maintain the high standard achieved at the beginning of the century. As the authors Gueraggio and Nastasi remark, Italian mathematics suffered from a certain provincialism, lack of interest in new disciplines such as modern algebra, topology and functional analysis, which proved to be very fruitful and were extensively studied in other countries.

Antonín Slavík, Praha

Anthony W. Knapp: BASIC REAL ANALYSIS. Cornerstones, Birkhäuser, Basel, 2005, xxi + 653 pages, EUR 58.00/CHF 92.00.

The present book is an introduction to the calculus.

The content of the volume is shortly characterized by the following account of its chapters. Chapter I *Theory of calculus in one real variable*, Chapter II *Metric spaces*, Chapter III *Theory of calculus in several real variables*, Chapter IV *Theory of ordinary differential equations and systems*, Chapter V *Lebesgue measure and abstract measure theory*, Chapter VI *Measure theory for Euclidean space*, Chapter VII *Differentiation of Lebesgue integrals on the line*, Chapter IX L^p *spaces*, Chapter X *Topological spaces*, Chapter XI *Integration on locally compact spaces*, Chapter XII *Hilbert and Banach spaces*.

The Appendix at the end of the volume contains the following: sets and functions, mean value theorem and some consequences, inverse function theorem in one variable, complex numbers, classical Schwarz inequality, equivalence relations, linear transformations, matrices and determinants, factorization and roots of polynomials, partial orderings and Zorn's lemma, cardinality.

This volume is useful and interesting for all who deal with analysis and its applications. The book can be warmly recommended to students and lecturers. There is a second part of this course of analysis with the title *Advanced real analysis* and both this two volumes of A. W. Knapp form a nice and good "cornerstone" of analysis.

Štefan Schwabik, Praha

Anthony W. Knapp: ADVANCED REAL ANALYSIS. Cornerstones, Birkhäuser, Basel, 2005, xxii + 465 pages, EUR 48.00/CHF 78.00.

This book accompanies the volume *Basic Real Analysis* of the same author.

The content of the book is given by the following list of topics.

Chapter I *Introduction to boundary-value problems*, Chapter II *Compact self-adjoint operators*, Chapter III *Topics in Euclidean Fourier analysis*, Chapter IV *Topics in functional analysis*, deals with basic results usually united under the name *Functional Analysis*, Chapter V *Distributions*, Chapter VI *Compact and locally compact groups*, Chapter VII *Aspects*

of partial differential equations, Chapter VIII *Analysis on manifolds* and Chapter IX *Foundations of probability.*

The volume contains many parts of pure mathematics, as well as applied mathematics, including statistics, mathematical physics and differential equations. Together with the first part mentioned above, this work can be useful for any mathematical library and can be recommended to students and lecturers.

Štefan Schwabik, Praha

Herbert Amann, Joachim Escher: ANALYSIS II. Grundstudium Mathematik (2nd corrected ed.), Birkhäuser, 2006, xii + 415 pages, EUR 28.00/SFR 42.00.

This is a slightly corrected new edition of the second volume of a nicely presented three volume treatise on classical analysis.

This volume contains the integral calculus of functions of one variable (Chap. VI) starting with the concept of the integral of a simple step-function and continuing directly and shortly to the Riemann integral and its properties. Special attention is paid to the study of Bernoulli polynomials, Euler's summation formula, classical Fourier series and to the Gamma and Beta functions of L. Euler.

In the second part (Chap. VII) the differential calculus for functions of more variables is dealt with. Without any difficulties the basic knowledge can be essentially translated to Banach space-valued functions defined on some Banach space. Basic things on the calculus of variations are included in a short, exact and comprehensible form with all the necessary mathematical rigor.

The third part (Chap. VIII) is devoted to curvilinear integration together with a nice excursion to the elements of holomorphic functions and especially to meromorphic functions.

Coming back to the whole work of Amann and Escher one thing can be said again. The three volume textbook presents a contemporary approach to the elements of calculus with a lot of examples, problems, etc. The book can be used by any teacher directly or it can be a guide how to teach effectively in a completely correct way having in mind the needs of advanced lectures in mathematics, too.

Štefan Schwabik, Praha

D. H. Mache, J. Szabados, M. G. de Bruin (eds.): TRENDS AND APPLICATIONS IN CONSTRUCTIVE APPROXIMATION. International Series in Numerical Mathematics, Vol. 151, Birkhäuser, Basel, 2005, 281 pages, ISBN 3-7643-7124-2, EUR 118.–.

The book contains the contributions presented at the 4th IBoMAT meeting held in Witten-Bommerholz (Germany) in 2004. The topic of the meeting was constructive approximation, in particular, multivariate approximation methods, approximation by orthogonal polynomials, special functions, quasi-interpolation and interpolation, neuro fuzzy methods, RBF networks, and industrial and engineering applications.

The area of constructive approximation comprises the computational and approximation-theoretical aspects of various interesting fields in applied analysis. The book presents 20 contributions from the whole range of constructive approximation and its applications, from orthogonal polynomials to fuzzy control theory.

The papers accent the applications to a wide variety of problems in various areas. Moreover, a lot of illustrative examples, tables, and figures from the mathematical, physical, and engineering context are contained in the contributions. There is no doubt that the book will be very useful for a large audience with diverse background and interests.

The text is also accompanied by several photographs from the 4th IBoMAT meeting.

Karel Segeth, Praha