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New books on physics and related sciences

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Zubarev D N, Morozov V G, Repke G *Statistical Mechanics of Nonequilibrium Processes* Vol. 2 (Moscow: Fizmatlit, 2002) 296 pp. ISBN 5-9221-0212-5. RFBR project 01-02-30008.

This book has been written for a modern course in the statistical theory of nonequilibrium processes in classical and quantum many-particle systems. Unlike most texts and monographs available on the subject, the theory of kinetic, hydrodynamic, and relaxation processes is presented within the unified framework of the Gibbs method of statistical ensembles as extended to nonequilibrium systems. The second volume comprehensively covers the method of nonequilibrium Green functions, the theory of relaxation and hydrodynamic processes, and the theory of hydrodynamic functions. The book is intended for scientific researchers, senior undergraduate students, and post-graduate students in the fields of theoretical physics, chemical physics, solid-state physics, plasma, and gas and fluid studies. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http:// www.fizmatlit.ru/)

Ovchinnikov V V *Mössbauer Analysis of the Atomic and Magnetic Structure of Alloys* (Moscow: Fizmatlit, 2002) 256 pp. ISBN 5-9221-0259-1. RFBR project 01-02-30051.

The aims of this monograph are, first, to highlight key challenges to further development of Mössbauer techniques for analyzing the atomic and magnetic structure of alloys, and, second, to see how these challenges can be resolved based on the extensive theoretical and experimental research effort in the field, including that by the author and his colleagues. For scientific workers, as well as post-graduate and senior undergraduate students. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http:// www.fizmatlit.ru/)

Polyanin A D, Zaĭtsev V F *Handbook of Nonlinear Equations of Mathematical Physics* (Moscow: Fizmatlit, 2002) 432 pp. ISBN 5-9221-0192-7.

This handbook contains exact solutions to about 1,200 nonlinear equations of mathematical physics and mechanics. It covers parabolic, hyperbolic, elliptic, and other types of equations. Many new solutions of nonlinear equations are presented. Special attention is given to equations of general form dependent on arbitrary functions. Besides equations of the second order, equations of the third, fourth, and higher orders are also considered. Overall, the handbook contains more nonlinear equations of mathematical physics and exact solutions than any other book. It presents solutions to equations arising in various branches of theoretical physics, mechanics and chemical engineering (heat and mass transfer, waves, hydrodynamics, nonlinear acoustics, combustion, nonlinear optics, nuclear physics, etc.). The appendix describes the methods of the generalized and functional separation of variables and considers specific examples of how these methods are applied to find exact solutions of nonlinear partial differential equations. The handbook will be valuable to a wide range of scientific workers, faculty, practising engineers, and students specializing in various areas of mathematics, physics, mechanics, control theory, and engineering science. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http:// www.fizmatlit.ru/)

Theory of Relativistic Particle Emission (Ed. by V A Bordovitsyn) (Moscow: Fizmatlit, 2002) 576 pp. ISBN 5-9221-0258-3.

This book addresses a broad range of questions concerning the relativistic particle radiation (synchrotron radiation, undulator radiation, electron radiation in short-length magnets and crystals, and cosmic radio emission). Topics discussed include radiation produced from relativistic electrons in the extreme cases of low-energy levels and superstrong magnetic fields, hard γ-radiation from relativistic particles under channeling conditions, and the coherent production of free and bound electron – positron pairs in crystals. Special attention is given to fundamental questions in the classical and quantum theory of relativistic radiation and in the physics of polarized relativistic particles. For research workers, faculty, and post-graduate students in physics-related disciplines. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http://www.fizmatlit.ru/)

Volosevich P P, Levanov E I, Fetisov S A Self-Similar Solutions of Problems in the Heating and Dynamics of Plasma (Moscow: MFTI Publ., 2001) 256 pp. ISBN 5-89155-067-9.

