The Electromagnetic Spectrum Link Springer

This book is a research monograph summarizing recent advances related to the molecular structure of water and ice, and it is based on the latest spectroscopic data available. A special focus is given to radio- and microwave frequency regions. Within the five interconnected chapters, the author reviews the electromagnetic waves interaction with water, ice, and moist substances, discussing the microscopic mechanisms behind the dielectric responses. Well-established classic views concerning the structure of water and ice are considered along with new approaches related to atomic and molecular dynamics. Particular attention is given to nanofluidics, atmospheric science, and electrochemistry. The mathematical apparatus, based on diverse approaches employed in condensed matter physics, is widely used and allows the reader to quantitatively describe the electrodynamic response of water and ice in both bulk and confined states. This book is intended for a wide audience covering physicists, electrochemists, geophysicists, engineers, biophysicists, and general scientists who work on the electromagnetic radiation interaction with water and moist substances.

Acoustic and electromagnetic waves underlie a range of modern technology from sonar, radio, and television to microwave heating and electromagnetic compatibility analysis. This book, written by an international researcher, presents some of the research in a complete way. It is useful for graduate students in mathematics, physics, and engineering.

Terahertz (THz) radiation, which is electromagnetic radiation in a frequency int- val from 0.3 to 10 THz (1 mm – 30 ?m wavelength), is the next frontier in science and technology. This band occupies a large portion of the electromagnetic sp- trum between the infrared and microwave bands. Basic research, new initiatives, and developments in advanced sensing and imaging technology with regard to the THz band remain unexplored compared to the relatively well-developed science and technology in the microwave and optical frequencies. Historically, THz technologies were used mainly within the astronomy c- munity for studying the background of cosmic far-infrared radiation, and by the laser-fusion community for the diagnostics of plasmas. Since the ?rst demonstration of THz wave time-domain spectroscopy in the late 1980s, there has been a series of signi?cant advances (particularly in recent years) as more intense THz sources and higher sensitivity detectors provide new opportunities for understanding the basic science in the THz frequency range.

After a brief introduction into the theory of electromagnetic fields and the definition of the field quantities the book teaches the analytical solution methods of Maxwell ' s equations by means of several characteristic examples. The focus is on static and stationary electric and magnetic fields, quasi stationary fields, and electromagnetic waves. For a deeper understanding, the many depicted field patterns are very helpful. The book offers a collection of problems and solutions which enable the reader to understand and to apply Maxwell ' s theory for a broad class of problems including classical static problems right up to waveguide eigenvalue problems.

Integral Representations for Harmonic Problems

Electromagnetic Wave Propagation in Turbulence

Patterns of Light

Electromagnetic Wave Scattering on Nonspherical Particles

Foundations of the Mathematical Theory of Electromagnetic Waves

Electrodynamics and Optics

This introduction to Atomic and Molecular Physics explains how our present model of atoms and molecules has been developed over the last two centuries both by many

