CRITICS AND BIBLIOGRAPHY

Review of *Linear Macroscopic Electromagnetics* by Yu. V. Pimenov (Intellect, Moscow, 2008)

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Received May 25, 2009

PACS numbers: 01.30.Vv

DOI: 10.1134/S1064226909100143

This is the last book written by a brilliant lecturer, scientist, and teacher who had trained several generations of researchers and engineers involved in applied electromagnetics. This textbook is based on the courses lectured by Yurii Vadimovich during his long-term teaching and scientific activities.

What place does this book occupy among courses of engineering electromagnetics? On the basis of the author's words, we can say the following. Numerous young researchers and engineers that graduate from especially engineering colleges encounter serious difficulties when they start working in the fields of radiophysics, microwave technology, and antenna systems and try to apply modern methods of applied electromagnetics to solution of practical problems. They often have to deal with branches of mathematics, mathematical physics, etc., that have not been studied during curriculum. At the same time, certain fundamentals presented in early courses have been forgotten. The purpose of the book is to help young researchers and engineers to refresh and construct in their minds the elegant theory of electromagnetic phenomena, learn to formulate research and engineering problems, orient themselves in numerous methods of solution of applied electromagnetics problems, and obtain practical results with the help of these methods. Owing to the comprehensive description of the material, this book is an excellent course for students who start studying electromagnetics and plan to seriously master this science.

The book substantially exceeds traditional textbooks of such a kind in size and contains information from related fields that is necessary for understanding the presented material. Much attention is paid to the physical meaning of the considered equations. The material is presented so as to remove the aforementioned gap between a graduate's knowledge of physics and mathematics on the one hand and the level of methods of modern electromagnetics on the other hand.

The first section of the book is devoted to the mathematical fundamentals of electromagnetics and contains detailed information from vector analysis, basic concepts of the complex variable theory, elements of the theory of special functions that are frequently used, etc. Next, the physical fundamentals of macroscopic electromagnetics are consid-

ered and macroscopic models of elementary media are introduced. In the section devoted to the basic system of equations of electromagnetics, the author shows the consistent logic path from Coulomb's and Ampere's laws to the Maxwell equations. The physical meaning of boundary conditions is comprehensively described, a circumstance that helps the reader to understand these conditions. Substantial attention is given to modern approaches to formulation of electromagnetics problems. The author prepares the reader for meeting numerous new (for the reader) concepts from the modern literature on electromagnetics such as the Hertz and Debye potentials, the complementarity principle following from the permutation duality of the Maxwell equations, and the features of 2D problems. The author considers electromagnetic fields under various conditions: electrostatic fields, dc fields, magnetostatic fields, various types of electromagnetic waves, and effects on a plane interface of two media. Special attention is given to methods of solution of boundary value problems of electromagnetics. The purpose of this chapter is to help the readers to orient themselves in plenty of modern methods, understand differences between methods, and assess their potentialities. The author comprehensively considers rigorous methods such as the Fourier and Grinberg methods and introduces the concept of integral transformation methods (the Fourier, Hankel, Laplace, Mellin, and Kontorovich–Lebedev transforms). Numerical methods that find wide application owing to the rapid progress in computing are classified and the main ideas of the most popular methods—the finite difference technique and the integral equation method—are presented. Practically important approximate methods—physical optics (the Huygens–Kirchhoff approximation), the Ufimtsev edge wave method, geometric optics, geometric diffraction theory, the shadow current method—are considered.

The book is splendidly illustrated, and the material in it is clearly described. As is noted by V.I. Vol'man in the preface to the book, the author guides the reader from one adventure, i.e., a physical concept or an equation, to another and each time shows a simple and elegant solution of arising problems.

The book is addressed to a wide circle of readers and will undoubtedly be helpful to students, postgraduate students, engineers, researchers, and lecturers of colleges.