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### New books on physics and related sciences

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**Kostrikin A I** *Introduction to Algebra* Volumes 1–3 Vol. 1: *Fundamentals of Algebra* (Moscow: Fizmatlit, 2000) 271 pp.

This first-semester textbook covers the material needed in studies of mathematics at the higher courses and concerns the set of linear equations; elementary matrix theory; the theory of determinants; the simplest properties of groups, rings, and fields; complex numbers, and roots of polynomials. The text features a large number of equations of various degree of complexity and a chapter on yet-unresolved problems in polynomials. Recommended by the Russian Ministry of Education for first- and second-year students at universities and colleges with heavy mathematical requirements. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

### **Kostrikin A I** *Introduction to Algebra* Volumes 1–3 Vol. 2: *Linear Algebra* (Moscow: Fizmatlit, 2000) 367 pp.

In this text the major aspects of linear algebra are discussed in the most accessible style possible by first introducing elementary geometric concepts and then evolving them to a comprehensive algebraic apparatus. Examples of applications include calculus, theory of linear groups, Lie algebras, mathematical economics, differential equations, and Lobatchewsky's geometry. Exercises are featured at the end of each section, and in a separate section the answers are given and solutions outlined. Some unresolved problems are also formulated. Recommended by the Russian Ministry of Education for colleges and universities offering advanced mathematical courses. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

### Kostrikin A I Introduction to Algebra Volumes 1–3

Vol. 3: *Basic Structures of Algebra* (Moscow: Fizmatlit, 2000) 336 pp.

Compared to the preceding two volumes, this book takes a more comprehensive approach to such branches of algebra as groups, rings, fields, and modules, addressing in particular the geometric and number-theoretic aspects. Recommended by the Russian Ministry of Education for students taking advanced mathematical courses. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

Kostrikin A I *Problem Book on Algebra* (Moscow: Fizmatlit, 2000) 320 pp.

The book is an integral part of Kostrikin's *Introduction to Algebra*. Recommended by the Russian Ministry of Education for teachers and junior students at colleges and

*Uspekhi Fizicheskikh Nauk* **170** (5) 581–584 (2000) Translated by E G Strel'chenko universities with a heavy mathematical curriculum. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

## **Peryazev N A** *Introduction to the Theory of Boolean Functions* (Moscow: Fizmatlit, 1999)

This book provides a basic introduction to the theory of Boolean functions with special emphasis on the term representation. Topics covered include expansions and canonical forms; differential calculus; series expansions, and closure and completeness problems. Part of the material requires previous experience with formal concepts and is intended for specialized courses. For first- and second-year students in mathematics. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

# Mottl' V V, Muchnik I B Hidden Markov Models in Signal Structure Analysis (Moscow: Fizmatlit, 1999) 350 pp.

This comprehensive, wide-ranging book examines the problems faced in the analysis of experimental data ordered throughout the axis of a certain argument (mostly of signals) and also discusses the theoretical methods and computer algorithms employed in this field. The problems and algorithms of signal structure analysis are treated as those of pattern recognition and detecting changes in the characteristics of random processes. Underlying the presentation is the concept of hidden Markov models, which allows a signal structure analysis algorithm to be constructed as a correct, realizable, computational solution-making procedure. For developers of analysis algorithms for complex signals of various kinds; for applied mathematicians concerned with pattern recognition and with the analysis of random processes, as well as for undergraduate and post-graduate students in cybernetics. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

### Katulev A N, Severtsev N A Operations Research: Decision Making and Safety Provision Principles (Moscow: Fizmatlit, 2000) 318 pp.

This book is one of the first to offer a systematic presentation of the basic principles of operations and safety research. It describes the generalized operation model, discusses the strategy effectiveness problem, and analyzes strategy optimization conditions, both necessary and sufficient, for continuous and discrete decision making problems under conditions of certainty, conflict, risk, and an undetermined objective. The book also discusses solutions for various optimum strategy selection problems, presenting solution algorithms in some cases. For undergraduate and post-graduate students, researchers and specialists studying mathematical methods in the safety and decision-making fields. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru) Izmailov A F, Tret'yakov A A 2-Regular Solutions to Nonlinear Problems. Theory and Numerical Methods (Moscow: Fizmatlit, 1999) 336 pp.

