

New books on physics and related sciences

DOI: 10.1070/PU2003v046n10ABEH001706

Bardzokas D I, Kudryavtsev B A, Senik N A *Wave Propagation in Electromagnetoelastic Media* (Moscow: Editorial URSS, 2003) 336 pp. ISBN 5-354-00421-7.

In this book coupled electromagnetoelastic waves, surface Rayleigh waves in piezoelectric and magnetoelastic media, Lamb waves, shear piezoelectric waves, and breakdown criteria for dielectric and piezoelectric materials are examined using state-of-the-art mathematical methods. For specialists in acoustics, flaw detection, and mechanics of deformable solids, as well as for undergraduates and postgraduates specializing in the fields of physics and the mechanics of continua. (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/>)

Il'ichev A T *Solitary Waves in Hydromechanical Models* (Moscow: Fizmatlit, 2003) 256 pp. ISBN 5-9221-0360-1.

Various types of nearly-at-rest solitary waves are considered using a number of hydrodynamic models of reversible wave processes as examples, namely, those of wave motions in dispersive and (in the absence of an explicit time dependence) in some dissipative media. For plane parallel motion, emphasis is placed on solitary wave types characteristic of reversible media: classical solitary waves, generalized solitary waves, and solitary wave packets. Taking three-dimensional surface waves in ideal incompressible fluid as an example, the author examines waveguides and considers generalized solitary wave packets — a product of a nonlinear resonance between periodic waves and localized waves or waves modulated in the direction of propagation. Considerable attention is given to the mechanical formulation of the problems discussed and how the physics of wave processes involved in the models under study should be described. For specialists in various areas of the mechanics of continua, mathematical physics, and applied mathematics, and for senior undergraduate and postgraduate students in physics and mathematic disciplines. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax: (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fizmatlit.ru/>)

Rybakov Yu P, Sanyuk V I *Multidimensional Solitons. An Introduction to the Theory and Applications* A textbook (Moscow: Izd. RUDN, 2001) 481 pp. Bibliography: 434 refs. ISBN 5-209-01314-6.

The text covers a wide class of nonlinear field models that have found numerous applications in hydrodynamics, solid state theory, plasma physics, the theory of magnetics and liquid crystals, gravitation, nuclear physics, and elementary particle physics. At strong excitation, localized states known as solitons arise in the model systems examined in the book. The book provides the first systematic presentation of methods which make it possible to study solitons in (3 + 1)-dimensional models and to establish the existence, regularity, and stability of soliton configurations. The representation is accompanied by illustrative examples and worked problems with physical content. The material of the textbook had previously been presented in a number of lecture courses the authors delivered to undergraduates, postgraduates, and research scientists at Russian Friendship of Peoples University, the Joint Institute for Nuclear Research in Dubna, Russia, Syracuse University in the US, and Free University of Brussels in Belgium. The publication has been adopted by the RF Ministry of Education as a manual for students in physics disciplines 510400 and 010400. For undergraduates and postgraduates and for scientific workers specializing in theoretical physics, and mathematics. (Russian Friendship of Peoples University Publ.: 117923 Moscow, ul. Ordzhonikidze 3; tel.: (7-095) 955-09-55; fax: (7-095) 952-04-41; e-mail: pfupress@mail.ru)

Belavin A A, Kulakov A G, Usmanov R A *Lectures on Theoretical Physics* ('Modern Lecture Courses' series) (Moscow: Izd. MTsNMO, 2001) 224 pp. ISBN 5-900916-91-X.

This book is based on a lecture course the theoretical physicist Aleksandr Belavin has been giving at Independent University of Moscow for a number of years. The lectures cover the principles and methods of both classical and newly emerged areas of theoretical physics: special and general theories of relativity, quantum mechanics, and the theory of the exactly solvable models of statistical physics. The text of the book has been substantially enlarged and revised compared to the previous 1999 edition. For physicists and mathematicians of various backgrounds, and for postgraduate and senior undergraduate students of the universities. (Publishing House of the Moscow Center for Continuous Mathematical Education: 121002 Moscow, Bol'shoi Vlas'evskii per. 11; tel.: (7-095) 241-72-85; fax: (7-095) 291-65-01; e-mail: biblio@mccme.ru; URL: <http://www.mccme.ru/>)

Irodov I E *Problems in General Physics* (St. Petersburg: Izd. Lan', 2003) 416 pp. ISBN 5-8114-0319-4.

