PREFACE 6/E

Building on the core content and style of its predecessor, this sixth edition (6/E) of *Applied Electromagnetics* introduces new features designed to help students develop a deeper understanding of electromagnetic concepts and applications. Prominent among them is a set of 42 CD simulation modules that allow the user to interactively analyze and design transmission line circuits; generate spatial patterns of the electric and magnetic fields induced by charges and currents; visualize in 2-D and 3-D space how the gradient, divergence, and curl operate on spatial functions; observe the temporal and spatial waveforms of plane waves propagating in lossless and lossy media; calculate and display field distributions inside a rectangular waveguide; and generate radiation patterns for linear antennas and parabolic dishes. These are valuable learning tools; we encourage students to use them and urge instructors to incorporate them into their lecture materials and homework assignments.

Additionally, by printing this new edition in full color, graphs and illustrations now more efficiently convey core concepts, and by expanding the scope of topics of the Technology Briefs, additional bridges between electromagnetic fundamentals and their countless engineering and scientific applications are established. In summary:

New to this edition

- A set of 42 CD-interactive simulation modules
- New/updated Technology Briefs
- Full-color figures and images
- New/updated end-of-chapter problems
- Updated bibliography

Acknowledgment

As authors, we were blessed to have worked on this book with the best team of professionals: Richard Carnes, Leland Pierce, Janice Richards, Rose Kernan, and Paul Mailhot. We are exceedingly grateful for their superb support and unwavering dedication to the project.

We enjoyed working on this book. We hope you enjoy learning from it.

Fawwaz T. Ulaby
Eric Michielssen
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EXCERPTS FROM THE PREFACE TO THE FIFTH EDITION

CONTENT

The book begins by building a bridge between what should be familiar to a third-year electrical engineering student and the electromagnetics (EM) material covered in the book. Prior to enrolling in an EM course, a typical student will have taken one or more courses in circuits. He or she should be familiar with circuit analysis, Ohm's law, Kirchhoff's current and voltage laws, and related topics. Transmission lines constitute a *natural* bridge between electric circuits and electromagnetics. Without having to deal with vectors or fields, the student uses already familiar concepts to learn about wave motion, the reflection and transmission of power, phasors, impedance matching, and many of the properties of wave propagation in a guided structure. All of these newly learned concepts will prove invaluable later (in Chapters 7 through 9) and will facilitate the learning of how plane waves propagate in free space and in material media. Transmission lines are covered in Chapter 2, which is preceded in Chapter 1 with reviews of complex numbers and phasor analysis.

Suggested Syllabi

		Two-semester Syllabus 6 credits (42 contact hours per semester)		One-semester Syllabus 4 credits (56 contact hours)	
	Chapter	Sections	Hours	Sections	Hours
1	Introduction: Waves and Phasors	All	4	All	4
2	Transmission Lines	All	12	2-1 to 2-8 and 2-11	8
3	Vector Analysis	All	8	All	8
4	Electrostatics	All	8	4-1 to 4-10	6
5	Magnetostatics	All	7	5-1 to 5-5 and 5-7 to 5-8	5
	Exams		3		2
		Total for first semester	42		
6	Maxwell's Equations for Time-Varying Fields	All	6	6-1 to 6-3, and 6-6	3
7	Plane-wave Propagation	All	7	7-1 to 7-4, and 7-6	6
8	Wave Reflection and Transmission	All	9	8-1 to 8-3, and 8-6	7
9	Radiation and Antennas	All	10	9-1 to 9-6	6
10	Satellite Communication Systems and Radar Sensors	All	5	None	—
	Exams		3		1
		Total for second semester	40	Total	56
	Extra Hours		2		0

The next part of the book, contained in Chapters 3 through 5, covers vector analysis, electrostatics, and magnetostatics. The electrostatics chapter begins with Maxwell's equations for the time-varying case, which are then specialized to electrostatics and magnetostatics, thereby providing the student with an overall framework for what is to come and showing him or her why electrostatics and magnetostatics are special cases of the more general time-varying case.

Chapter 6 deals with time-varying fields and sets the stage for the material in Chapters 7 through 9. Chapter 7 covers plane-wave propagation in dielectric and conducting media, and Chapter 8 covers reflection and transmission at discontinuous boundaries and introduces the student to fiber optics, waveguides and resonators.

In Chapter 9, the student is introduced to the principles of radiation by currents flowing in wires, such as dipoles, as well as to radiation by apertures, such as a horn antenna or an opening in an opaque screen illuminated by a light source.

To give the student a taste of the wide-ranging applications of electromagnetics in today's technological society, Chapter 10 concludes the book with overview presentations of two system examples: satellite communication systems and radar sensors.

The material in this book was written for a two-semester sequence of six credits, but it is possible to trim it down to generate a syllabus for a one-semester four-credit course. The accompanying table provides syllabi for each of these two options.

Message to the Student

The interactive CD-ROM accompanying this book was developed with you, the student, in mind. Take the time to use it in conjunction with the material in the textbook. The multiple-window feature of electronic displays makes it possible to design interactive modules with "help" buttons to guide the student through the solution of a problem when needed. Video animations can show you how fields and waves propagate in time and space, how the beam of an antenna array can be made to scan electronically, and examples of how current is induced in a circuit under the influence of a changing magnetic field. The CD-ROM is a useful resource for self-study. Use it!

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