

New books on physics and related sciences

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Klyatskin V I *Stochastic Equations in the Eyes of the Physicist (Basic Principles, Exact Results, and Asymptotic Approximations)* (Moscow: Fizmatlit, 2001) 528 pp. ISBN 5-9221-0186-2. RFBR project 01-05-78005.

Based on the functional approach, the theory of stochastic equations (ordinary differential equations, partial differential equations, boundary value problems, and integral equations) is presented. The approach developed by the author provides an exact solution to stochastic problems for a number of fluctuating parameter models, including the telegraph process, generalized telegraph process, Markovian processes with a finite number of states, the Gaussian Markovian process, and the functions of these processes. The book also covers the asymptotic methods of analysis of stochastic dynamical systems, such as the delta-correlated random process (field) approximation and the diffusion approximation, and discusses the application of these methods to coherent phenomena in stochastic dynamical systems (the clusterization of particles and a passive impurity in a random velocity field, dynamical plane-wave localization in random layered media, formation of caustic wave field structures in multidimensional random media). The book is intended for research workers who specialize in the fields of hydrodynamics, acoustics, radiophysics, theoretical and mathematical physics, and applied mathematics, and whose work involves stochastic dynamical systems. It will also be of use to senior undergraduate and post-graduate students. The monograph was supported by RFBR projects Nos 99-05-64350, 00-15-98608, and 01-05-64042. ('Fiziko-Matematicheskaya Literatura' Publishing — MAIK Nauka/Interperiodika: 117864 Moscow V-485, Profsoyuznaya ul. 90; e-mail: compmg@maik.ru; <http://www.maik.rssi.ru>)

Gusev A I, Rempel' A A *Nonstoichiometry, Disorder and Order in a Solid* (Ekaterinburg: UrO RAN Publ., 2001) 580 pp. Bibliography: 1039 refs.

This monograph unique in the content, depth, capacity and fullness of the scope is a comprehensive treatment of problems relevant to disorder, order, and nonstoichiometry in solids. It is the first book to summarize extensive experimental material on such topics as the structure and properties of disordered and ordered phases in highly nonstoichiometric compounds, and the relation between the short- and long-range order in ordering alloys, solid solutions, and nonstoichiometric compounds. The symmetry analysis of disorder–order transformations, and the met-

hods and results of phase equilibrium calculations for nonstoichiometric systems are discussed in detail. This book provides an exhaustive explanation of how ordering effects influence the crystalline and electronic structure of highly nonstoichiometric compounds and their electrokinetic, magnetic, superconducting, thermodynamic, and mechanical properties. Various manifestations of nonstoichiometry, disorder, and order in solids are mainly illustrated by considering transition metal systems, namely their carbides, nitrides, oxides, solid solutions, and metal alloys, i.e. component-substituted systems. The monograph will be valuable to specialists in the theory of solid-state phase transitions, in solid-state physics and chemistry, and in materials science. (RAS Ural Branch Publ. regular mail address: 620219 Ekaterinburg, GSP-145, ul. Pervomaïskaya 91)

Potapov A A *Fractals in Radiophysics and Radar* Monograph (Moscow: Logos, 2002) 664 pp. Bibliography: 694 refs. ISBN 5-94010-137-2.

This book provides an authoritative review of the current state of the theory of fractals when applied to radiophysics and radar — a new rapidly growing area of research which has branched off from the theory of deterministic chaos. The book presents an introduction to the theory of fractals. It covers diffusion processes in fractal spaces; descriptions of fractal surfaces; methods of solving the problems of wave diffraction from fractal surfaces and media; self-similarity of turbulence, lightning, rain, clouds, atmospheric aerosols, complex systems, and 3D structures of geosystems in remote sensing; modern fractal antennas and their synthesis; lines of attack on the problems of nonconventional fractal image processing for various signal-to-noise ratios and detection of low-contrast objects, and, finally, fractal modeling in space radiophysics and cosmology. At the heart of material presentation is the general approach leaning upon the ideas of fractal geometry, fractional integrodifferentiation and fractional-order dimensions. The book was supported by the 1997–2000 special-purpose federal program 'State Support for the Higher Education–Basic Science Integration'. The monograph is intended for physicists and mathematicians interested in the application of fractals to radiophysics and radar. It could also be the part of a syllabus for undergraduate and post-graduate students taking the radiophysics and applied mathematics and physics courses. (Logos Publ.: 105318 Moscow, Izmailovskoe Sh. 4; e-mail: ik_logos@hotmail.com)

Khokhlov A R, Kuchanov S I *Lectures on the Physical Chemistry of Polymers* (Moscow: Mir, 2000) 192 pp. ISBN 5-03-003317-3.

