

Unveiling the Secrets of Electrostatics, Magnetostatics, Time Varying Fields, and Maxwell Equations

The Fascinating World of Electrostatics

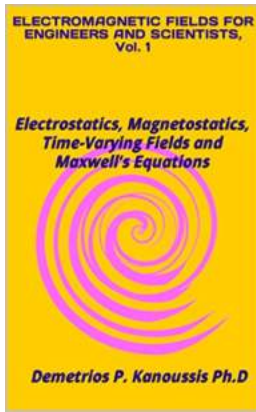
Have you ever wondered how electricity works and why electric charges behave the way they do? Prepare to be amazed as we delve into the captivating realm of electrostatics. From the basics of charge and Coulomb's Law to the complexities of electric fields and potentials, this article will provide you with a comprehensive understanding of electrostatics.

The Intricacies of Magnetostatics

Magnetostatics, the study of stationary magnetic fields, is not to be underestimated. Step into the realm of magnets and discover the astonishing properties they possess. Explore the laws of magnetism, magnetic fields, and forces experienced by charged particles in magnetic fields. Brace yourself for a magnetic journey that will leave you awestruck.

Unraveling the Mysteries of Time Varying Fields

Time varying fields, as the name suggests, involve changes in electric and magnetic fields over time. These dynamic fields give rise to a plethora of fascinating phenomena, including electromagnetic induction and electromagnetic waves. Learn how the interplay between electric and magnetic fields creates a wave-like nature that powers our world with a symphony of energy.



ELECTROMAGNETIC FIELDS FOR ENGINEERS AND SCIENTISTS, Vol. 1: Electrostatics, Magnetostatics, Time-Varying Fields and Maxwell's Equations

by Demetrios P. Kanoussis Ph.D ([Print Replica] Kindle Edition)

★★★★☆ 4.5 out of 5

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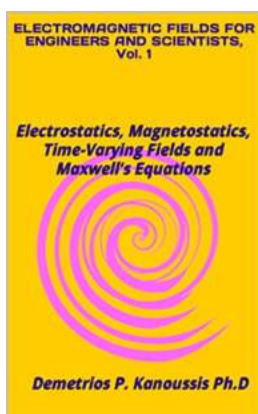
The Revolutionary Maxwell Equations

James Clerk Maxwell, a genius of his time, formulated four fundamental equations that unified the theories of electricity and magnetism. These Maxwell equations revolutionized the field of physics and laid the foundation for the study of electromagnetism. Discover the elegance and power behind these equations as we break them down and explore their implications in everyday life.

Unleashing the Power of Electromagnetism

From the tiny electrical impulses that allow nerve cells to communicate to the massive electric currents that power our homes, electromagnetism is at the heart of modern technology and our understanding of the universe. Dive into the applications of electrostatics, magnetostatics, time-varying fields, and the Maxwell equations in various fields, including electronics, telecommunications, and astrophysics.

Get ready to embark on a captivating journey through the fascinating realms of electrostatics, magnetostatics, time-varying fields, and the Maxwell equations. Whether you're a science enthusiast, a student, or simply curious about the inner workings of the universe, this article will quench your thirst for knowledge and leave you in awe of the wonders of electromagnetism.



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The central theme in this book is the development of Maxwell's equations, the fundamental equations of Electromagnetic fields. Newton's equations in Mechanics and Maxwell's equations in Electromagnetism are among the most influential equations in science and technology.

For this reason, Electromagnetism is one of the most fundamental subjects in an engineering curriculum with a huge number of applications. Capacitors and inductors, transmission lines, radiating systems (antennas), microwaves, lasers, motion of charged particles in electric and magnetic fields, propagation of electromagnetic waves in various media, transmission of electromagnetic energy, just to mention a few, are investigated and analyzed by means of Maxwell's

equations.

In this book we use the so called “historical approach” of developing Maxwell’s equations. We start with the relevant experimental laws, (Coulomb’s law, Gauss’s law, Biot-Savart law, Ampere’s circuital law, Faraday’s law of induction, etc), and gradually, step by step, build Maxwell’s equations. This method of approach has the advantage of introducing the student, gradually, not only to the pertinent physical laws but, also, to the mathematical methods and techniques, necessary for the manipulation of various problems in electromagnetism.

For the interested reader, at the Appendix, we present "an axiomatic derivation" of Maxwell’s equations. Taking this approach, the totality of our knowledge and experience with electromagnetic phenomena is summarized into four postulates, which, in conjunction with the principle of conservation of energy, lead directly to Maxwell’s equations.

The book contains 25 chapters, 245 fully solved examples and 867 problems for solution. Odd numbered problems are provided with answers. Chapter 1 is devoted to a brief, but systematic review of vectors and vector analysis. The three most commonly used coordinate systems, i.e. Cartesian, Cylindrical and Spherical, are presented in details. Expressions for the gradient, the divergence, the curl and the Laplacian in all coordinate systems are provided, and their physical significance is considered. The two fundamental theorems of vector analysis, i.e. the Gauss-Ostrogradsky theorem and the Stokes’ theorem (which are used frequently in this book), are presented and analyzed in details. The book is mathematically self- contained.

The rest of the book is divided in three parts:

Part A, (Chapters 2,...,12), Electrostatics

Part B, (Chapters 13,...,23), Magnetostatics and

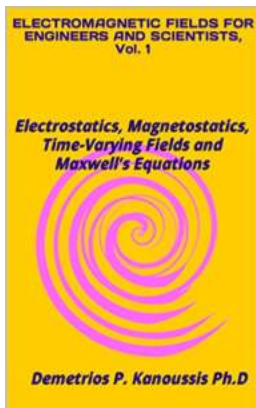
Part C, (Chapters 24, 25), Time –Varying fields and Maxwell’s equations.

The topics covered in the book are described in the Table of contents.

At the end of each section is a set of fully solved examples, followed by a set of

problems for solution. At the end of each chapter is an additional set of supplementary problems, (usually more difficult). The students are urged to study carefully the solved examples and solve the problems. This is essential to understanding the material covered in this book.

A second volume, covering propagation of electromagnetic waves in various media, waveguides, transmission lines, simple radiating systems and many other applications of Maxwell's theory, is to be published in the near future.



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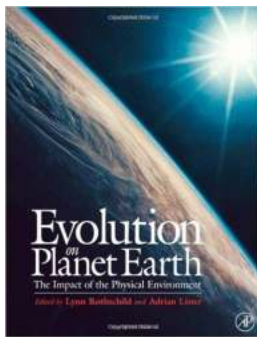
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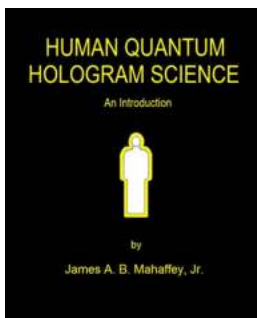
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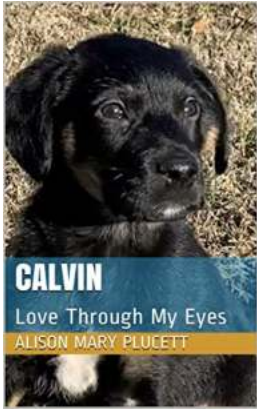
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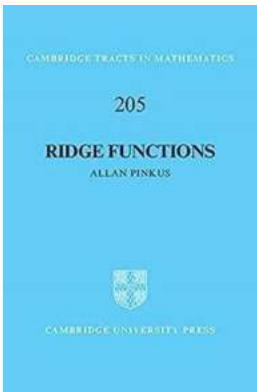
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