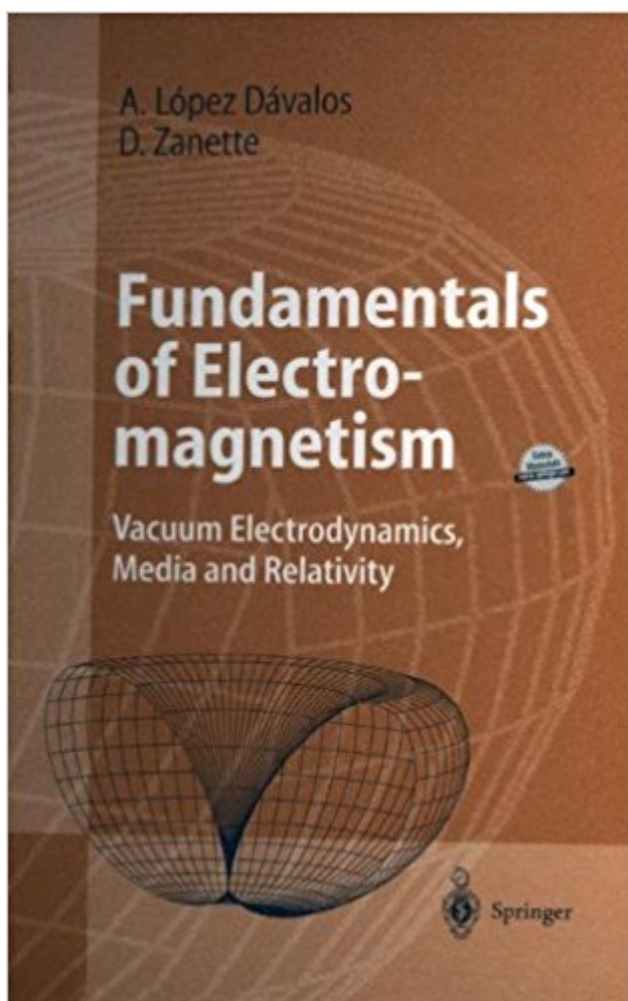


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# Fundamentals Of Electromagnetism: Vacuum Electrodynamics, Media, And Relativity



## Synopsis

This textbook is a revised and enlarged version of notes for a one-semester course on electromagnetism. It covers the theory of electromagnetic phenomena in vacuum and in material media. The book includes a CD-ROM with didactic software, to solve boundary value problems in electrostatics and magnetostatics.

## Book Information

Paperback: 294 pages

Publisher: Springer; 1999 edition (January 15, 2014)

Language: English

ISBN-10: 3642635768

ISBN-13: 978-3642635762

Product Dimensions: 6.1 x 0.7 x 9.2 inches

Shipping Weight: 15.5 ounces (View shipping rates and policies)

Average Customer Review: 4.5 out of 5 stars 3 customer reviews

Best Sellers Rank: #1,210,453 in Books (See Top 100 in Books) #128 in Books > Science & Math > Physics > Electromagnetism > Magnetism #302 in Books > Engineering & Transportation > Engineering > Materials & Material Science > Metallurgy #344 in Books > Science & Math > Physics > Electromagnetism > Electricity

## Customer Reviews

This textbook discusses the fundamentals and applications of the electromagnetic theory, emphasizing basic physical aspects rather than mathematics. The text is designed for an intermediate level course, and the topics are ordered in such a way as to makes the links with a previous course on classical mechanics quite natural. In addition, it prepares the reader/student for more advanced courses on quantum mechanics, solid state physics, field theory, and others. Some special topics of current interest, such as numerical methods and superconductivity, are also covered. The book includes a diskette with software for solving problems in electrostatics and magnetostatics.

Fundamental of Electromagnetism: Vacuum Electrodynamics, Media and Relativity This book is based on the large experience the authors have acquired teaching a course on Electromagnetism at Instituto Balseiro, in Bariloche, Argentina. Chapter I presents a very exciting essay on the historical perspectives of Electromagnetism, which becomes an excellent appetizer for the rest of the themes

developed in the book. Chapters II and III are devoted to the presentation of relativistic kinematics and dynamics, with an interesting collection of experiments, which help understand the properties of space-time. From there on the authors follow a traditional scheme and develop aspects of the electromagnetic field in vacuum. In this context, in Chapters IV through VIII the properties of the electric charge and of the electrostatic field, the solutions of Laplace and Poisson equations, including numerical methods, the laws of Ampere and Biot-Savart and multipole expansions are presented. The complete Maxwell equations, the concepts of electromagnetic energy, a clear discussion of the symmetry properties and conservation laws associated with Maxwell equations and the properties of radiation fields are also discussed. These topics are complemented in later chapters with a presentation of the covariant formulation, the properties of electromagnetic fields in material media, and finally a chapter on the properties of superconductors from the point of view of electromagnetism. The order of presentation is chosen to emphasize the fact that electromagnetic phenomena take place in the vacuum space surrounding atoms. Electromagnetic fields in material media are obtained as averages of the microscopic fields, a point of view which prepares the ground for the understanding of microscopic models of matter and for a deeper comprehension of the underlying phenomenology. Those readers which are familiar with a phenomenological presentation will be surprised by this particular idea of the authors, which is highly stimulating and has a great potential when proceeding to study the electromagnetic models of matter at a microscopic level. Another very interesting aspect of the book is the software "PhysicSolver" which comes with it. The program, developed by Prof. Sergio Pissanetzky, is based on his large experience and provides a means for finding numerical solutions to problems in electrostatics and magnetostatics. Teachers as well as students will find this tool very useful. At the end of each chapter problems which can be solved with "PhysicSolver" are indicated. Also, the reader can use the software to solve any problem for which there is no simple analytical solution or to gain physical insight through a pictorial representation of the solutions. The work is aimed at teachers and students in Physics, but it is certainly a reference for teachers and students in Engineering, interested in a presentation of the fundamentals of electromagnetism and of its applications.

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This book has been successfully used in a course for advanced MSc students at the Imperial College in London, UK. The book has been welcome by the students who found it very useful not only for its clarity but also for its collection of problems. The book achieves the right balance between presentation and content. It is a fact that most students cannot grasp all the information

contained in some of the classical books in the field in one semester. Some of the excellent books in the field, like the famous book by Jackson, contains too much information for a course. This book gives a consistent well-presented introduction to electromagnetism, without losing generality, which can be covered in one semester. In addition, the book comes with a program for solving electrostatic and magnetostatic problems. This added tool, not only increases its pedagogical value, but also finds great acceptance in the more computer-literate younger generations.

There are very books available which combines mathematical formulation of electrodynamics with physical aspects clearly explained. Classic books like Jackson are generally considered too tough even at graduate level. This book provides an intermediate level text which will be very useful for a Master's programme. The emphasis on relativity and covariant formulation is a refreshing feature of the book. Another extremely well written chapter is on radiation due to moving charge. An interesting addition is the inclusion of a chapter on superconductivity, which reminds one about a similar chapter in Feynmann Lectures on Physics. I would strongly recommend this book as a text book for the first course in electrodynamics at Master's level. We have included this in the list of books recommended for such a course in the Physics programme at the Indian Institute of Technology, Bombay.

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