PREFACE

It has been 52 years since the first edition of this book was published, then under the sole authorship of William H. Hayt, Jr. As I was five years old at that time, this would have meant little to me. But everything changed 15 years later when I used the second edition in a basic electromagnetics course as a college junior. I remember my sense of foreboding at the start of the course, being aware of friends' horror stories. On first opening the book, however, I was pleasantly surprised by the friendly writing style and by the measured approach to the subject, which — at least for me — made it a very readable book, out of which I was able to learn with little help from my professor. I referred to it often while in graduate school, taught from the fourth and fifth editions as a faculty member, and then became coauthor for the sixth and seventh editions on the retirement (and subsequent untimely death) of Bill Hayt. The memories of my time as a beginner are clear, and I have tried to maintain the accessible style that I found so welcome then.

Over the 50-year span, the subject matter has not changed, but emphases have. In the universities, the trend continues toward reducing electrical engineering core course allocations to electromagnetics. I have made efforts to streamline the presentation in this new edition to enable the student to get to Maxwell's equations sooner, and I have added more advanced material. Many of the earlier chapters are now slightly shorter than their counterparts in the seventh edition. This has been done by economizing on the wording, shortening many sections, or by removing some entirely. In some cases, deleted topics have been converted to stand-alone articles and moved to the website, from which they can be downloaded. Major changes include the following: (1) The material on dielectrics, formerly in Chapter 6, has been moved to the end of Chapter 5. (2) The chapter on Poisson's and Laplace's equations has been eliminated, retaining only the one-dimensional treatment, which has been moved to the end of Chapter 6. The two-dimensional Laplace equation discussion and that of numerical methods have been moved to the website for the book. (3) The treatment on rectangular waveguides (Chapter 13) has been expanded, presenting the methodology of two-dimensional boundary value problems in that context. (4) The coverage of radiation and antennas has been greatly expanded and now forms the entire Chapter 14.

Some 130 new problems have been added throughout. For some of these, I chose particularly good "classic" problems from the earliest editions. I have also adopted a new system in which the approximate level of difficulty is indicated beside each problem on a three-level scale. The lowest level is considered a fairly straightforward problem, requiring little work assuming the material is understood; a level 2 problem is conceptually more difficult, and/or may require more work to solve; a level 3 problem is considered either difficult conceptually, or may require extra effort (including possibly the help of a computer) to solve.

As in the previous edition, the transmission lines chapter (10) is stand-alone, and can be read or covered in any part of a course, including the beginning. In it, transmission lines are treated entirely within the context of circuit theory; wave phenomena are introduced and used exclusively in the form of voltages and currents. Inductance and capacitance concepts are treated as known parameters, and so there is no reliance on any other chapter. Field concepts and parameter computation in transmission lines appear in the early part of the waveguides chapter (13), where they play additional roles of helping to introduce waveguiding concepts. The chapters on electromagnetic waves, 11 and 12, retain their independence of transmission line theory in that one can progress from Chapter 9 directly to Chapter 11. By doing this, wave phenomena are introduced from first principles but within the context of the uniform plane wave. Chapter 11 refers to Chapter 10 in places where the latter may give additional perspective, along with a little more detail. Nevertheless, all necessary material to learn plane waves without previously studying transmission line waves is found in Chapter 11, should the student or instructor wish to proceed in that order.

The new chapter on antennas covers radiation concepts, building on the retarded potential discussion in Chapter 9. The discussion focuses on the dipole antenna, individually and in simple arrays. The last section covers elementary transmit-receive systems, again using the dipole as a vehicle.

The book is designed optimally for a two-semester course. As is evident, statics concepts are emphasized and occur first in the presentation, but again Chapter 10 (transmission lines) can be read first. In a single course that emphasizes dynamics, the transmission lines chapter can be covered initially as mentioned or at any point in the course. One way to cover the statics material more rapidly is by deemphasizing materials properties (assuming these are covered in other courses) and some of the advanced topics. This involves omitting Chapter 1 (assigned to be read as a review), and omitting Sections 2.5, 2.6, 4.7, 4.8, 5.5–5.7, 6.3, 6.4, 6.7, 7.6, 7.7, 8.5, 8.6, 8.8, 8.9, and 9.5.

A supplement to this edition is web-based material consisting of the aforementioned articles on special topics in addition to animated demonstrations and interactive programs developed by Natalya Nikolova of McMaster University and Vikram Jandhyala of the University of Washington. Their excellent contributions are geared to the text, and icons appear in the margins whenever an exercise that pertains to the narrative exists. In addition, quizzes are provided to aid in further study.

The theme of the text is the same as it has been since the first edition of 1958. An inductive approach is used that is consistent with the historical development. In it, the experimental laws are presented as individual concepts that are later unified in Maxwell's equations. After the first chapter on vector analysis, additional mathematical tools are introduced in the text on an as-needed basis. Throughout every edition, as well as this one, the primary goal has been to enable students to learn independently. Numerous examples, drill problems (usually having multiple parts), end-of-chapter problems, and material on the web site, are provided to facilitate this.

Answers to the drill problems are given below each problem. Answers to odd-numbered end-of-chapter problems are found in Appendix F. A solutions manual and a set of PowerPoint slides, containing pertinent figures and equations, are available to instructors. These, along with all other material mentioned previously, can be accessed on the website:

www.mhhe.com/haytbuck

I would like to acknowledge the valuable input of several people who helped to make this a better edition. Special thanks go to Glenn S. Smith (Georgia Tech), who reviewed the antennas chapter and provided many valuable comments and suggestions. Detailed suggestions and errata were provided by Clive Woods (Louisiana State University), Natalya Nikolova, and Don Davis (Georgia Tech). Accuracy checks on the new problems were carried out by Todd Kaiser (Montana State University) and Steve Weis (Texas Christian University). Other reviewers provided detailed comments and suggestions at the start of the project; many of the suggestions affected the outcome. They include:

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John A. Buck
Marietta, Georgia
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On the cover: Radiated intensity patterns for a dipole antenna, showing the cases for which the wavelength is equal to the overall antenna length (red), two-thirds the antenna length (green), and one-half the antenna length (blue).

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