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Plasma Physics Introduction to Plasma Physics and Controlled Fusion Plasma Physics Introduction to Plasma Physics **Plasma Physics: An Introductory Course Plasma Physics for Astrophysics** Plasma Physics and Controlled Nuclear Fusion **Principles of Plasma Physics Comments on Plasma Physics and Controlled Fusion The Framework Of Plasma Physics Introduction to Plasma Physics** *Plasma Physics* **Physics of the Solar Corona** *Basic Space Plasma Physics* Controlled Fusion and Plasma Physics **Fundamentals of Plasma Physics and Controlled Fusion** *Fundamentals of Plasma Physics Introduction to Plasma Physics* Reviews of Plasma Physics **An Introduction to Plasma Physics** *Plasma Physics Plasma Physics and Engineering, Second Edition* Statistical Plasma Physics, Volume I *Advances in Plasma Physics Research* **Theoretical Methods in Plasma Physics The Physics of Plasmas Plasma Physics** *Fundamentals of Plasma Physics 23rd European Physical Society Conference on Controlled Fusion and Plasma Physics* Sources of Plasma Physics *The Zakharov System and its Soliton Solutions Fundamentals of Plasma Physics* **Cosmic Plasma Physics Selected Topics in Plasma Physics Plasma Physics for Nuclear Fusion Fundamentals of Plasma Physics** *Plasma Physics* **Principles of Plasma Discharges and Materials Processing Plasma Physics Reports** *Periodic, Small-amplitude Solutions to the Spatially Uniform Plasma Continuity Equations*

Statistical Plasma Physics, Volume I Dec 10 2020 Plasma physics is an integral part of statistical physics, complete with its own basic theories. Designed as a two-volume set, Statistical Plasma Physics is intended for advanced undergraduate and beginning graduate courses on plasma and statistical physics, and as such, its presentation is self-contained and should be read without difficulty by those with backgrounds in classical mechanics, electricity and magnetism, quantum mechanics, and statistics. Major topics include: plasma phenomena in nature, kinetic equations, plasmas and dielectric media, electromagnetic properties of Vlasov plasmas in thermodynamic equilibria, transient processes, and instabilities.
An Introduction to Plasma Physics Mar 13 2021 Problems and answers to problems
Plasma Physics for Nuclear Fusion Nov 28 2019 The original English-language edition of this work appeared in 1979. Since then researchers around the world have made slow but steady progress toward the realization of sustained, controlled nuclear fusion. This new edition has been updated to review the important contributions of the past decade. The final chapter, "Confinement of High-Temperature Plasmas, " has been rewritten entirely to include the recent results of confinement in several types of devices and advances the under standing of wave heating. Miyamoto's approach is unique in encompassing Western, Soviet, and Japanese research in the fusion field. The book's 16 chapters are grouped into four major subject areas. Chapters in the first part develop the fundamentals of plasma physics and present the conditions of nuclear fusion reactions; those in the next two parts provide a magnetohydrodynamic description of plasmas and explain wave phenomena and instabilities by means of a kinetic model. Concluding chapters take up the problems of heating, diagnostics, and confinement. Specific topics include the Lawson condition; Boltzmann and Vlasov equations; plasma equilibrium; magnetohydrodynamic instabilities; waves in cold and hot plasmas; microinstabilities; fast neutral beam injection and wave heating; and diagnostics using microwaves, lasers, and energy analyzers. Plasma confinement in tokamaks and stellarators, multipole fields, mirrors, and cusps, as well as inertial confinement, are reviewed. Kenro Miyamoto, is Professor of Physics at the University of Tokyo.
Introduction to Plasma Physics and Controlled Fusion Sep 30 2022 TO THE SECOND EDITION

