Synopsis

Back Cover Field and Wave Electromagnetics, Second Edition features many examples of practical applications to give students an excellent physical -- as well as mathematical -- understanding of important concepts. These include applications drawn from important new areas of technology such as optical fibers, radome design, satellite communication, and microstrip lines. There is also added coverage of several new topics, including Hall effect, radar equation and scattering cross section, transients in transmission lines, waveguides and circular cavity resonators, wave propagation in the ionosphere, and helical antennas. New exercises, new problems, and many worked-out examples make this complex material more accessible to students.

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Customer Reviews

Respected for its accuracy, its smooth and logical flow of ideas, and its clear presentation, Field and Wave Electromagnetics has become an established textbook in the field of electromagnetics. This book builds the electromagnetic model using an axiomatic approach in steps: first for static electric fields, then for static magnetic fields, and finally for time-varying fields leading to Maxwell's equations. This approach results in an organized and systematic development of the subject matter. Applications of derived relations to fundamental phenomena and electromagnetic technologies are explained. Back Cover Field and Wave Electromagnetics, Second Edition features many examples of practical applications to give students an excellent physical -- as well as mathematical -- understanding of important concepts. These include applications drawn from important new areas of technology such as optical fibers, radome design, satellite communication, and microstrip lines. There is also added coverage of several new topics, including Hall effect, radar equation and scattering cross section, transients in transmission lines, waveguides and circular cavity resonators, wave propagation in the ionosphere, and helical antennas. New exercises, new problems, and many worked-out examples make this complex material more accessible to students.