experimental discoveries and, from the theoretical side, by the introduction of quantum physics to the adequate description of micro-particles. It illustrates the wave model of particles by many examples and shows the limits of classical description. The interaction of electromagnetic radiation with atoms and molecules and its potential for spectroscopy is outlined in more detail and in particular lasers as modern spectroscopic tools are discussed more thoroughly. Many examples and problems with solutions are offered to encourage readers to actively engage in applying and adapting the fundamental physics presented in this textbook to specific situations. Completely revised third edition with new sections covering all actual developments, like photonics, ultrashort lasers, ultraprecise frequency combs, free electron lasers, cooling and trapping of atoms, quantum optics and quantum information.
This one-semester textbook teaches students Electromagnetic Waves, via an early introduction to Maxwell ' s Equations in the first chapter. Mathematics fundamentals are used as needed, but rigor is de-emphasized in preference to understanding the basic ideas and principles of EM waves. Each chapter includes extensive, step-by-step, solved examples, as well as abundant exercises. Designed for a one-semester course in electromagnetic waves; Introduces Maxwell ' s equations in the first chapter; De-emphasizes mathematical rigor in order to make key ideas and principles easy to understand; Makes material accessible to readers of varying backgrounds, with extensive use of solved examples; Includes abundant exercises for each chapter.
This book is a very comprehensive textbook covering in great depth all the electricity and magnetism. The 2nd edition includes new and revised figures and exercises in many of the chapters, and the number of problems and exercises for the student is increased. In the 1st edition, emphasis much was made of superconductivity, and this methodology will be continued in the new edition by strengthening of the E-B analogy. Many of the new exercises and problems are associated with the E-B analogy, which enables those teaching from the book to select suitable teaching methods depending on the student's ability and courses taken, whether physics, astrophysics, or engineering. Changes in the chapters include a detailed discussion of the equivector-potential surface and its correspondence between electricity and magnetism. The shortcomings of using the magnetic scalar potential are also explained. The zero resistivity in a magnetic material showing perfect diamagnetism can be easily proved. This textbook is an ideal text for students, who are competent in calculus and are taking physics, astrophysics, or engineering at degree level. It is also useful as a reference book for the professional scientist.
This book addresses the theoretical foundations and the main physical consequences of electromagnetic interaction, generally considered to be one of the four fundamental interactions in nature, in a mathematically rigorous yet straightforward way. The major focus is on the unifying features shared by classical electrodynamics and all other fundamental relativistic classical field theories. The book presents a balanced blend of derivations of phenomenological predictions from first principles on the one hand, and concrete applications on the other. Further, it highlights the internal inconsistencies of classical electrodynamics, and addresses and resolves often-ignored critical issues, such as the dynamics of massless charged particles, the infinite energy of the electromagnetic field, and the limits of the Green ' s function method. Presenting a rich, multilayered, and critical

exposition on the electromagnetic paradigm underlying the whole Universe, the book offers a valuable resource for researchers and graduate students in theoretical physics alike.

Atoms, Molecules and Photons

From Fundamentals to Nanoscale Dynamics

Applications in Food and Agriculture

Magnetism

Electromagnetic Aquametry

Electromagnetic Radiation of Electrons in Periodic Structures

This book gives a detailed overview of the theory of electromagnetic wave scattering on single, homogeneous, but nonspherical particles. Beside the systematically developed Green's function formalism of the first edition this second and enlarged edition contains additional material regarding group theoretical considerations for nonspherical particles with boundary symmetries, an iterative T-matrix scheme for approximate solutions, and two additional but basic applications. Moreover, to demonstrate the advantages of the group theoretical approach and the iterative solution technique, the restriction to axisymmetric scatterers of the first edition was abandoned.

This open access book serves as textbook on the physics of the radiation belts surrounding the Earth. Discovered in 1958 the famous Van Allen Radiation belts were among the first scientific discoveries of the Space Age. Throughout the following decades the belts have been under intensive investigation motivated by the risks of radiation hazards they expose to electronics and humans on spacecraft in the Earth's inner magnetosphere. This textbook teaches the field from basic theory of particles and plasmas to observations which culminated in the highly successful Van Allen Probes Mission of NASA in 2012-2019. Using numerous data examples the authors explain the relevant concepts and theoretical background of the extremely complex radiation belt region, with the emphasis on giving a comprehensive and coherent understanding of physical processes affecting the dynamics of the belts. The target audience are doctoral students and young researchers who wish to learn about the physical processes underlying the acceleration, transport and loss of the radiation belt particles in the perspective of the state-of-the-art observations.

This reference and workbook provides not only a complete survey of classical electrodynamics, but also an enormous number of worked examples and problems to show the reader

how to apply abstract principles to realistic problems. The book will prove useful to graduate students in electrodynamics needing a practical and comprehensive treatment of the subject.