In the nine years since this book was first written, rapid progress has been made scientifically in nuclear fusion, space physics, and nonlinear plasma theory. At the same time, the energy shortage on the one hand and the exploration of Jupiter and Saturn on the other have increased the national awareness of the important applications of plasma physics to energy production and to the understanding of our space environment. In magnetic confinement fusion, this period has seen the attainment 13 of a Lawson number nTE of 2 x 10 cm -3 sec in the Alcator tokamaks at MIT; neutral-beam heating of the PL T tokamak at Princeton to KTi = 6. 5 keV; increase of average ß to 3%-5% in tokamaks at Oak Ridge and General Atomic; and the stabilization of mirror-confined plasmas at Livermore, together with injection of ion current to near field-reversal conditions in the 2XIIß device. Invention of the tandem mirror has given magnetic confinement a new and exciting dimension. New ideas have emerged, such as the compact torus, surface-field devices, and the EßT mirror-torus hybrid, and some old ideas, such as the stellarator and the reversed-field pinch, have been revived. Radiofrequency heat ing has become a new star with its promise of dc current drive. Perhaps most importantly, great progress has been made in the understanding of the MHD behavior of toroidal plasmas: tearing modes, magnetic Vll Vlll islands, and disruptions.
Plasma Physics Reports Jul 25 2019
Plasma Physics Aug 06 2020 The enlarged new edition of this textbook provides a comprehensive introduction to the basic processes in plasmas and demonstrates that the same fundamental concepts describe cold gas-discharge plasmas, space plasmas, and hot fusion plasmas. Starting from particle drifts in magnetic fields, the principles of magnetic confinement fusion are explained and compared with laser fusion. Collective processes are discussed in terms of plasma waves and instabilities. The concepts of plasma description by magnetohydrodynamics, kinetic theory, and particle simulation are stepwise introduced. Space charge effects in sheath regions, double layers and plasma diodes are given the necessary attention. The novel fundamental mechanisms of dusty plasmas are explored and integrated into the framework of conventional plasmas. The book concludes with a concise description of modern plasma discharges. Written by an internationally renowned researcher in experimental plasma physics, the text keeps the mathematical apparatus simple and emphasizes the underlying concepts. The guidelines of plasma physics are illustrated by a host of practical examples, preferentially from plasma diagnostics. There, Langmuir probe methods, laser interferometry, ionospheric sounding, Faraday rotation, and diagnostics of dusty plasmas are discussed. Though primarily addressing students in plasma physics, the book is easily accessible for researchers in neighboring disciplines, such as space science, astrophysics, material science, applied physics, and electrical engineering. This second edition has been thoroughly revised and contains substantially enlarged chapters on plasma diagnostics, dusty plasmas and plasma discharges. Probe techniques have been rearranged into basic theory and a host of practical examples for probe techniques in dc, rf, and space plasmas. New topics in dusty plasmas, such as plasma crystals, Yukawa balls, phase transitions and attractive forces have been adopted. The chapter on plasma discharges now contains a new section on conventional and high-power impulse magnetron sputtering. The recently discovered electrical asymmetry effect in capacitive rf-discharges is described. The text is based on an introductory course to plasma physics and advanced courses in plasma diagnostics, dusty plasmas, and plasma waves, which the author has taught at Kiel University for three decades. The pedagogical approach combines detailed explanations, a large number of illustrative figures, short summaries of the basics at the end of each chapter, and a selection of problems with detailed solutions.
Principles of Plasma Physics Mar 25 2022
Physics of the Solar Corona Oct 20 2021 A thorough introduction to solar physics based on recent spacecraft observations. The author introduces the solar corona and sets it in the context of basic plasma physics before moving on to discuss plasma instabilities and plasma heating processes. The latest results on coronal heating and radiation are presented. Spectacular phenomena such as solar flares and coronal mass ejections are described in detail, together with their potential effects on the Earth.
23rd European Physical Society Conference on Controlled Fusion and Plasma Physics Jun 03 2020
The Framework Of Plasma Physics Jan 23 2022 This book provides an excellent introduction to the fundamental physics of plasmas, which comprise most of the matter in the universe. It is based on lectures that were used for an introductory plasma course at the graduate level.

Plasma Physics Feb 09 2021 This edited collection of papers by pioneering experts was a standard text throughout the 1960s and 70s. A timeless introduction to foundations of plasma physics and a valuable source of historic context. 1961 edition.

The Zakharov System and its Soliton Solutions Apr 01 2020 This book focuses on the theory of the Zakharov system in the context of plasma physics. It has been over 40 years since the system was first derived by V. E. Zakharov – and in the course of those decades, many innovative achievements with major impacts on other research fields have been made. The book represents a first attempt to highlight the mathematical theories that are most important to researchers, including the existence and unique problems, blow-up, low regularity, large time behavior and the singular limit. Rather than attempting to examine every aspect of the Zakharov system in detail, it provides an effective road map to help readers access the frontier of studies on this system.