Based on the self-similar solutions of certain classes of problems in high-temperature gasdynamics, various processes occurring in plasma are examined. The results demonstrate the efficiency of the group methods (self-similar solutions) as tools for a qualitative analysis of the processes and for carrying out computing experiments. For undergraduate and post-graduate students of natural science departments at teacher-training institutes and technical colleges, as well as for experienced practitioners in the fields of continuum mechanics, plasma physics, mathematical simulation, and computing experiment. (MFTI Publ.: 141700, Moscow region, Dolgoprudnyĭ, Institutskiĭ per. 9; tel.: (7-095) 408-76 81)

Uspekhi Fizicheskikh Nauk **172** (12) 1475 – 1478 (2002)
Translated by E G Strel'chenko

A Problem Book in General Physics*. Part 1. *Mechanics, Thermodynamics and Molecular Physics (Ed. by V A Ovchinkin) (Moscow: MFTI Publ., 2002) 448 pp. ISBN 5-89155-092-X.

The first part of this collection includes more than 1,800 problems of varying levels of difficulty. Most of the problems are designed by the faculty members of the general physics department of the Moscow Institute of Physics and Technology. The problems are student-tested at examinations, tests, and physics contests. The book also contains classical methodical material necessary in the educational process. Some of the problems suggest submitting estimates and cover several branches of physics at once. About 10% of the problems are provided with solutions. As various branches of science and technology, in fact, employ units of measurement which are most suitable for their respective subjects, no particular system of units was given preference in the book. For undergraduate students in physics and for high-school and university physics teachers. (MFTI Publ.: 141700, Moscow region, Dolgoprudnyĭ, Institutskiĭ per. 9; tel.: (7-095) 408-76 81)

Arkhipov V N ***Mechanical Effects of the Nuclear Explosion*** (Moscow: Fizmatlit, 2002) 384 pp. ISBN 5-9221-0261-3. RFBR project 01-01-14070.

This book provides a systematic description of the physical and mathematical models of how a nuclear explosion grows in the air and underground and how the air and soil bulk are affected mechanically by the explosion. Featured topics include the outward energy transfer, the formation and propagation of heat and shock waves, the evaporation and melting of the soil, the formation and propagation of the explosive seismic wave in soil bulk, and the formation of the funnel with its associated phenomena. Special attention was given to how the above processes are affected by the boundaries between different media and by soil bulk inhomogeneities of various kinds (the stratification of sedimentary rocks, cracks, fractures of rocky soils, etc.). For research workers and professional engineers working in continuum mechanics, the physics of high energy densities, and the mathematical modeling of the effects of explosive and pulsed loads, as well as senior undergraduates and post-graduate students seeking scientific and technician qualification through the appropriate courses. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http://www.fizmatlit.ru/)

Astapenko V A ***Approximate Methods in the Theory of Interaction of Photons and Electrons with Atoms*** (Moscow: MFTI Publ., 2002) 104 pp. ISBN 5-7417-0185-X.

This book aims to present methods which are little-known in textbooks but whereby certain types of interactions of photons and electrons with atoms are described. The interactions in question include the scattering of a photon by an atom, the atomic photoeffect, and bremsstrahlung induced by collisions of electrons with multielectron atoms and ions in the presence of a polarization channel. The book gives a detailed account of the quantum and classical approaches to calculating the dynamic polarizability of atomic systems — a quantity of importance in describing many phenomena in atomic physics. The methods discussed combine mathematical simplicity with physical clarity, while at the same time providing reasonable accuracy. Extensive application of the statistical model of atom makes the presentation universal and helps elucidate important qualitative features of the phenomena studied. The book will be valuable to all those specializing in radiation – matter interactions, quantum electronics, laser physics, and plasma physics. (MFTI Publ.: 141700, Moscow region, Dolgoprudnyĭ, Institutskiĭ per. 9; tel.: (7-095) 408-76 81)

Vaks V G ***Interatomic Interactions and Bonding in Solids*** (Moscow: IzdAT, 2002) 256 pp. ISBN 5-86656-123-9.

