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Book Reviews

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BOOK REVIEWS

M. Chipot: l GOES TO PLUS INFINITY. Birkhäuser Advanced Texts. Birkhäuser-Verlag, Basel-Berlin-Boston, 2001, 192 pages, hardcover. ISBN 3-7643-6646-X, price EUR 52.–.

Many physical problems are considered in a cylindrical domain. When the size of the cylinder goes to infinity, the solutions, under some symmetry condition, are expected to be the same in all sections of the cylinder. The book starts with an introduction to linear elliptic problems. The Dirichlet, Neumann and mixed problems are introduced. In the second chapter the author concentrates on the ideas driving the rest of the book. Chapter 3 develops a general asymptotic theory for the linear elliptic equations. In the next chapter some nonlinear problems are introduced from the point of view of existence and uniqueness. Chapter 5 is devoted to the question of the asymptotic behavior of the nonlinear problems. In Chapters 6 and 7 the elliptic systems and the asymptotic behavior are studied. The last two chapters contain the parabolic problems—existence, uniqueness and asymptotic theory of them. Many results presented here are original and have not been published elsewhere. They will motivate and enable the reader to apply the theory to other problems in partial differential equations. This graduate textbook accompanies the reader starting from the basics of the theory of elliptic problems to recent researcher topics concerning asymptotic theory in cylindrical domains where many physical problems are settled. It is a valuable resource for graduates and researchers in applied mathematics and for engineers.

Šárka Nečasová

H. Wussing: DIE GROSSE ERNEUERUNG. Birkhäuser-Verlag, Basel-Berlin-Boston, 2002, x + 224 pages, 53 Fig's. ISBN 3-7643-6698-2, price EUR 48.–.

Under the title borrowed from Francis Bacon, the scientific restoration is featured covering the time span of about 180 years—from the middle of the XVIth to the beginning of the XVIIIth centuries. Only four generations of scientists were able to turn over nearly completely the way of thinking concerning the Universe as well as the terrestrial Nature. At the outbreak of the changes—in the year of 1543—there appeared, symbolically, two books: *De revolutionibus* by Copernicus and *De humanis corporis fabrica* by Andreas Veselius, an illustrated work on human anatomy based on dissections and overthrowing many obsolete ideas in medicine. 184 years later, the state funeral of Isaac Newton in Westminster Abbey in 1727 takes place in a completely different social and scientific atmosphere; the breakthrough is already accomplished.

The attention of the author is naturally focused on the leading personalities responsible for the revolution in thinking, methods and approaches. Some of them influenced several scientific disciplines: Galileo Galilei, Descartes, Kepler, Hooke, Leibniz and Newton. Their rather detailed biographies with many citations from their works form the skeleton of the book. Further, the discoveries of scientists active in the development of astronomy (Copernicus, Brahe, Halley), philosophy (Bacon), mathematics (Cardano, Viète, Fermat, Pascal, Bernoulli's family), physics including optics (Ch. Huyghens), chemistry (Boyle) and biology (Veselius, Harvey) are described.

The origins of the scientific organization are shortly sketched, namely the foundations of scientific societies (Gresham College later changed into the Royal Society, Academia dei

Lincei, Académie Royale des Sciences, St. Petersburg Academy of Sciences etc.) and the first scientific journals (Journal des Sçavans, Philosophical Transactions, both 1665). The book reminds us also of the inventions made in this period: binoculars, telescope and reflex telescope, microscope, barometer, vacuum pump, thermometer, pendulum clock, watch, first computers. Many beautiful historical images of inventions, and bindings and title pages of important publications are included. Interesting is also the chronological Table of important events closing the book. It considerably surpasses the described time period by three events and demonstrates that the rates of progress can be rather different. In 1822, the Inquisition declared as permissible the printing of works supporting the heliocentric system. In 1835, the works of Copernicus and Galilei were for the first time omitted from the list of prohibited books. In 1979, Galileo Galilei's name was cleared by the Pope.

The book will be appreciated by anyone interested in the history and progress of the mankind proceeding elsewhere than on the battlefields.

Ivan Saxl

A. N. Borodin, P. Salminen: HANDBOOK OF BROWNIAN MOTION—FACTS AND FORMULAE. Second edition. Birkhäuser-Verlag, Boston-Basel-Berlin, 2002, xvi + 672 pages. ISBN 3-7643-6705-9, price EUR 119.63.

The second revised and expanded version of this handbook appears only six years after the first edition which proves its success. The expansion is quite substantial: several chapters of the theoretical part are revised, new subchapters are added and the number of formulas included in the second part is nearly doubled. The number of pages has increased by about 200.

The book consists of two parts, the first of which overviews the properties of linear diffusion in general and then concentrates on Brownian motion and related phenomena. A particular attention is given to the theory of local time which proved its importance in many applications including economics and optimal control. The corresponding chapter entitled "Local time as a Markov process" has been deeply revised. In order to meet the applications in financial mathematics, a subchapter on geometric Brownian motion has been added. Also a new subsection on the Feynman-Kac formula appears in the section on "Differential systems associated to Brownian motion". All results are given without proofs but they are accompanied by all relevant references and frequently also by short historical remarks.