The book examines an effective approach, under development for over two decades now, by which singular solutions of nonlinear operator equations and extremum problems may be studied and calculated numerically using the concept of 2regularity of nonlinear maps. Unlike other books on this subject, this work puts particular emphasis on stability problems. For researchers concerned with nonlinear analysis and the numerical solution of nonlinear problems. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

**Lupanov O B** (Ed.) *Mathematical Problems in Cybernetics* Collection of works Vol. 7 (Moscow: Nauka, Fizmatlit, 1998) 368 pp.; Vol. 8 (Moscow: Nauka, Fizmatlit, 1999) 320 pp.

These are the latest two volumes in the mathematical branch, started in 1988, of the internationally recognized *Problems in Cybernetics* series. Bringing together original and review papers by leading figures in the field, the two volumes present the state of the art in, the historic background of, and future prospects for the major research areas currently under development. Also covered are the most interesting results obtained by young researchers in such areas as discrete mathematics, mathematical logic, programming theory, complexity of control systems, and decision-making methods. For researchers and undergraduate and post-graduate students interested in the present status and applications of mathematical cybernetics. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

*Elementary Physics* (Ed. by G S Landsberg) Volumes 1–3 Vol. 1: *Mechanics. Heat. Molecular Physics*; Vol. 2: *Electricity and Magnetism*; Vol. 3: *Vibrations and Waves. Optics. Atomic and Nuclear Physics* (Moscow: Fizmatlit, 2000) Vol. 1 — 605 pp, Vol. 2 — 478 pp, Vol. 3 — 654 pp.

This is another edition of the most widely acclaimed and one of the best elementary physics textbooks, whose primary merit is its in-depth introduction to all the processes and phenomena studied, whether natural or otherwise. A valuable teaching and study aid for schools, gymnasiums, and lyceums with mathematics- and physics-dominated curriculum. Those involved in self-study and school leavers preparing to college entrance exams will also benefit from this textbook. (Fizmatlit contact information: tel. (7-095) 334-7421, e- mail: fizmat@maik.rssi.ru)

### **Butikov E I, Kondrat'ev A S** *Physics* Volumes 1–3 Vol. 1: *Mechanics*; Vol. 2: *Electrodynamics and Optics*; Vol. 3: *Structure and Properties of Substance* (Moscow: Fizmatlit, 2000)

The presentation of material in this textbook follows the logical structure of physics as a science while at the same time reflecting current trends in physics teaching. The organization of the material into two categories, obligatory and supplementary, enables the teacher to tailor the course to an individual student and to plan a student's self-study program. The books contains a large amount of didactic material. A valuable source for schools, gymnasiums, and lyceums with

mathematics- and physics-dominated curricula as well as for school leavers preparing to college entrance exams. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fiz-mat@maik.rssi.ru)

Irodov I E *Wave Processes. Basic Laws* College textbook (Moscow: Laboratoriya Bazovykh Znaniĭ-Fizmatlit, 2000) 256 pp.

This college manual presents the theoretical background for understanding and the basic ideas behind wave processes. The book's major feature is many worked out examples and problems, which are closely linked to the main text material and often serve to supplement and develop it. For each problem the author outlines what he considers to be the most efficient solution strategy. The book avoids unnecessary mathematics and puts emphasis on the physical aspects of the phenomena studied. The textbook is recommended by the Ministry of Education of the Russian Federation. (Laboratoriya Bazovykh Znaniĭ contact information: tel. (7-095) 973-9064; Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

**Irodov I E** *Mechanics. Basic Laws* College textbook 5th revised edition (Moscow: Laboratoriya Bazovykh Znaniĭ–Fizmatlit, 2000) 320 pp.