The offered collection contains about 2,000 problems, with solution hints provided for the most challenging of them. With the choice of problems sufficiently wide both in terms of subject and the level of complexity, the book of problems meets the need for a wide variety of both physics as well as

technical and engineering disciplines at higher education institutions. At the beginning of each section, the basic formulas relevant to its material are summarized for the reader's convenience and to save him his time. There are normally no detailed comments on a formula, it being assumed that the meaning of all the quantities it contains is already known to the student as he or she sets out to solve a problem. Comments are only given in cases where confusion may arise for one reason or another. All the formulas in both the main text and answers are given in SI units — except for Part 6, where the Gaussian system of units is used. In giving initial data and presenting numerical answers, the accuracy of the corresponding quantities are taken into account and rules for handling approximate numbers are applied. At the end of the collection, major physical constants are summarized and reference tables are given. This edition retains the structure of the 1988 edition and corrects discovered errors, inaccuracies, and misprints. Several useful tables are added to the appendix. (Lan' Publ.: 193029 St. Petersburg, ul. Krupskoi 13; tel.: (7-812) 567-85-78, (7-812) 567-14-45; tel./fax: (7-812) 567-54-93; e-mail: root@lanpbl.spb.ru; URL: <http://www.lanpbl.spb.ru/>)

Andreev A V *Theory of Half-Integer Spin Particles and the Hyperfine Structure of Atomic Levels* (Moscow: Fizmatlit, 2003) 56 pp. ISBN 5-9221-0439-X.

An equation for the action of a spin 1/2 particle interacting with an electromagnetic field is deduced. The proposed action is both relativistically and gauge invariant. The main feature distinguishing the proposed action from earlier relativistic equations is that it is a quadratic form with respect to the 4-momentum operator and that it contains three material constants characterizing particle properties: the rest mass, the charge, and the value of the magnetic moment. Wave equations for the particle and the electromagnetic field are produced. Analytical solutions of equations for an electron moving in a Coulomb field and in a static magnetic field are found. The solutions obtained show that in a magnetic field the energy levels of an electron and hydrogen-like atoms possess a hyperfine structure due to the electron magnetic moment differing from the Bohr magneton. It is shown that the equations obtained are capable of describing the nucleon – nucleon interaction. A comparison with experimental results on the precision laser spectroscopy of the hydrogen atoms is made. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax: (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fizmatlit.ru/>)

Solid State Physics Vol. 1 Methods for the Fabrication and Structural Study of Solids Vol. 2. Physical Properties of Solids (Ed. by A F Khokhlov) (Moscow: Vysshaya Shkola, 2001) Vol. 1, 364 pp. ISBN 5-06-004021-6; Vol. 2, 484 pp. ISBN 5-06-004022-4.

The manual includes laboratory exercises, part of which support the basic university course in solid state physics, and part of which are intended for the more detailed study of certain sections of the course. The first volume presents exercises which use computer simulation, selective etching, electron and atomic-force microscopy, and X-ray radiography to study the structure of and defects in solids. These exercises are oriented toward the investigation of both

crystalline and amorphous solids, both in bulk and thin-film forms. Laboratory exercises on methods of fabricating such solids are also included. The second volume presents exercises on the physical (in particular, magnetic) properties of solids (metals, insulators, semiconductors, and superconductors), and on phase transformations in solids. (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/>)

Pavlenko Yu G *Lectures on Theoretical Mechanics* (Moscow: Fizmatlit, 2002) 392 pp. ISBN 5-9221-0241-9.