Current conceptions of interatomic interactions and bonding in solids are discussed in this volume. The book examines the physical foundations of the valence and covalence concepts, discusses the nature of various types of bonding in molecules and condensed phases, and takes a detailed look at the physical properties of and phenomena in systems with different types of bonding. The basic essentials of the electronic theory of solids are described, including the theory of electron structure and the effects of this structure on observed properties. The physical ideas and methods employed in the theory have been subjected to in-depth analysis. Considerable attention is given to experiment – theory comparison. It will be suitable as a textbook for senior undergraduates, post-graduates, and newly qualified practitioners in physics and related fields. [Atomic Science and Engineering Publ. (IzdAT) of the International Association of 'Chernobyl'-Atom' Unions: 123182 Moscow, ul. Zhivopisnaya 46; tel.: (7-095) 190-90 97]

Vekshteĭn G E ***Physics of Continua in Worked Problems*** (Izhevsk: RKhD, 2002) 208 pp. ISBN 5-93972-136-2.

Problems with solutions, covering various branches of electrodynamics of continua, hydrodynamics, elasticity theory, and mechanics of liquid crystals are brought to the attention of readers. Along with typical academic problems, there are a large number of problems which involve the analysis of unusual and instructive phenomena and of effects that have become 'classic' in recent decades (Landau damping, nonlinear interaction of waves, solitons, the Freedericksz transition, etc.). The book is intended primarily for college students and faculty in physics disciplines. ('Regular and Chaotic Dynamics' Publ.: 426034 Izhevsk, ul. Universitetskaya 1; tel.: (7-3412) 78-39 33; URL: http://old. rcd.ru/)

Kondaurov V I, Fortov V E ***Introductory Thermal Mechanics of Condensed Media*** (Moscow: MFTI Publ., 2002) 336 pp. ISBN 5-89155-080-6.

This book presents the mathematical foundations of the nonlinear theory of continua, necessary for the phenomenological description of thermal and mechanical processes and phenomena in condensed media at high energy densities. It formulates the general principles for constructing governing equations, taking classical equations of state as examples. For a long-memory medium — a viscoelastic material of the relaxation type — an effective method of internal parameters is developed, and the general nature of

the governing relations is examined. Considerable attention is given to first-order phase transitions in deformable media. Aspects covered in the book include a detailed theoretical discussion concerning the accumulation of damage in heterogeneous and initially porous media under quasi-static and dynamical loading. For research workers, senior undergraduate students, and post-graduate students in physics and in the mechanics of continua. (MFTI Publ.: 141700, Moscow region, Dolgoprudnyĭ, Institutskiĭ per. 9; tel.: (7-095) 408-76 81)

Lotov K V ***Physics of Continua*** (Izhevsk: RKhD, 2002) 144 pp. ISBN 5-93972-111-7.

This book provides a synopsis of a physics department course in the mechanics and physics of continua. It includes the foundations of the electrodynamics of continua, hydrodynamics, and elasticity theory. For undergraduate and post-graduate students and faculty in physics. ('Regular and Chaotic Dynamics' Publ.: 426034 Izhevsk, ul. Universitetskaya 1; tel.: (7-3412) 78-39 33; URL: http://old.rcd.ru/)

Markov A A ***Selected Works*****. Vol. 1.** ***Mathematics, Mechanics, and Physics*** (Compiler and general editor N M Nagornyĭ) (Moscow: MTsNMO, 2002) 478 pp. ISBN 5-94057-043-7. RFBR project 00-01-14030.