This book contains general ideas of the physics and statistical chemistry of polymers. In Part I, Introduction to the Physics of Polymers, basic data on the physical properties of polymers are presented, and the physical principles behind the current methods of their measurement are discussed. In Part II, Introduction to the Statistical Chemistry of Polymers, the principles governing the statistical description of the chemical structure of polymers are given, and the structure calculation methods for the major processes involved in the synthesis of high-molecular compounds are described. For undergraduate and post-graduate students seeking physicist and chemist qualifications through the course of polymers and for research workers and engineers engaged in the development of polymer materials. (Mir Publ.: 107996 Moscow, GSP-6, 1st Rizhskii per. 2; tel.: (7-095) 286-8388; <http://www.mir-pubs.dol.ru/>)

Stepanov N F *Quantum Mechanics and Quantum Chemistry* (Moscow: Mir, 2001) 519 pp. ISBN 5-03-003414-5.

This textbook corresponds to the syllabus of the corresponding university courses. The basic principles of quantum theory and its chemical applications are covered in detail. Questions and problems for self-study are provided at the end of every chapter. The book will be used by the university and engineering college students. (Mir Publ.: 107996 Moscow, GSP-6, 1st Rizhskii per. 2; tel.: (7-095) 286-8388; <http://www.mir-pubs.dol.ru/>)

Shurygin A M *Applied Stochastics: Robustness, Assessment, Prognosis* (Moscow: Finansy i Statistika, 2000) 224 pp. Bibliography: 113 refs. ISBN 5-279-02201-2. RFBR project 98-01-14155.

This book describes the author's procedure of optimizing the estimation of the parameters of arbitrary (as opposed to robustness) distributions over two characteristics (effectiveness and stability) using the variational methods. The procedure yields the best predictions possible for random processes and point fields involved in the initial conditions of many practical problems in finance, sociology, natural sciences, and engineering. For teachers and undergraduate and post-graduate students specializing in mathematical statistics and its applications, as well as for practising engineers whose work involves stochastic methods. (Finansy i Statistika Publ.: 101000 Moscow, ul. Pokrovka 7; tel.: (7-095) 925-3502; fax: (7-095) 925-0957; e-mail: mail@finstat.ru; <http://www.finstat.ru>)

Numerical Methods A lecture course in 2 parts. Part I. *Numerical Methods in Analysis and Linear Algebra* (Compiled by A I Golubev) (Sarov: RFYaTs-VNIIEF Publ., 2000) 253 pp. Bibliography: 14 refs. ISBN 5-85165-612-3. Part II. *Numerical Methods for Solving Partial Differential Equations* (Compiled by A I Golubev) (Sarov: RFYaTs-VNIIEF Publ., 2000), 171 pp. Bibliography: 6 refs. ISBN 5-85165-612-3.

Part I introduces the topic of numerical solution methods for differentiation and integration, for approximating functions and calculating the roots of equations, and for problems in linear algebra. The material is illustrated by numerical examples that help the reader to better grasp the essence of the methods discussed. Part II focuses on methods for

constructing and exploring difference schemes. Difference schemes for typical equations of mathematical physics in both one dimension and many dimensions are considered in detail. Basic methods for solving net equations are described. Audience: students seeking technician qualification through the course in applied mathematics. (RFYaTs-VNIIEF Publishing & Printing Complex regular mail address: 607190 Sarov, Nizhni Novgorod region)

Vasil'ev V A *Branching Integrals* (Moscow: MTsNMO, 2000) 432 pp. Bibliography: 191 refs. ISBN 5-900916-42-1. RFBR project 99-01-14002.