Periodic magnetic structures (undulators) are widely used in accelerators to generate monochromatic undulator radiation (UR) in the range from far infrared to the hard X-ray region. Another periodic crystalline structure is used to produce quasimonochromatic polarized photon beams via the coherent bremsstrahlung mechanism (CBS). Due to such characteristics as monochromaticity, polarization and adjustability, these types of radiation is of large interest for applied and basic research of accelerator-emitted radiation. The book provides a detailed overview of the fundamental principles behind electromagnetic radiation emitted from accelerated charged particles (e.g. UR, CBS, radiation of fast electrons in Laser flash fields) as well as a unified description of relatively new radiation mechanisms which attracted great interest in recent years. This are the so-called polarization radiation excited by the Coulomb field of incident particles in periodic structures, parametric X-rays, resonant transition radiation and the Smith-Purcell effect. Characteristics of such radiation sources and perspectives of their usage are discussed. The recent experimental results as well as their interpretation are presented.

Radio Wave Propagation for Telecommunication Applications

An Intensive Course

Imaging with Electromagnetic Spectrum

Electromagnetic Fluctuations at the Nanoscale

Applications of Artificial Neural Networks for Nonlinear Data

The Classical Theory of Fields

In this volume the properties of light waves in isotropic and anisotropic media are discussed on the basis of the electromagnetic nature of light. Diffraction of light is described for scalar waves and electromagnetic waves using theories like Kirchhoff's diffraction theory, the boundary diffraction wave of Young--Rubinowicz, the Larmor--Lorentz principle, etc. A unified approach involving Fourier optics is adapted to describe the diffractive theory of image formation. The basic principles of the Rayleigh scattering are discussed and the essence of various processes of scattering of light as well as their classification are included. Further topics include: the influence of spatial dispersion on wave propagation physical principles of holography nonlinear optical effects geometrical approximation in optics elements of optical planar

waveguides. P The book will be of interest to researchers in optoelectronics and optical engineering and graduate students in physics and engineering.
This book provides a general formalism for the calculation of the spectral correlation function for the fluctuating electromagnetic field. The procedure is applied to the radiative heat transfer and the van der Waals friction using both the semi-classical theory of the fluctuating electromagnetic field and quantum field theory. Applications of the radiative heat transfer and non-contact friction to scanning probe spectroscopy are presented. The theory gives a tentative explanation for the experimental non-contact friction data. The book explains that radiative heat transfer and the van der Waals friction are largely enhanced at short separations between the bodies due to the evanescent electromagnetic waves. Particular strong enhancement occurs if the surfaces of the bodies can support localized surface modes like surface plasmons, surface polaritons or adsorbate vibrational modes. An electromagnetic field outside a moving body can also be created by static charges which are always present on the surface of the body due to inhomogeneities, or due to a bias voltage. This electromagnetic field produces electrostatic friction which can be significantly enhanced if on the surface of the body there is a 2D electron or hole system or an incommensurate adsorbed layer of ions exhibiting acoustic vibrations.
This book is devoted to the fundamentals of classical electrodynamics, one of the most beautiful and productive theories in physics. A general survey on the applicability of physical theories shows that only few theories can be compared to electrodynamics. Essentially, all electric and electronic devices used around the world are based on the theory of electromagnetism. It was Maxwell who created, for the first time, a unified description of the electric and magnetic phenomena in his electromagnetic field theory. Remarkably, Maxwell ' s theory contained in itself also the relativistic invariance of the special relativity, a fact which was discovered only a few decades later. The present book is an outcome of the authors ' teaching experience over many years in different countries and for different students studying diverse fields of physics. The book is intended for students at the level of undergraduate and graduate studies in physics, astronomy, engineering, applied mathematics and for researchers working in related subjects. We hope that the reader will not only acquire knowledge, but will also grasp the beauty of theoretical physics. A set of about 130 solved and proposed problems shall help to attain this aim.
This volume addresses the physical foundation of remote sensing. The basic grounds are presented in close association with the kinds of environmental targets to monitor and with the observing techniques. The book aims at plugging the quite large gap between the thorough and quantitative description of electromagnetic waves interacting with the Earth's environment and the user applications of Earth observation. It is intended for scientifically literate students and professionals who plan to gain a first understanding of remote sensing data and of their information content.
Electromagnetism
Electricity and Magnetism
Electromagnetic Theory for Microwaves and Optoelectronics