The many books on introductory electromagnetics can be roughly divided into two main groups. The first group takes the traditional development: starting with the experimental laws, generalizing them in steps, and finally synthesizing them in the form of Maxwell's equations. This is an inductive approach. The second group takes the axiomatic development: starting with Maxwell's equations, identifying each with the appropriate experimental law, and specializing the general equations to static and time-varying situations for analysis. This is a deductive approach. A few books begin with a treatment of the special theory of relativity and develop all of electromagnetic theory from Coulomb's law of force; but this approach requires the discussion and understanding of the special theory of relativity first and is perhaps best suited for a course at an advanced level. Proponents of the traditional development argue that it is the way electromagnetic theory was unraveled historically (from special experimental laws to Maxwell's equations), and that it is easier for the students to follow than the other methods. I feel, however, that the way a body of knowledge was unraveled is not necessarily the best way to teach the subject to students. The topics tend to be fragmented and cannot take full advantage of the conciseness of vector calculus. Students are puzzled at, and often form a mental block to, the subsequent introduction of gradient, divergence, and curl operations. As a process for formulating an electromagnetic model, this approach lacks cohesiveness and elegance. The axiomatic development usually begins with the set of four Maxwell's equations, either in differential or in integral from, as fundamental postulates. These are equations of considerable complexity and are difficult to master. They are likely to cause consternation and resistance in students who are hit with all of them at the beginning of a book. Alert students will wonder about the meaning of the field vectors and about the necessity and sufficiency of these general equations. At the final stage students tend to be confused about the concepts of the electromagnetic model, and they are not yet comfortable with the associated mathematical manipulations. In any case, the general Maxwell's equations are soon simplified to apply to static fields, which allow the consideration of electrostatic fields and magnetostatic fields separately. Why then should the entire set of four Maxwell's equations be introduced at the outset? It may be argued that Coulomb's law, though based on experimental evidence, is in fact also a postulate. Consider the two stipulations of Coulomb's law: that the charged bodies are very small compared with their distance of separation, and that the force between the charged bodies is inversely proportional to the square of their distance. The question arises regarding the first stipulation: How small must the charged bodies be in order to be considered "very small" compared with their distance? In practice the charged bodies cannot be of vanishing sizes (ideal point charges), and there is difficulty in determining the "true" distance between two bodies of finite dimensions. For given body sizes the relative accuracy in distance measurements is better when the separation is larger. However, practical considerations (weakness of force, existence of extraneous charged bodies, etc.) restrict the usable distance of separation in the laboratory, and experimental inaccuracies cannot be entirely avoided. This leads to a more important question concerning the inverse-square relation of the second stipulation. Even if the charged bodies were of vanishing sizes, experimental measurements could not be of an infinite accuracy no matte how skillful and careful an experimenter was. How then was it possible for Coulomb to know that the force was exactly inversely proportional to the square (not the 2.000001th or the 1.999999th power) of the distance of separation? This question cannot be answered from an experimental viewpoint because it is not likely that during Coulomb's time experiments could have been accurate to the seventh place. We must therefore conclude that Coulomb's law is itself a postulate and that it is a law of nature discovered and assumed on the basis of his experiments of a limited accuracy (see Section 3.2). This book builds the electromagnetic model using an axiomatic approach in steps: first for static electric fields (Chapter 3), then for static magnetic fields (Chapter 6), and finally for time-varying fields leading to Maxwell's equations (Chapter 7). The mathematical basis for each step is Helmholtz's theorem, which states that a vector field is determined to within an additive constant if both its divergence and its curl are specified everywhere. Thus, for the development of the electrostatic model in free space, it is only necessary to define a single vector (namely, the electric field intensity E) by specifying its divergence and its curl as postulates. All other relations in electrostatics for free space, including Coulomb's law and Gauss's law, can be derived from the two rather simple postulates. Relations in materials media can be developed through the concept of equivalent charge distributions of polarized dielectrics. Similarly, for the magnetostatic model in free space it is necessary to define only a single magnetic flux density vector B by specifying its divergence and its curl as postulates; all other formulas can be derived from these two postulates. Relations in material media can be developed through the concept of equivalent current densities. Of course, the validity of the postulates lies in their ability to yield results that conform with experimental evidence. For time-varying fields, the electric and magnetic field intensities are coupled. The curl E postulate for the electrostatic model must be modified to conform with Faraday's law. In addition, the curl B postulate for the mangetostatic model must also be modified in order to be consistent with the equation of continuity. We have, then, the four Maxwell's equations that constitute the electromagnetic model. I believe that this gradual development of the electromagnetic model based on Helmholtz's theorem is novel, systematic, pedagogically sound, and more easily accepted by students. In the presentation of the material, I strive for lucidity and unity, and for smooth and logical flow of ideas. Many worked-out examples are included to emphasize fundamental concepts and to illustrate methods for solving typical problems. Applications of derived relations to useful technologies (such as ink-jet printers, lightning arresters, electret microphones, cable design, multiconductor systems, electrostatic shielding, Doppler radar, random design, Polaroid filters, satellite communication systems, optical fibers, and microstrip lines) are discussed. Review questions appear at the end of each chapter to test the students' retention and understanding of the essential material in the chapter. The problems in each chapter are designed to reinforce sturdents' comprehension of the interrelationships between the different quantities in the formulas, and to extend their ability of applying the formulas to solve practical problems. In teaching, I have found the review questions a particularly useful device to stimulate students' interest and to keep them alert in class. Besides the fundamentals of electromagnetic fields, this book also covers the theory and applications of transmission lines, waveguides, and cavity resonators, and antennas and radiating systems. The fundamental concepts and the governing theory of electromagnetism do not change with the introduction of new electromagnetic devices. Ample reasons and incentives for learning the fundamental principles of electromagnetic are given in Section 1.1. I hope that the contents of this book, strengthened by the novel approach, will provide students with a secure and sufficient background for understanding and analyzing basic electromagnetic phenomena as well as prepare them for more advanced subjects in electromagnetic theory. There is enough material in this book for a two-semester sequence of courses. Chapters 1 through 7 contain the material on fields, and Chapters 8 through 11 on waves and applications. In schools where there is only a one-semester course on electromagnetics, Chapters 1 through 7, plus the first four sections of Chapter 8 would provide a good foundation on fields and an introduction of waves in unbounded media. The remaining material would serve as a useful reference boon on applications or as a textbook for a follow-up elective course. Schools on a quarter system could adjust the material to be covered in accordance with the total number of hours assigned to the subject of electromagnetics. Of course, individual instructors have the prerogative to emphasize and expand certain topics, and to deemphasize or delete certain others. I have given considerable thought to the advisability of including computer programs for the solution of some problems, but have finally decided against it. diverting students' attention and effort tot numerical methods and computer software would distract them from concentrating on learning the fundamentals of electromagnetism. Where appropriate, the dependence of important results on the value of a parameter is stressed by curves; field distributions and antenna patterns are illustrated by graphs; and typical mode patters in waveguides are plotted. The computer programs for obtaining these curves, graphs, and mode patterns are not always simple. Students in science and engineering are required to acquire a facility of using computers; but the inclusion of some cookbook-style computer programs in a book on the fundamental principles of electromagnetic fields and waves would appear to contribute little to the understanding of the subject matter. This book was first published in 1983. Favorable reactions and friendly encouragement from professors and students have provided me with the impetus to come out with a new edition. In this second edition I have added many new topics. These include Hall effect, d-c motors, transformers, eddy current, energy-transport velocity for wide-band signals in waveguides, radar equation and scattering cross section, transients in transmission lines, Bessel functions, circular waveguides and circular cavity resonators, waveguide discontinuities, wave propagation in ionosphere and newer earth's surface, helical antennas, log-periodic dipole arrays, and antenna effective length and effective area. The total number of problems has been expanded by about 35 percent. The Addison-Wesley Publishing Company has decided to make this second edition a two-color book. I think the readers will agree that the book is handsomely produced. I would like to take this opportunity to express my appreciation to all the people on the editorial, production, and marketing staff who provided help in bringing out this new edition. In particular, I wish to thank Thomas Robbins, Barbara Rifkind, Karen Myer, Joseph K. Vetere, and Katherine Harutunian.