Sources of Plasma Physics May 03 2020

Comments on Plasma Physics and Controlled Fusion Feb 21 2022

Introduction to Plasma Physics Jul 29 2022 This book grew out of lecture notes for an undergraduate course in plasma physics that has been offered for a number of years at UCLA. With the current increase in interest in controlled fusion and the wide spread use of plasma physics in space research and relativistic as trophysics, it makes sense for the study of plasmas to become a part of an undergraduate student's basic experience, along with subjects like thermodynamics or quantum mechanics. Although the primary purpose of this book was to fulfill a need for a text that seniors or juniors can really understand, I hope it can also serve as a painless way for scientists in other fields-solid state or laser physics, for instance to become acquainted with plasmas. Two guiding principles were followed: Do not leave algebraic steps as an exercise for the reader, and do not let the algebra obscure the physics. The extent to which these opposing aims could be met is largely due to the treatment of a plasma as two interpenetrating fluids. The two-fluid picture is both easier to understand and more accurate than the single-fluid approach, at least for low-density plasma phe nomena.

The Physics of Plasmas Sep 06 2020 A comprehensive introductory graduate textbook illustrating specialised topics in current physics.

Introduction to Plasma Physics Dec 22 2021 Introduction to Plasma Physics presents the latest on plasma physics. Although plasmas are not very present in our immediate environment, there are still universal phenomena that we encounter, i.e., electric shocks and galactic jets. This book presents, in parallel, the basics of plasma theory and a number of applications to laboratory plasmas or natural plasmas. It provides a fresh look at concepts already addressed in other disciplines, such as pressure and temperature. In addition, the information provided helps us understand the links between fluid theories, such as MHD and the kinetic theory of these media, especially in wave propagation. Presents the different phenomena that make up plasma physics Explains the basics of plasma theory Helps readers comprehend the various concepts related to plasmas

Controlled Fusion and Plasma Physics Aug 18 2021 Resulting from ongoing, international research into fusion processes, the International Tokamak Experimental Reactor (ITER) is a major step in the quest for a new energy source.The first graduate-level text to cover the details of ITER, Controlled Fusion and Plasma Physics introduces various aspects and issues of recent fusion research activities through the shortest access path. The distinguished author breaks down the topic by first dealing with fusion and then concentrating on the more complex subject of plasma physics. The book begins with the basics of controlled fusion research, followed by discussions on tokamaks, reversed field pinch (RFP), stellarators, and mirrors. The text then explores ideal magnetohydrodynamic (MHD) instabilities, resistive instabilities, neoclassical tearing mode, resistive wall mode, the Boltzmann equation, the Vlasov equation, and Landau damping. After covering dielectric tensors of cold and hot plasmas, the author discusses the physical mechanisms of wave heating and noninductive current drive. The book concludes with an examination of the challenging issues of plasma transport by turbulence, such as magnetic fluctuation and zonal flow. Controlled Fusion and Plasma Physics clearly and thoroughly promotes intuitive understanding of the developments of the principal fusion programs and the relevant fundamental and advanced plasma physics associated with each program.

Plasma Physics for Astrophysics May 27 2022 In this book, a distinguished expert introduces plasma physics from the ground up, presenting it as a comprehensible field that can be grasped largely on the basis of physical intuition and qualitative reasoning, similar to other fields of physics. Plasmas are ionized gases that can be found in a hydrogen bomb explosion, the confinement chamber of an experimental fusion reactor, the solar corona, the aurora borealis, the interstellar medium, and the immediate vicinity of a gravitational black hole. Not surprisingly, plasma physics appears to consist of numerous topics arising independently from astrophysics, fusion physics, and other practical applications, and hence it remains a field poorly understood even by many astrophysicists. But, in fact, most of these topics can be approached from the same perspective, with a simple, physical intuition. Selecting simple examples and presenting them in a simultaneously intuitive and rigorous manner, Russell Kulsrud guides readers through a careful derivation of the results and allows them to think through the physics for themselves. Thus, they are better prepared for complex cases and more general results. The first eleven chapters present topics by their importance to plasma physics while the last three chapters emphasize the field's astrophysical applications, applying the results accrued earlier. Throughout, many problems illustrate the field's applications. Based on a course the author taught for many years, Plasma Physics for Astrophysics is intended for graduate students as well as for working astrophysicists.

