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Book reviews

The Best Writing on Mathematics 2014, Edited by Mircea Pitici, Princeton University Press 2014, 376 pp., ISBN: 9780691164175, ISBN: 9781400865307 (eBook).

Mircea Pitici does, in the foreword of his book, a very good characterization of the relationship between mathematics and "everything". "When we talk about mathematics, or when we teach it, or when we write about it, many of us feign detachment. It is almost a cultural universal to pretend that mathematics is "out there," independent of our whims and oddities. But doing mathematics and taking or writing about it are activities neither neutral nor innocent; we can only do them if we are engaged, and the engagement marks not only us (as thinkers and experimenters) but also those who watch us, listen to us, and think with us. Thus mathematics always requires full participation; without genuine involvement, there is no mathematics". This may actually serve as the mission statement of any honest mathematician. Since Middle Ages, Mathematics has been thought as the fabric of this world, and the fundamental mathematical principles have been accepted as the principles all the living beings naturally obey. An accurate understanding of mathematics is essential for the educated person in order to be able to start asking questions and getting answers about the environment.

This volume, the fifth in a series edited by M. Pitici and published with PUP (2010, 2011, 2012, 2013), is a work of this fundamental nature. This is a collection of 20 previously published essays introducing to the general audience various topics of mathematics through applications and applicative and experimental fields of science.

A simple coverage of the titles show quite a nice variety of concerns:

The Prospects for Mathematics in a Multimedia Civilization (Philip J. Davies); *Fearful Symmetry* (Ian Stewart); *E pluribus unum: From Complexity, Universality* (Terence Tao); *Degrees of Separation* (Gregory Goth); *Randomness* (Charles Seife); *Randomness in Music* (Donald E. Knuth); *Playing the Odds* (Soren Johnson), *Machines of the Infinite* (John Pavlus); *Bridges, String Art, and Bezier Curves* (Renan Gross); *Slicing a Cone for Art and Science* (Daniel S. Silver); *High Fashion Meets Higher Mathematics* (Kelly Delp); *The Jordan Curve Theorem is Nontrivial* (Fionna Ross and William T. Ross); *Why Mathematics? What Mathematics*? (Anna Sfard); *Math Anxiety: Who Has It, Why It Helps, and How to Guard against It*; (Erin A. Maloney and Sian L. Beilock); *How Old Are the Platonic Solids*? (David R. Lloyd); *Early Modern Mathematical Instruments* (Jim Bennett); *A Revolution in Mathematics? What Really Happened a Century Ago and Why It Matters Today* (Frank Quinn);

Errors of Probability in Historical Context (Prakash Gorroochurn); *The End of Probability* (Ellie Ayache); *An abc Proof Too Tough Even for Mathematicians* (Kevin Hartnett).

This volume is compulsory reading for any person involved with, or interested in mathematics and its positioning in the nature as we know it.

Horia F. Pop

Hongyu Guo , Modern Mathematics and Applications in Computer Graphics and Vison, World Scientific, London-Singapore-Hong Kong 2014, xxiii + 408 pp, ISBN: 978-981-4449-32-8.

In contrast to many areas of Computer Science where discrete mathematics is mostly applied, computer graphics and vision utilize many domains of continuous mathematics. Unfortunately, many students in this area lack a sufficient knowledge of the needed results from this part of mathematics and the reading of books dedicated to specified topics is discouraging. The intention of the author of the present book is to supply them with an easy to handle and understand record of some results in these abstract areas of mathematics.

In order to make the book easy to read the author omitted all the proofs. This does not mean that, at the same time, the rigor is sacrificed – the book contains rigorous definitions (put in boxes with headings) and the formal enounces of theorems (highlighted with gray shades). Instead presenting the proofs, the author prefers to carefully explain and motivate the notions and the results with emphasis on the intuition, with many examples and historical and philosophical insights.

The book has four parts: I. Algebra; II. Geometry; III. Topology and more; IV. Applications. A preliminary chapter, Chapter 0, *Mathematical structures*, contains an essay on mathematics in historical perspective, its role in society, the relations between mathematics and reality (are the mathematical results reflecting some real things or a creation of the human mind).

The first part deals with linear algebra, tensor algebra, exterior algebra and geometric algebra. The part on geometry is concerned with projective geometry, differential geometry and elements of non-Euclidean geometry. The third part includes general topology, manifolds, Hilbert spaces and elements of measure theory and probability theory. In the last part of the book, based in part on some articles by the author, one shows how the elaborated machinery can be put to solve problems in computer vision and computer graphics and includes: color spaces, perspective analysis of images, quaternions and 3-D rotations, manifold learning in machine learning. Written in a pleasant and alive style, with suggestive quotations and witty comments of the author (also many photos illustrating the text are made by the author), the book will be of great help for students in computer science specializing in computer vision and computer graphics. Other students who use mathematics in their disciplines (physics, chemistry, biology, economics) will find the book as a good source of rapid and reliable information.

Dana Cobzaş

H. Scott Dumas, THE KAM STORY – A Friendly Introduction to the Content, History, and Significance of Classical Kolmogorov-Arnold-Moser Theory, World Scientific, London-Singapore-Hong Kong 2014, xv + 361 pp, ISBN: 978-981-4556-58-3.