Understanding Electromagnetic Waves
Millimetre and Submillimetre Wavelength Lasers
Wave Optics

This book demonstrates how imaging techniques, applying different frequency bands from the electromagnetic spectrum, are used in scientific research. Illustrated with numerous examples this book is structured according to the different radiation bands: From Gamma-rays over UV and IR to radio frequencies. In order to ensure a clear understanding of the processing methodologies, the text is enriched with descriptions of how digital images are formed, acquired, processed and how to extract information from them. A special emphasis is given to the application of imaging techniques in food and agriculture research.

The Essence of Dielectric Waveguides provides an overview of the fundamental behavior of guided waves, essential to finding and interpreting the results of electromagnetic waveguide problems. Clearly and concisely written as well as brilliantly organized, this volume includes a detailed description of the fundamentals of electromagnetics, as well as a new discussion on boundary conditions and attenuation. It also covers the propagation characteristics of guided waves along classical canonical dielectric structures - planar, circular cylindrical, rectangular and elliptical waveguides. What ' s more, the authors have included extensive coverage of inhomogeneous structures and approximate methods, as well as several powerful numerical approaches specifically applicable to dielectric waveguides.

Any student or engineer working in optics or the field of laser technology will find this a fascinating read. The book begins by addressing the properties of light as seen in the everyday world: events such as refraction in a pool, lenses in the form of glasses, the colors of objects, and atmospheric events. Latter chapters explain these events at the atomic and subatomic level and address the use of electron and optical microscopy in observing the worlds unseen by the unaided eye. Exercises and activities will be found in an appendix, but the primary volume can stand alone if the reader so desires.

X-Ray DiffractionA Practical ApproachSpringer Science & Business Media
An Introduction to Atomic-, Molecular- and Quantum Physics
Electromagnetic Fields and Waves
A Modern Perspective
Research Anthology on Artificial Neural Network Applications
Magnetohydrodynamics and Spectral Theory

A broad region of the electromagnetic spectrum long assumed to have no influence on living systems under natural conditions has been critically re-examinjld over the past decade. This spectral region extends from the superhigh radio frequencies, through de creasing frequencies, to and including essentially static electric and magnetic fields. The author of this monograph, A. S. Presman, has reviewed not only the extensive Russian literatur!;"l, but also al most equally

comprehensively the non-Russian literature, dealing with biological influences of these fields. Treated also is literature shedding some light on possible theoretical foundations for these phenomena. A substantial, rapidly increaSing number of studies in many laboratories and countries has now clearly established bio logical influences which are independent of the theoretically pre dictable, simple thermal effects. Indeed many of the effects are produced by field strengths very close to those within the natural environment. The author has, even more importantly, set forth a novel, imaginative general hypothesis in which it is postulated that such electromagnetic fields normally serve as conveyors of information from the environment to the organism, within the organism, and among organisms. He postulates that in the course of evolution or ganisms have come to employ these fields in conjunction with the well-known sensory, nervous, and endocrine systems in effecting coordination and integration.

This textbook is intended for a course in electromagnetism for upper undergraduate and graduate students. The main concepts and laws of classical macroscopic electrodynamics and initial information about generalized laws of modern electromagnetics are discussed, explaining some paradoxes of the modern theory. The reader then gets acquainted with electrodynamics methods of field analysis on the basis of wave equation solution. Emission physics are considered using an example of the Huygens-Fresnel-Kirchhoff canonic principle. The representation about strict electrodynamics task statement on the base of Maxwell equations, boundary conditions, emission conditions and the condition on the edge is given. Different classes of approximate boundary conditions are presented, which essentially simplify understanding of process physics. The canonic Fresnel functions are given and their generalization on the case of anisotropic impedance. The free waves in closed waveguides and in strip-slotted and edge-dielectric transmission lines are described. A large number of Mathcad programs for illustration of field patterns and its properties in different guiding structures are provided. The material is organized for self-study as well as classroom use.