The aim of this book is to present the fundamental principles and methods of theoretical mechanics, to teach the reader to actively apply the modern mathematical apparatus to the solution of concrete problems of dynamics, and to lead up the reader to analyzing a wide range of problems studied in a theoretical physics course. Emphasis is on the study of classical and current problems of mechanics in the framework of the Lagrangian and Hamiltonian approaches, methods of 'Hamiltonizing' systems of nonlinear equations, and new methods of integrating canonical systems. For undergraduate students in mechanics and mathematics departments at universities, students in higher technical education institutions being trained in the disciplines of mechanics and applied mathematics, teachers, and postgraduate students. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax: (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fizmatlit.ru/>)

Pavlenko Yu G *Problems in Theoretical Mechanics* (Moscow: Fizmatlit, 2003) 536 pp. ISBN 5-9221-0302-4.

In this book, solutions to 560 problems for all sections of a theoretical mechanics course are presented. The aim of the collection is to help the reader master the fundamental methods of theoretical mechanics and to teach him or her to apply the mathematical apparatus of the theory to the study of specific systems. The problems considered are related to the analysis of the motion of charged particles in electromagnetic fields and of the motion of spacecraft in a Newtonian gravitational field, correcting spacecraft orbits, celestial mechanics, vibrations of linear and nonlinear systems, the dynamics of a solid body, electromechanics, and relativistic dynamics. An essential feature of this book lies in the fact that the mathematical aspects of the Hamilton formalism are presented as a powerful apparatus with which a wide range of problems can be analyzed using the integration methods the author developed for systems of a general form. For students in physics and mathematics departments at universities and higher technical education institutions following higher programmes in the disciplines of mechanics, applied mathematics, physics, or astronomy. Postgraduate students and teachers will also benefit from the book. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax: (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fizmatlit.ru/>)

Bredov M M, Rumyantsev V V, Toptygin I N *Classical Electrodynamics* 2nd ed., reprint (St. Petersburg: Izd. Lan', 2003) 400 pp. ISBN 5-8114-0511-1.

This electrodynamics course covers one of the branches of theoretical physics and is intended for 2nd and 3rd year higher education students who have taken sufficiently comprehensive courses in general physics and classical mechanics. At the same time, due to a reasonable choice of material and to the state-of-the-art presentation style, the book is a good reference for senior undergraduates, practising engineers, and scientific workers. The book concentrates on the theory of electromagnetic phenomena in a vacuum and in media and introduces the special theory of relativity. The exposition of the latter precedes microscopic electrodynamics, which is developed as a consistent relativistic theory. In the electrodynamics of media, both micro- and macroscopic approaches to the description of physical phenomena are employed. The textbook is recommended for students in physics departments at the universities and other higher education institutions, and can also be used by engineers and research workers. (Lan' Publ.: 193029 St. Petersburg, ul. Krupskoi 13; tel.: (7-812) 567-85-78, (7-812) 567-14-45; tel./fax: (7-812) 567-54-93; e-mail: root@lanpbl.spb.ru; URL: <http://www.lanpbl.spb.ru/>)

Berezin A V, Kurochkin Yu A, Tolkachev E A *Quaternions in Relativistic Physics* 2nd ed. (Moscow: Editorial URSS, 2003) 200 pp. ISBN 5-354-00403-9.

This book is the first in the scientific literature to systematically cover the application of quaternions to the parametrization of space-time symmetry groups and to the realization of some of their representations. An original approach to the description of the kinematics and dynamics of classical and quantized fields is presented, which is based on the use of objects of a common nature, namely biquaternions. A brief account of the historical development of quaternion calculus and its applications is given. The first edition was published by Nauka and Tekhnika (Science and Technology) Publishers, Minsk, in 1989. Can be of interest to a wide range of people — including postgraduate students and scientific workers — interested in theoretical physics, algebra, and geometry. While different portions of the text require a different level of preparedness on the part of the reader, most of its sections are quite accessible to undergraduate students seeking their qualification through the courses in physics and mathematics disciplines. (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/>)

Uchaikin V V *Fundamentals of the Mechanics of Continua. Problems and Exercises* (Izhevsk: Izd. RKhD, 2002) 196 pp. ISBN 5-93972-210-5.