The book tells the story of the discovery of the Kolmogorov-Arnold-Moser theory (KAM in short) as well as of the results and controversies preceding it. The story starts in 1954 at the International Congress of Mathematicians when A. N. Kolmogorvov presented an astonishing result with a sketch of the proof. The details, with completions and extensions, were supplied by Kolmogorov's student Vladimir Arnold and by the German-American-Suisse mathematician Jürgen Moser (Kolmogorov considered the analytic case while Moser treated the smooth one, with order of smoothness 333, currently reduced at 3). The theory has its origin in the paper published in 1890 by H. Poincaré in Acta Mathematica (a whole volume of 270 pages) who received for it the prize offered by Oscar II, King of Norway and Sweden, the results being then expanded in his three volume book *Les méthodes nouvelles de la mécanique céleste*, Paris, 1892, 1893 and 1899. This was turning point in the development of mathematics and mechanics that led also to a new domain - dynamical systems and chaos. As the jury heaps praise on the paper "it will change the course of astronomical dynamics for ever" - and it did indeed, even much more. Roughly speaking, Kolmogorov proved the existence of invariant tori of perturbed Hamiltonian systems of the form $H(\theta, I, \varepsilon) = h(I) + \varepsilon f(\theta, I, \varepsilon)$, where (θ, I) are the action-angles variables and $h(I)$ is a smooth (or even analytic) completely integrable Hamiltonian system. The problem is related to the n-body problem, the stability of the solar system and Boltzman ergodic hypothesis (invalidated by this theory), and in this extended form its origins can be traced back to Kepler, Newton, Lagrange, Hamilton, and others.

The book presents in an informal way the basics of classical KAM theory in a broader context, with emphasis on the evolution of ideas in historical perspective. Subsequent developments are discussed in Chapter 6, *Other results in Hamiltonian Perturbation Theory* (HPT) (the work of Chirikov and Nekhoroshev), and physical applications in Chapter 7. The author appeals as possible to original sources, correcting errors in attributing some results. Besides the mathematical problems the author discusses some general questions as the Russian, European and American ways of doing mathematics (a long time in mutual isolation, leading to some priority discussions) as well as some philosophical aspects - "the last laugh of Hegel". There are a lot of footnotes which make part of the text, completing it with comments of the author or from persons involved in these events. The main body of the book is completed by 6 very useful appendices: A. *Kolmogorov's 1954 paper*; B. *Overview of low-dimensional small divisors problem*; C. *East meets West–Russians, Europeans, Americans*; D. *Guide for further reading*; E. *Selected quotations*, and F. *Glossary* (80 pages, explaining the main notions used in the text–a welcome addition). Written in a live and accessible style, the book is addressed to a large audience, first of all to mathematicians and physicists of various specialties, as it does not require a background in dynamical systems. Some part of it can be read with benefit and enchantment by anybody interested in the evolution of scientific ideas.

Paul Blaga

Qamrul Hasan Ansari (Editor), Nonlinear Analysis–Approximation Theory, Optimization and Applications, Springer India, New Delhi, Heidelberg, 2014, xv + 352 pp, ISBN 978-81-322-1882-1; ISBN 978-81-322-1883-8 (eBook).

This is a collection of survey papers on some topics in nonlinear functional analysis–best approximation, optimization, fixed point theory, monotone operators and variational inequalities, equilibrium problems. The papers included in this volume emphasize the tight connections existing between these domains and show how results and methods from one area help to solve problems in another ones.

The papers on best approximation concern various continuity properties of the metric projection in Banach spaces (P. Veeramani and S. Rajesh), the use of various kinds of convergence of slices in the study of the geometry of Banach spaces in connection with applications to best approximation (P. Shunmugaraj). Two papers, *Best proximity points* (P. Veeramani and S. Rajesh) and *Best approximation in nonlinear functional analysis* (S. P. Singh and M. R. Singh), wheels around the famous result of Ky Fan on the existence of best proximity points and its relevance for various questions in fixed point theory, optimization and variational inequalities. The paper by J. Banaś, *Measures of noncompactness and well-posed minimization problems,* shows how some geometric properties of Banach spaces, as nearly strict convexity, nearly uniform convexity, nearly uniform smoothness, defined through various measures of noncompactness can be used to prove the well-posedness of some generalized minimization problems. Well posedness is also the subject of the paper by D. V. Pai, *Well-posedness, regularization, and viscosity solutions of minimization problems.* Iterative methods for finding fixed points and zeros of monotone operators, and for solving variational inequalities are presented in the papers *Hierarchical minimization problems and applications* (D. R. Sahu and Q. H. Ansari), *Triple hierarchical variational inequalities* (Q. H. Ansari, L.-C. Ceng and H. Gupta) and *Split feasibility and fixed point problems* (Q. H. Ansari and A. Rehan). Isotone projection cones in Hilbert spaces with applications to complementarity problems are discussed in the paper by M. Abbas and S. Z. Németh, *Isotone projection cones and nonlinear complementarity problems.*

Containing well written survey papers by renown experts, the volume will provide researchers in nonlinear analysis and related domains to a quick introduction and, at the same time, with a state-of-the-art in several very active area of current investigation.

S. Cobzaş