Published to mark the centenary jubilee of the birth of the prominent Russian mathematician, this collection includes Andreĭ Andreevich Markov's major works encompassing his most important finding. The first volume presents Markov's contributions to mathematics, mechanics and physics. The book is intended for mathematicians, physicists, and historians of science. (Publishing House of the Moscow Centre of Continuous Mathematical Education: 121002 Moscow, B Vlas'evskiĭ per. 11; tel.: (7-095) 241-72 85; fax: (7-095) 291-65 01; e-mail: biblio@mccme.ru; URL: http://www.mccme.ru/)

Malinetskiĭ G G, Potapov A B ***Modern Problems in Nonlinear Dynamics*** ("Synergetics: From the Past to the Future" series) 2nd ed. revised and enlarged (Moscow: Editorial URSS, 2002) 360 pp.

This book addresses some of the key problems in modern nonlinear dynamics. The authors' belief is that the fundamental difficulties faced by this interdisciplinary approach now require that a new paradigm be adopted. The book attempts to outline what this paradigm might be. After the current era of dissipative structures and dynamic chaos, a new epoch must take over. Whereas previously many concepts and basic mathematical models came to synergetics from physics, chemistry and hydrodynamics, today they mainly originate from such areas as neuroscience, theory of risk, biology, theoretical history, psychology, and other fields involving the analysis of complex, irreversibly evolving systems. The authors discuss a number of original results concerning the mathematical modeling of nonlinear phenomena and the analysis of temporal series. Considerable attention is given to dramatically growing synergetic disciplines such as the theory of inertial manifolds, reconstruction of attractors, the theory of self-organized criticality, and lattice gases. This ensures that the book will appeal to specialists in nonlinear dynamics and related branches of science. More than twenty years of synergy studies force to draw some preliminary conclusions and make it necessary to revise time-shaped ideas, models, and concepts and to take a closer look at the 'language' of nonlinear science. This is precisely what most of the text is concerned with, thus making the book very useful for a wide circle of undergraduate and post-graduate students and for everyone who wants to become acquainted with the concrete mathematical content of nonlinear dynamics. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44 23, 135-42 46; e-mail: urss@urss.ru; URL: http://urss.ru/)

Sigov Yu S ***Computing Experiments: Bridging the Past and Future of Plasma Physics*****.** Selected Works (Compiled by G I Zmievskaya and V D Levchenko) (Moscow: Fizmatlit, 2001) 288 pp. ISBN 5-9221-0193-5. RFBR project 00-02-30005.

This monograph commemorates Yuriĭ Sergeevich Sigov and contains original works of this prominent scientist. It examines the fundamental mechanisms of strong and moderate plasma turbulence, which have become classic in modern physics after the author first discovered them in his numerical experiments of the 1970s – 1990s. The book addresses problems of self-organization and dissipation in plasmas: the formation of coherent wave packets in plasma beam systems, the generation of superthermal electrons and ion sound at the kinetic stage of the Langmuir collapse, and many other examples. Coverage also includes methodical issues related to the efficiency of the numerical methods developed by Sigov's scientific school, from the modifications of the method of macroparticles to a modern object-oriented plasma model. The book discusses the potentialities and prospects of the computing experiment as a method of theoretical physics that can be used in basic and applied studies of plasmas and plasma-like media. Excerpts of memoirs about Yu S Sigov by his friends and colleagues are also included in the book. For physicists using the methods of applied mathematics in the study of strongly nonequilibrium (fusion and cosmic) plasmas and plasma-like media. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http://www.fizmatlit.ru/)

Saranin V A ***Equilibrium States of Fluids and Their Stability*** (Izhevsk: RKhD, 2002) 144 pp. ISBN 5-93972-137-0.

This book considers both well-known classic and some new problems concerning the equilibrium of liquid masses under the action of capillary forces, as well as under the forces of gravitational, electric, and magnetic fields. Almost all cases of the equilibrium of fluids are analyzed for stability. The author describes simple experiments illustrating the phenomena of equilibrium and stability (instability) of liquid masses. A number of exercise problems are included. The level of the book is appropriate for school seniors and for the first and second year college students. It will also serve as a useful guide to all those concerned with hydrodynamics and a diversity of its applications. ('Regular and Chaotic Dynamics' Publ.: 426034 Izhevsk, ul. Universitetskaya 1; tel.: (7-3412) 78-39 33; URL: http://old.rcd.ru/)

Rumer Yu B, Ryvkin M Sh *Thermodynamics, Statistical Physics, and Kinetics*. A manual for college courses in physics disciplines, 3rd ed. reprint (Novosibirsk: Novosibirsk State University Publ., 2001) 608 pp. ISBN 5-7615-0511-2.