Fundamentals of Plasma Physics Jul 05 2020

Plasma Physics: An Introductory Course Jun 27 2022 A wide-ranging introduction to the theoretical and experimental study of plasmas and their applications.

Plasma Physics and Engineering, Second Edition Jan 11 2021 Plasma plays an important role in a wide variety of industrial processes, including material processing, environmental control, electronic chip manufacturing, light sources, and green energy, not to mention fuel conversion and hydrogen production, biomedicine, flow control, catalysis, and space propulsion. Following the general outline of the bestselling first edition, Plasma Physics and Engineering, Second Edition provides a clear fundamental introduction to all aspects of the modern field. Reflecting recent scientific and technological developments, this resource will be useful to engineers, scientists, and students working with the physics, engineering, chemistry, and combustion of plasma, as well as chemical physics, lasers, electronics, new methods of material treatment, fuel conversion, and environmental control. The book includes many enhancements and some totally new coverage of fundamental subjects such as: Interaction and dynamics of streamers Plasma-flow interaction High-speed plasma aerodynamics Plasma-surface interaction Mechanisms and kinetics of plasma–medical processes Along with these new topics and deeper coverage of material from the first book, this edition presents two new chapters on microdischarges and discharges in liquids. It also contains an extensive database on plasma kinetics and thermodynamics, many helpful numerical formulas for practical calculations, and an array of problems and concept questions. PowerPointTM slides and a solutions manual are available for qualifying instructors who adopt this book for their courses.

Principles of Plasma Discharges and Materials Processing Aug 25 2019 A Thorough Update of the Industry Classic on Principles of PlasmaProcessing The first edition of Principles of Plasma Discharges and MaterialsProcessing, published over a decade ago, was lauded for itscomplete treatment of both basic plasma physics and industrialplasma processing, quickly becoming the primary reference forstudents and professionals. The Second Edition has been carefully updated and revised toreflect recent developments in the field and to further clarify thepresentation of basic principles. Along with in-depth coverage ofthe fundamentals of plasma physics and chemistry, the authors applybasic theory to plasma discharges, including calculations of plasmaparameters and the scaling of plasma parameters with controlparameters. New and expanded topics include: * Updated cross sections * Diffusion and diffusion solutions * Generalized Bohm criteria * Expanded treatment of dc sheaths * Langmuir probes in time-varying fields * Electronegative discharges * Pulsed power discharges * Dual frequency discharges * High-density rf sheaths and ion energy distributions * Hysteresis and instabilities * Helicon discharges * Hollow cathode discharges * Ionized physical vapor deposition * Differential substrate charging With new chapters on dusty plasmas and the kinetic theory ofdischarges, graduate students and researchers in the field ofplasma processing should find this new edition more valuable thanever.

Plasma Physics Sep 26 2019 Plasma Physics - Basic Theory with Fusion Applications presents a thorough treatment of plasma physics, beginning at an introductory level and including an extensive discussion of applications in thermonuclear fusion research. The physics of fusion plasmas is explained in relation to recent progress in tokamak research and other plasma confinement schemes, such as stellarators and intertial confinement. The unique and systematic presentation and numerous problems will help readers to understand the overall structure of plasma theory and will facilitate access to more advanced literature on specialized topics. This new edition has been updated with more recent-results.

Cosmic Plasma Physics Jan 29 2020 This unusual book considers physical principles, starting from the most general ones, and simplifies assumptions, helping students answer two key questions: what approximation is the simplest, but still sufficient for the description of a phenomenon in cosmic plasmas, and how to build an adequate model.

Fundamentals of Plasma Physics Oct 27 2019 This rigorous explanation of plasmas is relevant to diverse plasma applications such as controlled fusion, astrophysical plasmas, solar physics, magnetospheric plasmas, and plasma thrusters. More thorough than previous texts, it exploits new powerful mathematical techniques to develop deeper insights into plasma behavior. After developing the basic plasma equations from first principles, the book explores single particle motion with particular attention to adiabatic invariance. The author then examines types of plasma waves and the issue of Landau damping. Magnetohydrodynamic equilibrium and stability are tackled with emphasis on the topological concepts of magnetic helicity and self-organization. Advanced topics follow, including magnetic reconnection, nonlinear waves, and the Fokker-Planck treatment of collisions. The book concludes by discussing unconventional plasmas such as non-neutral and dusty plasmas. Written for beginning graduate students and advanced undergraduates, this text emphasizes the fundamental principles that apply across many different contexts.