This engaging text offers an accessible and clear treatment of the fundamentals of electromagnetics and optics, a core part of the standard undergraduate physics curriculum. Starting with static electric and magnetic fields, the book works through electromagnetic oscillations and the formation and propagation of electromagnetic waves, before moving on to geometric and wave optics, optical instrumentation and some discussion of new technologies in optics. The text is written from the experimental physics point of view, giving numerous real life examples and applications of devices. This highly motivating presentation deepens the knowledge in a very accessible way, carefully interweaving theory and practical applications. Students are guided through the material with well-chosen examples and case studies, and helpful chapter summaries are provided together with numerous exercises and detailed solutions, all intended to motivate and develop a well-founded understanding of the subject matter.

Mformation about a material can be gathered from its interaction with electromagnetic waves. The information may be stored in the amplitude, the phase, the polarisation, the angular distribution of energy transportation or the spectral characteristics. When re trieved from the wave, certain material properties may thus be determined indirectly. Compared on the one hand to direct material analysis, an indirect method requires calibration and is prone to interference from undesired sources. On the other hand, however, it permits the

determination of features inaccessible by direct methods, such as non-destructive material interrogation, high measurement speed, or deep penetration depth. However, being a physical method, the use of electromagnetic waves is still handicapped by the lack of acceptance by many chemists, who are used to applying direct approaches. Historically, the first application of electromagnetic wave interaction with mat ter involved measurement of amplitude changes at a single frequency caused by material properties, and it is still used today by some systems. This approach was soon supplemented by single frequency phase measurements, in order to avoid distortions through amplitude instabilities or parasitic reflections. Such single pa rameter measurements of course require dependence only on one variable in the measured process and sufficient stability of all other ancillary conditions. If that is not the case, the single parameter measurement fails.

Theory and Applications

Electromagnetic Fields and Life

Electromagnetic Wave Interaction with Water and Moist Substances

Surface Plasmons on Smooth and Rough Surfaces and on Gratings

Physics of Earth's Radiation Belts

A Handbook of cw Measurements

For the last twenty years astronomy has been developing dramatically. Until the nineteen-fifties, telescopes, spectrometers, and photographic plates consti tuted a relatively simple set of tools which had been refined to a high degree of perfection by the joint efforts of physicists and astronomers. Indeed these tools helped at the birth of modern astrophysics: the discovery of the expan sion of the Universe. Then came radioastronomy and the advent of electronics; the last thirty years have seen the application to astrophysics of a wealth of new experimental techniques, based on the most advanced fields of physics, and a constant interchange of ideas between physicists and astronomers. Last, but not least, modern computers have sharply reduced the burden of dealing with the information painfully extracted from the skies, whether from ever scarce photons, or from the gigantic data flows provided by satellites and large telescopes. The aim of this book is not to give an extensive overview of all the tech niques currently in use in astronomy, nor to provide detailed instructions for preparing or carrying out an astronomical project. Its purpose is methodologi cal: photons are still the main carriers of information between celestial sources and the observer. How we are to collect, sample, measure, and store this infor mation is the unifying theme of the book. Rather than the diversity of tech niques appropriate for each wavelength range, we emphasize the physical and mathematical bases which are common to all wavelength regimes.