Proceeding step-by-step from elementary concepts, this book aims to introduce the reader to the methods of thermodynamics, statistical physics, and kinetics, to teach the reader techniques for solving concrete problems, and to bring him as soon as possible to a level needed to read special monographs and papers. For college students beginning to take theoretical courses in the title disciplines. (Internet shop 'Fizmatkniga': URL: http://www.fizmatkniga.ru/catalog/)

Sidorenkov N S *Physics of Instabilities in the Earth's Rotation* (Moscow: Fizmatlit, 2002) 384 pp. ISBN 5-9221-0244-3. RFBR project 01-02-30050.

This book summarizes the studies into the nature of nonuniformities in the Earth rotation, the motions of the poles, precession, nutation, and related geophysical processes. It presents a series of observations of the parameters of the Earth rotation around the center of mass; derives differential equations describing instabilities in the Earth rotation against perturbations; presents a derivation and a series expansion of the tidal potential; reviews information on atmospheric tides; presents a theoretical grounds of such phenomena as tidal variations in the rate of Earth rotation, pole motions, precession and nutation; calculates the components of the atmosphere's tensor of inertia, and estimates the effects of the seasonal redistribution of atmospheric masses. The book also explores variations in the angular momentum of atmospheric winds and how these variations contribute to the instability in the Earth rotation, elaborates the theory of the zonal circulation of the atmosphere, and reveals the mechanism of the seasonal nonuniformity in the Earth rotation. Other topics include annual variations in the Earth – ocean – atmosphere system, the model of the excitation of Chandler's pole motions, mechanical effects of the atmosphere on the Earth rotation, the mechanism for the motions of lytospheric plates, and geophysical processes that may be responsible for the long-term (2 to 100 years) instabilities in the Earth rotation. For undergraduate and post-graduates university students in astronomy, geophysics, geology, meteorology, and oceanology. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http:// www.fizmatlit.ru/)

Sheshin E P *Surface Structure and Field Emission Properties of Carbon Based Materials* (Moscow: MFTI Publ., 2001) 288 pp. ISBN 5-89155-066-0.

This book takes the reader more deeply into the structural features of some carbon-based materials which currently show particular promise for creating stable field emission (FE) cathodes: carbon fibers, structural graphite, and film structures. It describes key techniques used in FE studies. Special attention is given to the FE properties of carbon-based materials (current – voltage characteristics, energy distributions of FE electrons, durability issues, adsorption properties), as well as to structural changes the materials undergo under the operating conditions of an FE cathode. Some designs of the electronic devices currently being most intensively developed using carbon-based FE cathodes are given as examples. For undergraduate and post-graduate students, professional engineers, and research workers specializing in field emission, solid-state physics, FE materials science, and in the development of FE cathodes and devices which are based on them. (MFTI Publ.: 141700, Moscow region, Dolgoprudnyĭ, Institutskiĭ per. 9; tel.: (7-095) 408-76 81)

Pikhtin A N *Optical and Quantum Electronics* (Moscow: Vysshaya Shkola, 2002) 574 pp. ISBN 5-06-002703-1.

This book examines the physical foundations of optoelectronics, including interactions of electromagnetic radiation with matter and optical phenomena in solids, as well as the operating principles, salient features, and basic characteristics of the devices and methods of quantum electronics and optoelectronics. For undergraduate college students taking courses in electronics and microelectronics. (Vysshaya Shkola Publ.: 127994 Moscow, Neglinnaya 29/14; tel.: (7-095) 200-33 70; fax: (7-095) 200-03 01; e-mail: info@v-shkola.ru; URL: http://www.v-shkola.ru/)

Vasil'eva A B, Tikhonov N A *Integral Equations* (Moscow: Fizmatlit, 2002) 160 pp. ISBN 5-9221-0275-3.

