



METADATA

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Abstract

The aim of this book is the study of the electric and magnetic field in static and time-dependent physical systems. Most of the book is devoted to describing the various forms of Maxwell's equations and developing techniques for solving them and finding the electric and magnetic fields resulting from given charge distributions and boundary/initial conditions. For example, introducing the scalar and vector potential is a useful technique for solving Maxwell's equations. In the introductory mathematical part of the book (chapter 1) there is a review of basic concepts of vector analysis necessary to describe the vector functions corresponding to the electric and magnetic fields, as well as the corresponding integral and differential equations by solving which these fields can arise. In the first part of the book (chapters 2-7) static physical systems

are studied and methods for calculating electromagnetic fields in these systems are developed. In the second part of the book (chapters 8-15) the complete formalization of Maxwell's equations in time-dependent systems is introduced where the correlation and integration of the electric field with the magnetic field becomes apparent since a changing electric field can cause a magnetic field and vice versa. This unification becomes even clearer in chapter 10, where the relativistic formalism of electrodynamics is introduced, as well as the electromagnetic tensor, which includes the electric and magnetic field components in a single relativistic entity. Electromagnetic waves and their production (electromagnetic radiation) are also introduced and studied in the second part of the book also revealing the unified nature of the electromagnetic field.