Periodic, Small-amplitude Solutions to the Spatially Uniform Plasma Continuity Equations Jun 23 2019

Plasma Physics Nov 01 2022 This book provides the ideal introduction to this complex and fascinating field of research, balancing the theoretical and practical and preparing the student for further study.

Plasma Physics Nov 20 2021 The enlarged new edition of this textbook provides a comprehensive introduction to the basic processes in plasmas and demonstrates that the same fundamental concepts describe cold gas-discharge plasmas, space plasmas, and hot fusion plasmas. Starting from particle drifts in magnetic fields, the principles of magnetic confinement fusion are explained and compared with laser fusion. Collective processes are discussed in terms of plasma waves and instabilities. The concepts of plasma description by magnetohydrodynamics, kinetic theory, and particle simulation are stepwise introduced. Space charge effects in sheath regions, double layers and plasma diodes are given the necessary attention. The novel fundamental mechanisms of dusty plasmas are explored and integrated into the framework of conventional plasmas. The book concludes with a concise description of modern plasma discharges. Written by an internationally renowned researcher in experimental plasma physics, the text keeps the mathematical apparatus simple and emphasizes the underlying concepts. The guidelines of plasma physics are illustrated by a host of practical examples, preferentially from plasma diagnostics. There, Langmuir probe methods, laser interferometry, ionospheric sounding, Faraday rotation, and diagnostics of dusty plasmas are discussed. Though primarily addressing students in plasma physics, the book is easily accessible for researchers in neighboring disciplines, such as space science, astrophysics, material science, applied physics, and electrical engineering. This second edition has been thoroughly revised and contains substantially enlarged chapters on plasma diagnostics, dusty plasmas and plasma discharges. Probe techniques have been rearranged into basic theory and a host of practical examples for probe techniques in dc, rf, and space plasmas. New topics in dusty plasmas, such as plasma crystals, Yukawa balls, phase transitions and attractive forces have been adopted. The chapter on plasma discharges now contains a new section on conventional and high-power impulse magnetron sputtering. The recently discovered electrical asymmetry effect in capacitive rf-discharges is described. The text is based on an introductory course to plasma physics and advanced courses in plasma diagnostics, dusty plasmas, and plasma waves, which the author has taught at Kiel University for three decades. The pedagogical approach combines detailed explanations, a large number of illustrative figures, short summaries of the basics at the end of each chapter, and a selection of problems with detailed solutions.

Theoretical Methods in Plasma Physics Oct 08 2020

Plasma Physics Aug 30 2022 Encompasses the Lectured Works of a Renowned Expert in the Field Plasma Physics: An Introduction is based on a series of university course lectures by a leading name in the field, and thoroughly covers the physics of the fourth state of matter. This book looks at non-relativistic, fully ionized, nondegenerate, quasi-neutral, and weakly coupled plasma. Intended for the student market, the text provides a concise and cohesive introduction to plasma physics theory, and offers a solid foundation for students wishing to take higher level courses in plasma physics. Mathematically Rigorous, but Driven by Physics This work contains over 80 exercises—carefully selected for their pedagogical value—with fully worked out solutions available in a separate solutions manual for professors. The author provides an in-depth discussion of the various fluid theories typically used in plasma physics. The material presents a number of applications, and works through specific topics including basic plasma parameters, the theory of charged particle motion in inhomogeneous electromagnetic fields, plasma fluid theory, electromagnetic waves in cold plasmas, electromagnetic wave propagation through inhomogeneous plasmas, magnetohydrodynamical fluid theory, and kinetic theory. Discusses fluid theory illustrated by the investigation of Langmuir sheaths Explores charged particle motion illustrated by the investigation of charged particle trapping in the earth’s magnetosphere Examines the WKB theory illustrated by the investigation of radio wave propagation in the earth’s ionosphere Studies the MHD theory illustrated by the investigation of solar wind, dynamo theory, magnetic reconnection, and MHD shocks Plasma Physics: An Introduction addresses applied areas and advanced topics in the study of plasma physics, and specifically demonstrates the behavior of ionized gas.