Processing information and analyzing data efficiently and effectively is crucial for any company that wishes to stay competitive in its respective market. Nonlinear data presents new challenges to organizations, however, due to its complexity and unpredictability. The only technology that can properly handle this form of data is artificial neural networks. These modeling systems present a high level of benefits in analyzing complex data in a proficient manner, yet considerable research on the specific applications of these intelligent components is significantly deficient. Applications of Artificial Neural Networks for Nonlinear Data is a collection of innovative research on the contemporary nature of artificial neural networks and their specific implementations within data analysis. While highlighting topics including

propagation functions, optimization techniques, and learning methodologies, this book is ideally designed for researchers, statisticians, academicians, developers, scientists, practitioners, students, and educators seeking current research on the use of artificial neural networks in diagnosing and solving nonparametric problems.

The book reviews the properties of surface plasmons that depict electromagnetic surface waves or surface plasma polaritons. Their propagation on smooth and corrugated surfaces (with rough or grating profiles) is considered. In the latter case, the corrugations can cause strong coupling of the surface plasmons with photons leading to resonances with a strong enhancement of the electromagnetic field in the surface. Coupling and field enhancement are the most prominent phenomena on corrugated surfaces and lead to numerous important applications. Attention has been focused on the explanation of the physics. To keep the text readable, sophisticated calculations have been avoided, and instead various applications dealing with enhanced light emission, nonlinear optics, SERS, and other cases of interest are discussed.

2 The linearized ideal MHO equations. . . . . 204 3 Spectral problems corresponding to evolutionary problems . . 211 4 Stability of equilibrium configurations and the Energy Principle 215 5 Alternative forms of the plasma potential energy 220 6 Minimization of the potential energy with respect to a parallel displacement . . . . . 222 7 Classification of ideal MHO instabilities . 224 8 The linearized non-ideal MHO equations . 226 Chapter 6. Homogeneous and discretely structured plasma oscillations 229 I Introduction . . . . . 229 2 Alfven waves in an incompressible ideal plasma 230 3 Cold ideal plasma oscillations. . . . 233 4 Compressible hot plasma oscillations 236 5 Finite resistivity effects . . . . . 239 6 Propagation of waves generated by a local source 240 7 Stratified plasma oscillations . . . . . 247 8 Oscillations of a plasma slab . . . . . 254 9 Instabilities of an ideal stratified gravitating plasma 256 10 Instabilities of a resistive stratified gravitating plasma. 262 Chapter 7. MHO oscillations of a gravitating plasma slab 265 I Introduction . . . . . 265 2 Gravitating slab equilibrium . . . . . 266 3 Oscillations of a hot compressible plasma slab 267 4 Investigation of the slab stability via the Energy Principle 270 5 On the discrete spectrum of the operator Kk . . . . . 274 6 On the essential spectrum of the operator Kk . . . . . 279 7 On the discrete spectrum embedded in the essential spectrum 282 8 The eigenfunction expansion formula . . . . . 285 9 Excitation of plasma oscillations by an external power source . 288 10 The linearized equations governing resistive gravitating plasma slab oscillations . . . . . 290 II Heuristic investigation of resistive instabilities. . . . . .

The Electrodynamics of Water and Ice

A Practical Approach

Acoustic and Electromagnetic Equations

Relativistic Quantum Mechanics and Introduction to Field Theory

Electromagnetic Field Theory

Introduction to THz Wave Photonics

In this, the only book available to combine both theoretical and practical aspects of x-ray diffraction, the authors emphasize a "hands on" approach through experiments and examples based on actual laboratory data. Part I presents the basics of x-ray diffraction and explains its use in obtaining structural and

