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New books on physics and related sciences

General Physics Institute of the Russian Academy of Sciences (Eds A M Prokhorov, E M Dianov, V V Osiko, P P Pashinin, I A Shcherbakov, T B Volyak, V P Kalinushkin, and B V Ershov) (Moscow: Radékon, 1997) 160 pp.

This collection of PR materials on the General Physics Institute, RAS introduces the reader to the structure and substructure of the institute, lists its basic research areas, highlights the latest advances, shows the institute's links with other scientific institutions in Russia and abroad, and considers prospects for the future scientific activity. Of special interest is the advertising of the unique equipment developed at the institute for a variety of uses in fundamental and applied science as well as in technology, medicine and ecology. For those interested in the structure, main research directions, basic achievements, and prospects of the institute.

Mechanisms of Secondary Electron Emission from a Solid Surface with Relief (Proceedings of IOFAN, Vol. 55; ed.-in-chief Yu A Novikov) (Moscow: Nauka – Fizmatlit, 1998) 128 pp.

This book examines methods for, and analyzes the results of, the study of secondary electron emission from a solid surface with relief in a scanning electron microscope operating in the regime of collecting low-energy and back-scattered secondary electrons. A new mechanism of the secondary electron generation, the emission of surface state electrons when acted upon by an incident primary electron, is considered and its use in measuring linear dimensions of microstructures in a scanning electron microscope is illustrated. An important resource for researchers, engineers, and undergraduate and post-graduate students engaged in studying solid surfaces, secondary electron emission, and applications of scanning electron microscopy.

Third International Symposium on Classical and Celestial Mechanics (23 – 28 August 1998, Velikie Luki, Russia) Abstracts of papers (Eds V V Rumyantsev, I I Kosenko) (Moscow – Velikie Luki: RAS Computation Centre Publ., 1998) 188 pp. RFBR project 98-01-10085.

This volume provides abstracts of papers on classical mechanics, with special emphasis on rigid-body dynamics and the theory of stability. Many of the papers are concerned with the mathematical methods of mechanics, and in the areas of astronomy and celestial mechanics much attention is given to the many-body problem and to the analysis of spacecraft flight. Some problems in applied celestial mechanics and in particular the effect of solar light pressure on the motion of celestial bodies are also analyzed.

Uspekhi Fizicheskikh Nauk **169** (7) 821 – 822 (1999)
Translated by E G Strel'chenko

Physics and Chemistry of Silicates and Oxides (Ed.-in-chief M M Shul'ts) (Saint-Petersburg: Nauka, 1998) 305 pp.

Marking the 50th anniversary of the I V Grebenshchikov Institute of Silicate Chemistry, this collection covers the basic research areas and major achievements of the institute, whose fundamental and applied research has the development of new silicates and high-melting oxide materials as the primary objective.

Rapid Explosive Initiation. Special Detonation Regimes. A collection of papers (Ed. V I Tarzhanov) (Snezhinsk, Chelyabinsk region: RFYaTs – VNIITF Press, 1998) 168 pp.

In this collection of twenty scientific papers, researchers from the Russian Federal Nuclear Centre — All-Russian Research Institute of Technical Physics (VNIITF) summarize an experimental study of laser-assisted explosive initiation and suggest a rapid initiation phenomenology based on the results of this study. New special detonation regimes in explosionable media are explored both experimentally and theoretically, and common approaches to all currently known stationary detonation regimes are developed. The prospects for both conventional and novel multichannel diagnostic techniques as applied to explosive processes are analyzed in detail. A much needed guide for researchers, engineers, and post-graduate students interested in the study and use of energetically reach materials in explosion technologies.

Arutyunov A V ***Extremum Conditions. Anomalous and Degenerate Problems*** (Moscow: Faktorial, 1997) 256 pp. Bibliography: 94 refs. RFBR project 95-01-21076.