Selected Topics in Plasma Physics Dec 30 2019 This book is planned to introduce the advances topics of plasma physics for research scholars and postgraduate students. This book deals with basic concepts in plasma physics, non-equilibrium plasma modeling, space plasma applications, and plasma diagnostics. It also provides an overview of the linear and nonlinear aspects of plasma physics. Chapters cover such topics as plasma application in space propulsion, microwave–plasma interaction, plasma antennas, solitary waves, and plasma diagnostic techniques.

Introduction to Plasma Physics May 15 2021 Introduction to Plasma Physics is the standard text for an introductory lecture course on plasma physics. The text’s six sections lead readers systematically and comprehensively through the fundamentals of modern plasma physics. Sections on single-particle motion, plasmas as fluids, and collisional processes in plasmas lay the groundwork for a thorough understanding of the subject. The authors take care to place the material in its historical context for a rich understanding of the ideas presented. They also emphasize the importance of medical imaging in radiotherapy, providing a logical link to more advanced works in the area. The text includes problems, tables, and illustrations as well as a thorough index and a complete list of references.

Basic Space Plasma Physics Sep 18 2021 This textbook deals with the requirements of space physics. The first part starts with a description of the Earth's plasma environment, followed by a derivation of single particle motions in electromagnetic fields, with applications to the Earth's magnetosphere. Then the origin and effects of collisions and conductivities, formation of the ionosphere, magnetospheric convection and dynamics, and solar wind-magnetosphere coupling are discussed.The second part of the book presents a more theoretical foundation of plasma physics, starting from kinetic theory. Introducing moments of the distribution function permits derivation of the fluid equations, followed by an analysis of fluid boundaries, with the Earth's magnetopause and bow shock as examples. Finally, fluid and kinetic theory are applied to derive the relevant wave modes in a plasma.A representative selection of the many space plasma instabilities and relevant aspects of nonlinear theory is given in a companion textbook, Advanced Space Plasma Physics, by the same authors.

Advances in Plasma Physics Research Nov 08 2020 This book presents state-of-the-art analysis of developments in plasma physics.

Plasma Physics and Controlled Nuclear Fusion Apr 25 2022 The primary objectives of this book

are, firstly, to present the essential theoretical background needed to understand recent fusion research and, secondly, to describe the current status of fusion research for graduate students and senior undergraduates. It will also serve as a useful reference for scientists and engineers working in the related fields. In Part I, Plasma Physics, the author explains the basics of magneto-hydrodynamics and kinetic theory in a simple and compact way and, at the same time, covers important new topics for fusion studies such as the ballooning representation, instabilities driven by energetic particles, and various plasma models for computer simulations. Part II, Controlled Nuclear Fusion, attempts to review the "big picture" in fusion research. Mathematical derivations are comprehensively explained to better enable readers to later concentrate on the physics. All important phenomena and technologies are addressed, with a particular emphasis on the topics of most concern in current research.

Fundamentals of Plasma Physics Mar 01 2020 A general introduction designed to present a comprehensive, logical and unified treatment of the fundamentals of plasma physics based on statistical kinetic theory. Its clarity and completeness make it suitable for self-learning and self-paced courses. Problems are included.

Fundamentals of Plasma Physics and Controlled Fusion Jul 17 2021

Reviews of Plasma Physics Apr 13 2021 'The review articles in this series are invariably of a high standard, and those contained in the most recent volumes to appear are no exception....an excellent fund of detailed and reasonably up-to-date information.' -Journal of Plasma Physics, from a review of a previous volume Volume 19 offers plasma physicists detailed studies on paraxial WKB solution of a scalar wave equation, multiple-mirror plasma confinement, and plasma rotation in tokamaks.

Fundamentals of Plasma Physics Jun 15 2021 Fundamentals of Plasma Physics is a general introduction designed to present a comprehensive, logical and unified treatment of the fundamentals of plasma physics based on statistical kinetic theory, with applications to a variety of important plasma phenomena. Its clarity and completeness makes the text suitable for self-learning and for self-paced courses. Throughout the text the emphasis is on clarity, rather than formality, the various derivations are explained in detail and, wherever possible, the physical interpretations are emphasized. The mathematical treatment is set out in great detail, carrying out the steps which are usually left to the reader. The problems form an integral part of the text and most of them were designed in such a way as to provide a guideline, stating intermediate steps with answers.