chemical information. In Part II, eight experimental modules enable the students to gain an appreciation for what information can be obtained by x-ray diffraction and how to interpret it. Examples from all classes of materials -- metals, ceramics, semiconductors, and polymers -- are included. Diffraction patterns and Bragg angles are provided for students without diffractometers. 192 illustrations.
This book provides students with a thorough theoretical understanding of electromagnetic field equations and it also treats a large number of applications. The text is a comprehensive two-semester textbook. The work treats most topics in two steps – a short, introductory chapter followed by a second chapter with in-depth extensive treatment; between 10 to 30 applications per topic; examples and exercises throughout the book; experiments, problems and summaries. The new edition includes: modifications to about 30-40% of the end of chapter problems; a new introduction to electromagnetics based on behavior of charges; a new section on units; MATLAB tools for solution of problems and demonstration of subjects; most chapters include a summary. The book is an undergraduate textbook at the Junior level, intended for required classes in electromagnetics. It is written in simple terms with all details of derivations included and all steps in solutions listed. It requires little beyond basic calculus and can be used for self-study. The wealth of examples and alternative explanations makes it very approachable by students. More than 400 examples and exercises, exercising every topic in the book Includes 600 end-of-chapter problems, many of them applications or simplified applications Discusses the finite element, finite difference and method of moments in a dedicated chapter
This advanced textbook supplies graduate students with a primer in quantum theory. A variety of processes are discussed with concepts such as potentials, classical current distributions, prescribed external fields dealt with in the framework of relativistic quantum mechanics. Then, in an introduction to field theory, the author emphasizes the deduction of the said potentials or currents. A modern presentation of the subject together with many exercises, unique in its unusual underlying concept of combining relativistic quantum mechanics with basic quantum field theory.
This book summarizes the basics of electricity and magnetism prior to covariant formulation of Maxwell's equations. The book works out the basics of special relativity and then applies the covariant formalism to understand radiation, both in vacuum and in material medium. The emphasis is on cleaner mathematical formalism based on experimental facts. The book contains many problems/exercises which will help the students to understand the basics of the subject. The difference between the present book with existing books of this level lies in the presentation of the topics and the subjects chosen. Instead of presenting a lot of material related to electromagnetism, it presents some very important but selected problems of advanced electromagnetism to students who are learning it for the first time. This book is aimed at graduate/advanced graduate students who have done at least one basic level course in electricity

and magnetism.

Engineering Electromagnetics

The Electromagnetic Foundation of Remote Sensing

X-Ray Diffraction

Introduction to Advanced Electrodynamics

Understanding Earth Observation

Basic Methodology and Simulations

This text book gives a comprehensive account of magnetism, one of the oldest yet most vibrant fields of physics. It spans the historical development, the physical foundations and the continuing research underlying the subject. The book covers both the classical and quantum mechanical aspects of magnetism and novel experimental techniques. Perhaps uniquely, it discusses spin transport and magnetization dynamics phenomena associated with atomically and spin engineered nano-structures against the backdrop of spintronics and magnetic storage and memory applications. The book is for students, and serves as a reference for scientists in academia and research laboratories.

This book is a first-year graduate text on electromagnetic fields and waves. It is the translated and revised edition of the Chinese version with the same title published by the Publishing House of Electronic Industry (PHEI) of China in 1994. The text is based on the graduate course lectures on "Advanced Elec trodynamics" given by the authors at Tsinghua University. More than 300 students from the Department of Electronic Engineering and the Depart ment of Applied Physics have taken this course during the last decade. Their particular fields are microwave and millimeterwave theory and technology, physical electronics, optoelectronics and engineering physics. As the title of the book shows, the texts and examples in the book concentrate mainly on electromagnetic theory related to microwaves and optoelectronics, or light wave technology. However, the book can also be used as an intermediate-level text or reference book on electromagnetic fields and waves for students and scientists engaged in research in neighboring fields.

This book begins by introducing magnetism and discusses magnetic properties of materials, magnetic moments of atoms and ions, and the elements important to magnetism. It covers magnetic susceptibilities and electromagnetic waves in anisotropic dispersive media among other topics. There are problems at the end of each chapter, many of which serve to expand or explain the material in the text. The bibliographies for each chapter give an entry to the research literature.