The substantial part of the volume (more than 500 pages) consists of "Tables of distributions of functionals of Brownian motion and related processes". The nine subsections composing the handbook part are as follows: Brownian motion, Brownian motion with drift, Reflecting Brownian motion, Bessel process of order ν, zero and 1/2, Ornstein-Uhlenbeck process and its radial version, and geometric (exponential) Brownian motion. The total number of formulas is nearly 3000.

Five appendices summarize basic notions and formulae associated with some diffusions, properties of special functions, the inverse Laplace transforms of selected functions, a list of important differential equations with solutions, and, finally, formulae for n-fold differentiation.

Already the first edition of the book was highly praised in various reviews. The second revised edition will certainly be welcome by researchers in probability, statistics and mathematical finances.

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M. Golubitsky and I. Stewart: THE SYMMETRY PERSPECTIVE. FROM EQUILIBRIUM TO CHAOS IN PHASE SPACE AND PHYSICAL SPACE. Birkhäuser-Verlag, Basel-Boston-Berlin, 2003, 344 pages, softcover. ISBN 3-7643-2171-7, price EUR 42.–.

The central topic of this book is the phenomenon of pattern formation in physical systems considered from a single point of view: symmetry. The theory of nonlinear dynamical systems is largely discussed mainly in terms of trajectories in abstract phase spaces. The role of symmetry as an important link between the abstract theory and the experimental observations is emphasized.

The main topics include:

1. Steady state bifurcations with many examples and generalizations to partial differential equations.
2. The theory of linear stability with emphasis on the steady tate bifurcations phenomena.
3. Time periodicity related to the spatio-temporal symmetry.
4. Hopf bifurcation and symmetry.
5. Steady state bifurcations in Euclidean equivariant systems with applications to the theory of liquid crystals.
6. Bifurcation from group orbits.
7. Hidden symmetry and genericity.
8. Heteroclinic orbits and the phenomenon of cycling chaos.
9. Symmetric chaos and its relation to turbulence phenomena.
10. Periodic solutions of symmetric Hamiltonian systems.

In each case, the dynamical behavior being studied is motivated through applications and physical examples. An extensive bibliography is provided.

Eduard Feireisl

P. Picco, J. San Martin (Eds.): FROM CLASSICAL TO MODERN PROBABILITY. CIMPA Summer School 2001. Progress in Probability, Vol. 54. Birkhäuser-Verlag, Basel, 2003, xvi+219 pages. ISBN 3-7643-2169-5, price EUR 88.–.

This book contains lecture notes for six courses read at the Cimpa Summer School: From Classical to Modern Probability, held at Temuco (Chile) in January 2001.

Let us list the included articles: Anna De Masi's course is devoted to Ising spin systems with Kac potentials, with a particular emphasis paid to phase transitions, Glauber dynamics and interface dynamics. First passage percolation is dealt with in the paper written by Harry Kesten. Claudio Landim's paper on central limit theorems for Markov processes is divided into three independent parts. In the first of them, a central limit theorem for additive functionals of a reversible ergodic Markov chain on a countable state space is proved via a reduction to a corresponding result for martingale differences. In the second one, related considerations are used to prove a central limit theorem for a tagged particle in the simple exclusion process. In the last part, smoothness of the diffusion coefficient is studied. These three papers (each approximately fifty pages long) are essentially self-contained and basically no preliminary knowledge of their topics is needed to follow them. Pierre Collet discusses in his article recent results on asymptotics of heat kernels in unbounded domains, the proofs of which are based on probabilistic representation of the heat kernels. The reader of this paper is presupposed to have some acquaintance with stochastic analysis. Claude Dellacherie, in his short article, presents some ideas concerning nonlinear Dirichlet problems and nonlinear integration. Finally, Isaac Meilijson explains in his mini course in a rather informal manner how some seemingly unrelated problems like stochastic orders, the

Skorokhod embedding, Azéma-Yor stopping times or look-back American put options are tied together.

To remind us that probability theory stemmed historically from studying games, the Editors open the book with a description of a Chilean dice game of Dudo.

The lecturers are leading specialists in probability theory and their articles make some current research topics available to wider audience. The volume under review is, therefore, of considerable interest for both researchers and graduate students.

Martin Ondreját

A. Guzman: DERIVATIVES AND INTEGRALS OF MULTIVARIABLE FUNCTIONS. Birkhäuser-Verlag, Boston, 2003. ISBN 0-8176-4274-9, prize EUR 49.–.

The book introduces the differential and integral calculus for multivariable functions. The reader is supposed to be familiar with properties of continuous functions, with the topology of Euclidean space and with the basic concepts of linear algebra.

In Chapter 1 the concept of the differentiability of a vector function is introduced. The connection with partial derivatives is discussed. The chain rule is given. Higher derivatives are defined. Chapter 2 is devoted to derivatives of scalar functions. The directional derivatives are defined. The mean value theorem is proved. The extreme values of functions are studied. Chapter 3 deals with derivatives of vector functions. The theorem on the derivative of the inverse function, the implicit function theorem and the theorem on the fixed point are presented here. The Riemann integral of multivariable functions is introduced in Chapter 4. Properties of the Riemann integral are studied in Chapter 5. The last chapter is devoted to vector integrals and vector-field theorems. Green's theorem, Stokes's theorem and the divergence theorem are stated here. Potential vector fields are studied here, too. Each chapter is accompanied by exercises.

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