The collection contains problems and exercises to be used in universities in practical sessions, personal study, tests, credit tests, and exams in physics and physics-related disciplines. Methodological hints on solving the problems are given, full or partial answers to the problems are provided, and a bibliography is included. The problems are selected in accordance with the State Education Standard of the year 2000 for the university professional education discipline category 010400 Physics (OPD.F.01 Theoretical Physics. Mechanics. Fundamentals of the Mechanics of Continua) in the Russian academic discipline coding scheme. (Research and Publishing Center 'Regular and Chaotic Dynamics'

Publ.: 426034 Izhevsk, ul. Universitetskaya 1, UdSU, RKhD; tel.: (7-3412) 50-02-95; fax: (7-3412) 50-02-95; e-mail: subscribe@rcd.ru; URL: <http://www.rcd.ru/>)

Neurocomputers in Image Processing Systems ('Neurocomputers and their Application' series, Book 7, General editor: A I Galushkin) (Moscow: Radiotekhnika, 2003) 192 pp ISBN 5-93108-029-5.

Topics covered include promising directions in the use of neurocomputers in image processing systems; neuronet realization of the separate blocks of such systems (filtering, pattern recognition, etc.); printed circuit board diagnostics; processing of starry sky images; identification of earth cover types; face and road sign recognition, and more. The book is designed for students taking degree courses in applied physics and mathematics as well as for research workers, postgraduates, and undergraduates concerned with supercomputer solution algorithms. (Publishing Enterprise of the 'Radio-tekhnika' (Radio Engineering) Editorial Board: 103031 Moscow, K-31, ul. Kuznetskii most 20/6; tel./fax: (7-095) 921-48-37, 925-92-41; e-mail: ipzhr@ipzhr.ru; URL: <http://webcenter.ru/~ipzhr/>)

Tarasevich Yu Yu *Mathematical and Computer Modeling* 3rd ed. (Moscow: Editorial URSS, 2003) 144 pp. ISBN 5-354-00381-4.

This textbook draws on the author's experience in giving lecture and laboratory courses. In the first part, the author presents examples from physics, chemistry, and ecology to show how differential models are constructed and analyzed. Thus, the first part is an introduction to the qualitative methods for studying differential equations. The second part is devoted to problems in which qualitative analysis is either difficult or impossible, and direct computer modeling of the process is needed. Topics covered here include chaotically behaving systems, cell automata, percolation and kinetic growth problems, and some others. In the appendix, examples of the application of various software tools (Mathematica, Maple, Matlab, Mathcad) to a dynamic system are presented and introductory information about random number generation algorithms is given. Extensive illustrative material and, in most cases, sufficiently detailed mathematical calculations support the exposition. At the same time, a number of examples undoubtedly imply that much personal study into the development of computer programs and the analysis of their results should be made by the student. The book can be used as a textbook on Computer Modeling courses for students in informatics. Students in natural science and mathematics-related disciplines who take the course 'Concepts in Modern Natural Science (Mathematical Models of Natural Science and Ecology)' will also benefit from the book. (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/>)

Kozlov V V *Thermal Equilibrium: Gibbs's and Poincaré's Ideas* (Izhevsk: Izd. RKhD, 2002) 320 pp. ISBN 5-93972-187-7.

Gibbs's and Poincaré's ideas on the thermal equilibrium of mechanical systems are developed in this book. While Gibbs's ideas are widely known, some of the problems he posed are

not yet resolved. On the contrary, Poincaré's profound results on kinetics turned out to be undemanded by and altogether unknown to specialists in statistical mechanics. There are three interrelated themes which underlie the range of questions considered in the book: the weak convergence of probability measures (whose densities are solutions of the Liouville equation), the hierarchy of chaoticity of Hamilton dynamic systems, and perturbation theory for an ensemble of weakly interacting subsystems. The results obtained offer new insights into the nature of the irreversible behavior of thermodynamic systems, allow a new interpretation of the second law of thermodynamics with its principle of increasing entropy, and permit a rigorous, nonergodic derivation of Gibbs's canonical distribution. The text of the book is structured in the form of essays, its four chapters being largely independent of each other. Each of the chapters contains a commentary and a bibliography. Supplements cover the properties of invariant measures with smooth density, conditions for the existence of additional conservation laws for the first integrals of Hamilton's equations, and the phenomenon of diffusion in nonlinear dynamic systems. The book is intended for mathematicians, physicists, and specialists in mechanics interested in classical statistical mechanics and in the foundational issues of thermodynamics. (Research and Publishing Center 'Regular and Chaotic Dynamics' Publ.: 426034 Izhevsk, ul. Universitetskaya 1, UdSU, RKhD; tel.: (7-3412) 50-02-95; fax: (7-3412) 50-02-95; e-mail: subscribe@rcd.ru; URL: <http://www.rcd.ru/>)