Artificial neural networks (ANNs) present many benefits in analyzing complex data in a proficient manner. As an effective and efficient problem-solving method, ANNs are incredibly useful in many different fields. From education to medicine and banking to engineering, artificial neural networks are a growing phenomenon as more realize the plethora of uses and benefits they provide. Due to their complexity, it is vital for researchers to understand ANN capabilities in various fields. The Research Anthology on Artificial Neural Network Applications covers critical topics related to artificial neural networks and their multitude of applications in a number of diverse areas including medicine, finance, operations research, business, social media, security, and more. Covering everything from the applications and uses of artificial neural networks to deep learning and non-linear problems, this book is ideal for computer scientists, IT specialists, data scientists, technologists, business owners, engineers, government agencies, researchers, academicians, and students, as well as anyone who is interested in learning more about how artificial neural networks can be used across a wide range of fields.

Spin Waves

Theory and Observations

Evaluation and Application of Mellin Transforms
A Collection of Problems
Electrodynamics
New Formulation by Introduction of Superconductivity

This book describes the physical mechanisms involved in the propagation of electromagnetic waves in the radiofrequency range, inside and outside buildings, in the terrestrial and near space environments, with a special focus on mobile radio communication. It combines a theoretical and an experimental approaches with an understanding of the physical environment through adequate formulations of the laws of electromagnetism. It should thus provide the background needed by advanced students and development engineers for the conception of high quality and reliable telecommunication systems.

The optically pumped laser has made an enormous contribution to research in the part of the electromagnetic spectrum known as the far infrared, or submillimetre region. I hope that this book will be useful to both practising and prospective workers in the field, since it contains an up-to-date catalogue of measurements of the main properties of submillimetre lasers as well as an introductory review of the measurement techniques themselves. Wavelength and frequency measurements have been exhaustively compiled (in Part II of this book) along with molecule and pump identification. Part I contains a short review of the relevant measurement techniques in each of these areas and, in addition, a review of power measurements. Working in this field, as in any other, one's satisfaction is determined largely by the colleagues one has and the friends one makes along the way. I am very grateful to Dr G. Dodel, Dr L. C. Robinson and Dr G. F. Brand for introducing me to the field. Dr I. S. Falconer and Dr P. A. Krug have been good colleagues and friends. For this book in particular I am grateful to Dr Dodel, Dr K. M. Evenson, Dr H. Figger, Prof. M. Fourrier, P. Kempf, Dr K. J. Siemsen and Dr M. S. Tobin for their comments, and to Dr D. J. E. Knight for a great deal of help, including data from unpublished or obscure sources which he had gathered for his own compilation.

The study of classical electromagnetic fields is an adventure. The theory is complete mathematically and we are able to present it as an example of classical Newtonian experimental and mathematical philosophy. There is a set of foundational experiments, on which most of the theory is constructed. And then there is the bold theoretical proposal of a field-field interaction from James Clerk Maxwell. This textbook presents the theory of classical fields as a mathematical structure based solidly on laboratory experiments. Here the student is introduced to the beauty of classical field theory as a gem of theoretical physics. To keep the discussion fluid, the history is placed in a beginning chapter and some of the mathematical proofs in the appendices. Chapters on Green's Functions and Laplace's Equation and a discussion of Faraday's Experiment further deepen the understanding. The chapter on Einstein's relativity is an integral necessity to the text. Finally, chapters on particle motion and waves in a dispersive medium complete the picture. High quality diagrams and detailed end-of-chapter questions enhance the learning experience.

Electromagnetic Wave Propagation in Turbulence is devoted to a method for obtaining analytical solutions to problems of electromagnetic wave propagation in turbulence. In a systematic way the monograph presents the Mellin transforms to evaluate analytically integrals that are not in integral tables. Ample examples of application are outlined and solutions for many problems in turbulence theory are given. The method itself relates to asymptotic results that are applicable to a broad class of problems for which many asymptotic methods had to be employed previously.

The Essence of Dielectric Waveguides
Observational Astrophysics
Classical Electrodynamics
Microwave and mmWave Engineering with Generalized Macroscopic Electrodynamics

Chasing the Spectrum from Aristotle to LEDs