The book covers the basic laws of both Newtonian mechanics and relativistic mechanics — i.e. the laws of motion and the laws of conservation of momentum, energy, and angular momentum — using numerous examples and problems to illustrate their application. The presentation of the energy and angular momentum conservation laws have been somewhat revised and improved for this edition as compared with the 4th edition of 1997, the section 'Geometrical interpretation of the Lorentz transformations' has been omitted for methodological reasons, and misprints removed wherever found. Recommended by the Ministry of Education of the Russian Federation as a textbook for college and university students in physics. (Laboratoriya Bazovykh Znaniĭ contact information: tel. (7-095) 973-9064; Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

### **Titomir L I, Kneppo P** Mathematical Simulation of the Bioelectrical Heart Generator (Moscow: Fizmatlit, 2000) 448 pp.

This monograph describes the mathematical models, well grounded from both electrophysiological and biophysical viewpoints, of the bioelectric heart generator and its electromagnetic field. Based on the electrodynamics of steady-state currents and on the multipole theory, it formulates level models for such objects as an excitable cell membrane, an individual cell, a macroscopic portion of the myocardium, the heart as a functioning body organ, and the entire body as a bulk conductor with an electrogenic region inside. The book discusses new methods by which electrophysiological heart characteristics may be presented in substantive-figurative manner suited to cardio-diagnostics computer systems. It also updates and extends the theoretical material of the authors' previous book Bioelectric and Biomagnetic Fields. Theory and Applications in Electrocardiology (Boca Raton, FL: CRC Press, 1994) as well as presents entirely new material based on recent research. For researchers as well as undergraduate and post-graduate students in theoretical and experimental electrocardiology, heart biophysics, biosystem modelling, and computer-aided automation of electrocardiographic diagnostics. (Fizmatlit contact information: tel. (7-095) 334-7421, e-mail: fizmat@maik.rssi.ru)

Khanin Ya I Fundamental Laser Dynamics (Moscow: Nauka-Fizmatlit, 1999) 368 pp. Bibliography: 584 refs. RFBR project 98-02-30034.

This book reviews the current status of laser dynamics. It provides the reference material and major experimental facts about old- and new-generation lasers and describes the most common mathematical models, for each of which the areas of applicability are indicated. The book examines the impact of various physical factors on the stability of stationary lasing and discusses laser operation above the instability threshold. Coverage also includes bifurcation, changing of laser behavior under variation of controlling parameters, spontaneous intensity pulsations in solid-state lasers, and the effects of unsteady parameters and nonlinear laser elements on lasing characteristics. Special attention is given to the low-frequency dynamics of multimodal lasers. The book is intended for undergraduate and post-graduate students and researchers in quantum electronics and laser physics. ('Fiziko-Matematicheskaya Literatura RAN' Publ. regular mail address: 117071 Moscow V-71, Leninskiĭ prospekt 15)

Vasil'ev A N Quantum Field Renormalization Group in the Theory of Critical Behavior and in Stochastic Dynamics (St. Petersburg: PIYaF Publ., 1998) 774 pp. Bibliography: 239 refs. RFBR project 96-02-30086.

This book examines the quantum-field renormalization group technique and its numerous applications to the theory of critical behavior and to stochastic dynamics. The book has developed from a lecture course of the same name for undergraduate students in theoretical physics at St. Petersburg State University and is intended for use as an advanced textbook as well as a reference source. With Chapters 2 and 3 presenting all the necessary reference material on the functional and diagram techniques as well as the theory of ultraviolet renormalization, the book assumes no previous knowledge of the mathematical apparatus of quantum field theory. The book's distinctive feature is that it aims primarily to give a detailed description of calculating technique, and accordingly any major point is illustrated by detailed specific calculation — hence the claim for college textbook status. The second objective, to make a reference source, is achieved by the meticulous removal of misprints and use of a unified notation and the maximum accuracy currently available when presenting the final results of computations. As a result, the reader can find all the necessary information without referring to original works. The higher-than-usual level of details in discussing stochastic dynamics problems is another feature of the book. An indispensable source for researchers, undergraduate and post-graduate students in theoretical physics. (PIYaF RAN Publ. regular mail address: 188350 Gatchina, Leningrad region, Orlova Roshcha)

*Physical Ecology (Physical Problems in Ecology)* (Eds V I Trukhin, Yu A Pirogov, and K V Pokazeev) Issue no. 1 (Moscow: MSU Physics Department Publ., 1998) 164 pp.