In this book one of the central questions in the theory of extremal problems — that of necessary and sufficient extremum conditions — is explored. Focusing on the so-called anomalous and degenerate problems, the author develops a formalism which together with the perturbation theory method presents an efficient tool for treating this class of problems. For mathematical programming problems, new necessary and sufficient conditions of the first and second order are presented, which turn into their classical counterparts when normal problems are addressed. A class of common-position 2-normal constraints is identified, for which the necessary conditions become sufficient ones after a second-order perturbation procedure is applied. A simple method for proving Pontrjagin's principle of the maximum is described with special emphasis on phase-constrained problems and maximum-principle nondegeneracy conditions. For the degenerate quadratic forms of the calculus of variations with violated strong Legendre condition, a formula for computing the index is presented and criteria for their nonnegativity are developed. Vital reading for undergraduate and post-graduate students, researchers, and all those interested in optimization problems.

Zelikin M I ***Homogeneous Spaces and the Riccati Equation in Calculus of Variations*** (Moscow: Faktorial, 1998) 351 pp. Bibliography: 122 refs. RFBR project 95-01-02867.

This book considers the geometrical methods in the theory of (Riccati type) differential equations with a quadratic right-hand side, which are closely related both to the calculus of variations and to optimal control problems. Special attention is given to how the calculus of variations and Riccati equations relate to the geometry of Lagrange – Grassman manifolds and to Cartan – Siegel's classical domains of homogeneity in multivariable complex space. On investigating the problem of minimization of the multiple integral, the quadratic partial differential equation representing an analog of the Riccati equation in calculus of variations was deduced and analyzed. The book has been developed from a lecture course given by the author at the MSU Department of Mechanics and Mathematics over a period of several years. An important resource for researchers, undergraduate and post-graduate students and for all those concerned with geometry, calculus of variations, and differential equations.

Petrov K P ***Aerodynamics of Bodies of Elementary Configurations.*** A scientific publication (Moscow: Faktorial, 1998) 432 pp. Bibliography: 70 refs.

This volume discusses flowfield and aerodynamic data obtained experimentally on bodies of simple geometries in subsonic, transonic and supersonic flows at practical angles of attack. Data on both individual and interfering flowfields are presented. Organized into eight chapters, the book examines flat, spherical, cone-shaped, cylindrical, segment-conical and drop-shaped bodies and bodies formed by conical and cylindrical surfaces, thus covering both typical flight vehicle configurations and those of ground transportation vehicles and engineering structures operating in air flow. For university students and teachers, aerodynamic design engineers, and researchers involved in the development of computational methods for aerodynamics.

Kuznetsov V A, Yalunina G V ***Metrology*** (Theory, Application, Law) Textbook (Ed. V A Kuznetsov) (Moscow: IPK Standard Publishing, 1998) 336 pp. Bibliography: 39 refs.

This book looks at metrology as a science concerned with measurements, methods and means that provide their traceability. Introducing the basic terms, definitions and concepts used in the field, the authors present the major systems of units of physical quantities (measurement units) and illustrate their uses for measuring. The authors consider the general concepts embodied in the construction of standards for primary measurement units, the metrological characteristics of measuring procedures and devices, methods of measurement data processing as well as methods providing traceability of measurements. Other topics include the error classification and estimation methods. Recommended by the General and Professional Education Ministry as a student-level instrument engineering textbook, *Metrology* will also interest researchers engaged in the development and application of measuring techniques and will be useful to everyone working on the metrological support of engineering systems.

Semenov A A ***Take a Look at the Past.*** Autobiographical Essays of a Soviet Physicist (Tomsk: Tomsk State University of Control Systems and Radioelectronics, 1998) 240 pp.

The memoirs of the Doctorate of Physicomathematical Sciences, Professor Aleksandr Aleksandrovich Semenov, the author of over 100 scientific papers, several monographs and textbooks, currently a science consultant and formerly (1973 – 1986) a laboratory head at the Institute of Radio Engineering and Electronics, RAS.

Reshetnyak S A, Shelepin L A ***Quasi-stationary Distributions in Kinetics*** (Moscow: Avtor, 1996) 296 pp., 39 figures

Based on the use of Green's functions and on the consistent generalization of equilibrium statistical theory to nonequilibrium processes, the authors develop a universal approach allowing the formalization of the analysis of various kinetic phenomena. Specific topics covered from the unified standpoint include processes in gases and plasmas, chemical processes, phase transitions, statistical radiophysics, and coherent phenomena.

The books listed above are currently available in the library stock of the MSU Department of Physics.

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