Veretennikov V G, Sinitsyn V A *Variable Action Methods* 2nd ed. (Moscow: Fizmatlit, 2003) 176 pp. ISBN 5-9221-0217-6.

In this book, virtual variation and variable action methods are examined as two complementary techniques which combine to form a unified analytical approach that is conceptual for natural science disciplines. Taking mechanical systems as an example, the author studies changes in the action due to virtual variation with ideal-constraint reactions left out of consideration. In this way, a kind of tool is created, which should necessarily be mastered in order that the influence of constraints be taken into account when studying nonfree dynamic systems. For researchers, teachers, and undergraduate and postgraduate students in related disciplines. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax: (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fizmatlit.ru/>)

Terekhov V A *A Book of Problems in Electronic Devices* 3rd revised ed. (St. Petersburg: Izd. Lan', 2003) 288 pp. ISBN 5-8114-0503-0.

This book has been adopted by the Ministry of Education of the Russian Federation as a textbook for higher education students being trained in the disciplines of Microelectronics and Solid State Electronics, Electronic Devices and Instruments, and Industrial Electronics and seeking to become certified specialists in Electronics and Microelectronics. The book contains problems and questions in electronic devices. Many questions and problems are included with the aim of linking the study of electron-discharge and semiconductor devices with the study of the simplest radio engineering

circuits under various operation conditions. In the present edition, problems in modern devices are included. For students at higher education institutions, whose curricula include electronics, radio engineering, automatics, telemechanics, electronic instrument engineering, or computer technology. (Lan' Publ.: 193029 St. Petersburg, ul. Krupskoi 13; tel.: (7-812) 567-85-78, (7-812) 567-14-45; tel./fax: (7-812) 567-54-93; e-mail: root@lanpbl.spb.ru; URL: <http://www.lanpbl.spb.ru/>)

Zaitsev V F, Polyanin A D *Handbook of First Order Partial Differential Equations* (Moscow: Fizmatlit, 2003) 416 pp. ISBN 5-9221-0287-7.

The handbook contains more than 3,000 first-order partial differential equations with solutions. A large number of new exact solutions for linear and nonlinear equations are presented. Particular emphasis is given to equations of a general form dependent on arbitrary functions. By and large, in this handbook there are several times as many first-order PDEs and exact solutions as in any other book. At the beginning of each chapter, basic solution methods for the corresponding differential equation types are briefly described, and specific examples of the application of these methods are given. Along with smooth solutions, nonsmooth and discontinuous ones are examined. Equations encountered in differential geometry, nonlinear mechanics, gas dynamics, geometrical optics, wave theory, optimal control theory, differential games, chemical technology, and in other applications are considered. In the supplement, the method of generalized separation of variables is described. The handbook is intended for a large circle of research workers, teaching staff, practising engineers and students at the universities who specialize in various fields of applied mathematics, mechanics, physics, control theory, and engineering. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax: (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.maik.rssi.ru/>).

Danilov Yu A *Chebyshev Polynomials* 2nd ed. (Moscow: Editorial URSS, 2003) 160 pp. ISBN 5-354-00350-4.

The remarkable properties and numerous applications of Chebyshev polynomials are popularly discussed in this book. The exposition starts with P L Chebyshev's original work on the theory of mechanisms and function approximation theory and ends with a description of where the theory of best approximation to functions is now. The first edition was published in 1984 (Minsk: Vysheishaya Shkola, 1984). For a wide range of readers interested in mathematics. (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, 135-4246; e-mail: urss@urss.ru; URL: <http://urss.ru/>)

Compiled by *E V Zakharova*
(E-mail: zaharova@ufn.ru)