This book is another volume in series of the proceedings of the First All-Russian Conference 'Physical Problems in Ecology (Physical Ecology)', which was organized by the MSU Physics Department and the Pushchino Research Center, RAS under the sponsorship of the RF Ministry of General and Professional Education, Ministry of Science, and RFBR, and was held at the MSU Physics Department on June 23-27, 1997. The first portion of the conference reports was published as a special, April 1998 issue of the journal Vestnik Moskovskogo Universiteta, Ser. 3: Fizika. Astronomiya (4) (1998), and the remaining papers, by the same publisher and under the same editorship as the present publication, in the Physical Ecology (Physical Problems in Ecology) collection in 1998 (Nos 2 and 3). Coverage includes the ecology of the Earth's upper atmosphere and circumterrestrial space, ecological problems in geophysics, physical approaches to the monitoring of natural media, and the impact of physical factors on biological objects. The papers of the Second All-Russian Conference 'Physical Problems in Ecology (Physical Ecology)', held at the MSU Physics Department on January 18-21, 1999, were published in 1999 in issues Nos 4 and 5 of the same collection (the same editors and publishers again). This edition was supported by the federal special-purpose program 'Integratsiya' through Grants 2.1-304 and M0020. The abstracts of the conference papers are also available in an MSU Physics Department 1999 publication. (MSU Physics Department Publ. regular mail address: 119899 Moscow, Vorob'evy Gory, M V Lomonosov MSU, Physics Department)

VIII School on Neutron Physics (Dubna, August 30 – September 5, 1998) (Dubna: OIYaI Publ., 1999) 330 pp.

The book presents some of the lectures from the VIII School on neutron physics, organized by the I M Frank Neutron Physics Laboratory (OIYaI, Dubna) and M V Lomonosov MSU to commemorate the 90th anniversary of the birth of I M Frank (October 23, 1908-June 22, 1990), Nobel laureate in physics (1958) and the Laboratory's first director (1957). After the first such school in 1969, initiated by Norbert Kroo and organized by the Neutron Physics Laboratory, all subsequent schools were headed by I M Frank until his death. The eighth school, the first to be carried out as a joint MSU-Frank Laboratory effort, was fully oriented towards students, both undergraduate and post-graduate, and was indeed a schooling event in the sense that, unlike a conference, it was organized as a complete educational cycle, with leading Russian scientists delivering plenary session lectures on topical problems in condensed matter physics and nuclear physics.

**Pobedrya B E, Georgievskii D V** *Lectures on Elasticity Theory* (Moscow: Editorial URSS, 1999) 208 pp. Bibliography: 30 refs. RFBR project 98-01-14063, Federal special-purpose Integratsiya program (project No 426).

This book is intended for a wide range of readers who have taken a differential calculus technical college course and are interested in elasticity theory as taught at the mechanics and mathematics departments of classical universities. Additional mathematical apparatus is introduced whenever required. Some portions of the lecture course were taught at the MSU Mechanics and Mathematics Department, at the Materials Science Higher College, and at Havana University. (Editorial URSS Publ. contact information: tel./fax (7-095) 135-4423, tel. (7-095) 135-4246, e-mail: urss@urss.isa.ac.ru)

Zagoruĭko N G Applied Methods of Data and Knowledge Analysis (Novosibirsk: Institute of Mathematics Publ., 1999) 270 pp. Bibliography: 168 refs. RFBR project 98-01-14175.