The subject matter of this monograph lies at the intersection of several classic branches of mathematics: the theory of singularities, topology, algebraic geometry and integral geometry, complex analysis, and the equations of mathematical physics. The book provides introduction to the Picard – Lefschetz theory and the local theory of singularities, both governing the qualitative behavior of functions specified by integral transformations. It describes original applications to the problems of integral geometry and the theory of hyperbolic operators in partial derivatives, as well as to the theory of potential and to generalized hypergeometric functions. In particular, the multidimensional generalizations of the Newton theorem on the nonintegrability of plane ovals are proved for the functions of volume; for hyperbolic partial differential equations, the Atiyah – Bott – Gording hypothesis of the equivalence of wave front sharpness and Petrovskii's local topological condition is proved; in the theory of potential, the algebraic nature of the potential of hyperbolic hypersurface of power d in \mathbb{R}^n is proved for $d = 2$ or $n = 2$ and disproved for other d, n ; for general hypergeometric Gelfand-Aomoto functions, the number of the independent solutions to hypergeometric equations is indicated. For undergraduate and post-graduate students and research workers specializing in complex analysis, equations of mathematical physics, the theory of singularities, algebraic geometry, integral geometry, and topology. (Publishing House of the Moscow Center of Continuous Mathematical Education: 121002 Moscow, B. Vlas'evskii per. 11; tel.: (7-095) 241-7285; fax: (7-095) 291-6501; e-mail: biblio@mccme.ru; <http://www.mccme.ru/>)

Abramov I I *Modeling of Physical Processes in the Elements of Silicon Integrated Microcircuits* (Minsk: BGU Publ., 1999) 189 pp. Bibliography: 254 refs. ISBN 985-445-148-8.

This monograph concentrates on the methods for the multi-dimensional modeling of physical processes in the elements and components of silicon-based superlarge-scale integrated (SLSI) and ultralarge-scale integrated (ULSI) circuits. In particular, it presents the continuous models of diffusion – drift approximation permitting the study of the effects of heavy doping, self-heating, and the ambient temperature on the processes running in circuit structures. The book provides a survey of methods by which discrete physical and topological models of circuit elements and components can be constructed from continuous models and realized in practice. The capabilities of the methodology are illustrated with the examples of the multidimensional modeling of physical processes in typical active VLSI and ULSI structures, including nonlinear regimes for which no rigorous theory is

yet available. Although intended for professional engineers in microelectronics and the physics of semiconductor devices, the monograph will also be useful for researchers and practising engineers engaged in VLSI and ULSI circuit design automation, as well as for undergraduate and post-graduate students of microcircuits engineering. (Belarussian State University Publ. regular mail address: 220050 Minsk, pr. F. Skoriny 4)

Kadykov I F *Underwater Low-Frequency Acoustic Noise of the Ocean* (Moscow: Éditorial URSS, 1999) 152 pp. Bibliography: 118 refs. ISBN 5-901006-83-6. RFBR project 98-05-78029.

In this book, based on the author's extensive experimental material, the present state of knowledge of the acoustic oceanic noise in the frequency range from thousandths of a hertz to hundreds of hertz is summarized. The topics covered in detail include the methods for conducting studies, observational results on low-frequency noise in deep-sea and shallow waters, and some features of noise in these regions of the ocean. Also covered are low-frequency noise-like signals due to oceanic earthquakes. The text also presents some theoretical and numerical analyses of several problems related to noise field formation and the interpretation of experimental data. Practical applications of the results obtained to the solution of acoustic problems in oceanology are discussed as well. The book is intended for ocean science and hydroacoustics researchers, and for those involved in the design of hydroacoustic tools for studying the ocean and applying them. (Éditorial URSS Publ.: 113208 Moscow, ul. Chertanovskaya 2/11; tel./fax (7-095) 135-4423; e-mail: urss@urss.ru; Internet site: <http://urss.ru/>)

Mamaev O I *Physical Oceanography: Selected Works* (Compiled by S A Dobrolyubov and V L Lebedev) (Moscow: VNIRO Publ., 2000) 364 pp. ISBN 5-85382-162-8. RFBR project 97-05-78133.

This book by Oleg Ivanovich Mamaev (1925–1994), the author of nine monographs and over a hundred of papers, and the last of the Mohicans of classical ocean science in our country, is devoted to the most important issues in the dynamics of the seas and the oceans. (VNIRO Publ. regular mail address: 107140 Moscow, ul. Verkhnyaya Krasnosel'skaya 17)

Compiled by *E V Zakharova*