This educational manual familiarizes the reader with the concept of the integral equation and with the existence theorem for the eigenvalues and eigenfunctions of the Fredholm homogeneous integral equation of the second kind. Topics covered include the power expansion in terms of eigenfunctions, the Sturm – Liouville problem, Fredholm inhomogeneous integral equations of the second kind, and Volterra type equations. Fredholm integral equations of the first kind are treated as ill-posed problems, and in this connection the foundations of A N Tikhonov's regularizing algorithm are presented. The book also provides information on the numerical methods used in the theory of equations and discusses some problems in the theory of integro-differential equations. For undergraduate university students taking courses in physics and in applied mathematics. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: http:// www.fizmatlit.ru/)

Volkov I K, Kanatnikov A N *Integral Transforms and Operational Calculus* ("Mathematics in the Technical University" series, issue No. XI) 2nd ed. (Moscow: N É Baumann MGTU Publ., 2002) 228 pp. ISBN 5-7038-1273-9.

This book explores the elementary theory of integral transforms. It discusses the major classes of integral transforms playing an important role in solving problems in mathematical physics, electrical engineering, and radio engineering. Theoretical material is illustrated with many examples. The volume also includes a section on operational calculus, a subject of great importance from the application viewpoint. The content of the textbook corresponds to the author's course at N É Baumann MGTU. For undergraduate and post-graduate students of technical schools and colleges and for research workers who employ analytical methods in the study of mathematical models. (N É Baumann MGTU Publ.: 107005 Moscow, 2-ya Baumanskaya 5; tel.: (7-095) 263-60 45;

fax: (7-095) 265-42 98; e-mail: press@bmstu.ru; URL: http://www.press.bmstu.ru/)

Golod P I, Klimyk A U ***Mathematical Foundations of Symmetry Theory*** (Izhevsk: RKhD, 2001) 528 pp. ISBN 5-93972-052-8.

This book examines the methods used in group theory, Lie algebras, the theory of finite and discrete groups, and the theory of other algebraic structures that together furnish the mathematical framework for the theory of symmetry in physics and that are widely used in quantum field theory, in the theory of the atomic nucleus and elementary particles, in solid state theory, and in quantum chemistry. The book covers the foundations of the theory of affine algebras and their representations, and introduces the theory of the representations of quantum groups and algebras. For research workers in theoretical and mathematical physics, and for undergraduate and post-graduate university students taking courses in physics and mathematics. ('Regular and Chaotic Dynamics' Publ.: 426034 Izhevsk, ul. Universitetskaya 1; tel.: (7-3412) 78-39 33; URL: http://old.rcd.ru/)

Artemenko A I, Tikunova I V, Malevannyĭ V A ***Chemistry Reference Manual*** 2nd ed. revised and enlarged (Moscow: Vysshaya Shkola, 2002) 367 pp. ISBN 5-06-004098-4.

This reference book covers basic theoretical propositions concerning inorganic, physical, and analytical chemistry, electrochemistry, and thermodynamics, provides information on technical analysis and general chemical technology, and illustrates the solutions of a number of typical problems. It presents a substantial body of information on the products of basic inorganic and organic synthesis, building materials, fertilizers, medicinal substances, etc. First published in 1990, the book has been revised and substantially enlarged. For students in non-chemical university departments and for university and industrial laboratory technicians. (Vysshaya Shkola Publ.: 127994 Moscow, ul. Neglinnaya 29/14; tel.: (7-095) 200-33 70; fax: (7-095) 200-03 01; e-mail: info@v-shkola.ru; URL: http://www.v-shkola.ru/)

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