This is a very popular book assigned by professor for students who are taking Electromagnetic Fields. This book while it may be helpful and in depth has the issue of being overly complex and not worded in the best of ways. When you read this book, you have to read it at least twice to understand what the author is trying to say. Although the author goes into depth with these advanced topics, I wish the jargon was written in a more understandable manner that the average student can understand. But if you are taking Electromagnetic Fields, then along with this book buy the Schuam’s Outline for Electromagnetic Fields which helps teach the topics in a more understandable manner.

This book is unmatched in terms of its clarity. The organizational structure of this book allowed me to really follow the progression of electromagnetic theory from electrostatics to electrodynamics, and fill up gaps in my understanding. The author's axiomatic approach allows the book to develop the theory step by step without any ambiguity. The chapter on transmission lines in particular is very well written.This book might be a tough read for someone who is exposed to this subject for the first time. Also, you need a strong math base if you want to follow this book (and this subject in general). If you are learning the subject for the first time then a good book to supplement this one is "Introductory Electromagnetics" by Popovic and Popovic. For a more extensive treatment on electromagnetic waves, a good book would be "Electromagnetic Waves" by Inan and Inan.

The subject itself is quite difficult. This book is the best book you can get to take undergrad electromagnetic. If your school is not using this, then your department must really have a deal with some other publisher. What I really like is the organization. Start of with the review of vector space, followed by a full chapter review of electricity and magnetism you learned in undergrad physics. Almost everything is fully derived. And there are help full questions on end of the chapter to check conceptual understanding.

Simply awesome book! Explains things very clearly and it is easy to understand. However, some of the notation differs from other books and I dislike that as it can be confusing if you have multiple references. Non-the less, this was very useful to me for my E&M class!

excellent

I am a self studier. I bought at least 6 to 7 different books on the subjects including book by Ulaby, Kraus, Popovic, Schwarz, Hayt, J.D. Jackson. This is about the best book. It explain the equations relative clear, quite detail on how to derive the equation. This and Ulaby are the two main book I use. This one is still better. Ulaby is too simplified.There are a few equations that the reasoning is a little thin, but still is the closest to "the book".

Thank you.

Well written and easy to follow. However, some proofs lack rigidness.

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