The primary objective of the computer processing of experimental or statistical data is the automated discovery of hidden regular features, knowledge of which may reveal the essence of the process under study and, based on available data, may lead to new predictions. The first part of Zagoruĭko's book constitutes an explanation of fundamental principles underlying this realm of science. The second covers a wide variety of methods and algorithms for extracting new knowledge from data at hand. Massive amounts of knowledge also require computer processing if regular features of higher order are to be found. The third part is devoted to knowledge analysis methods. The book presents original results of research by the author and his colleagues. Most of the algorithms presented in the book have been widely used for a long time in solving applied problems in geology, medicine, economics, oceanology, and many other disciplines. The book will serve as a useful introduction to modern methods of data and knowledge analysis for college and university students in many academic disciplines. Post-graduate students in statistics and artificial intelligence will find the book a valuable source of novel research topics, and practitioners in many and varied applied areas will learn about new tools and techniques they can employ in pre-decision-making information analysis.

Frolov A D Electrical and Elastic Properties of Frozen Rocks and Ices (Pushchino: ONTI PNTs RAN Publ., 1998) 515 pp. Bibliography: 300 refs. RFBR project 96-05-78144.

The 1976 book Electrical and Elastic Properties of Cryogenic *Rocks*, the first attempt to summarize the knowledge of the physics of cryogenic rocks, has now been revised and enlarged into what is, in fact, a new book. Treating cryogenic rocks (i.e. ices and frozen rocks of different composition) as heterogeneous multiphase systems, the book describes their salient features and analyzes experimental data on their electrical and elastic properties. Special attention is given to the effect on these properties of such factors as temperature of a cryogenic rock, percentage of an unfrozen liquid phase, ice content, lithology, ac electromagnetic field frequency, etc. The book also examines the interrelation of the electrical, elastic, strength, and other properties of cryogenic rocks, illustrates the critical role of liquid phase content, ice content, and cryogenic texture in determining many of these physical properties, and describes the physical principles underlying the electrometrical and acoustic methods for studying and monitoring the composition and state of cryogenic rocks. The propagation of elastic and electromagnetic waves in such media is also discussed. The book is based on years of study in the field and will be a valuable source of information for specialists and researchers in mining, permafrostology, engineering geology, geophysics, and civil engineering. (Science and Technology Information Department of the RAS Pushchino Science Center regular mail address: 142292 Pushchino, Moscow region, prospekt Nauki 3: ONTI)

Neutronics-98 (27–28 October 1998, Obninsk): Algorithms and programs for the neutron design of a reactor. Proceedings of the seminar (Ed.-in-chief O G Komlev) (Obninsk: FEI Publ., 1999) 272 pp.

This collection is based on materials presented at the 9th seminar on algorithms and programs for neutron design of nuclear reactors, held in Obninsk, Russia, October 27-28, 1998. Containing over 50 papers by recognized experts from research institutes, design offices, and higher education institutions, the book covers program verification and validation problems, program testing systems, methods and programs for solving nonstationary problems, and numerical methods for solving transport equations. The papers published are those submitted to the seminar's Organizing Committee. (FEI Publ. regular mail address: 249020, Obninsk, Kaluga region, pl. Bondarenko 1)

Sonin A S, Frenkel' V Ya Vsevolod Konstantinovich Frederiks: 1885 – 1944 (Ed.-in-chief B K Vaĭnshteĭn) (Moscow: Nauka. Fizmatlit, 1995) 176 pp. Bibliography: 172 refs. RFBR project 95-06-32012.

A valuable addition to the *Scientific Biographies* series, this volume describes the life and scientific career of the Russian physicist Vsevolod Konstantinovich Frederiks. A theoretician, experimenter, engineer, all in one person, a pioneer in many areas of solid-state physics and liquid crystal physics, and author of many books and college manuals, he was the first to advocate general relativity theory in Russia. For physicists and all those interested in the history of science. ('Fiziko-Matematicheskaya Literatura RAN' Publ. regular mail address: 117071 Moscow V-71, Leninskiĭ prospekt 15)

Compiled by E V Zakharova