Dedication

To my father, Seyed Hassan, and mother Azardokht
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A multi-disciplinary effort was initiated at Michigan Technological University, with a support from the U.S. National Science Foundation’s Engineering Education division. The goal was to create a curriculum that (1) encourages students to pursue the life-long learning necessary to keep pace with the rapidly-evolving engineering industry and emerging interdisciplinary technologies, (2) maintains sufficient connection between the students’ chosen engineering fields and class content; and (3) motivates and excite the students about the importance of EE concepts to their discipline and career.

Seven faculty members across different departments contributed to this process. Participating departments included: electrical engineering, chemical engineering, civil and environmental engineering, mechanical engineering, biomedical engineering, and the education division of the cognitive and learning science department. The group’s curriculum reform efforts were informed by a nationwide survey of engineering schools. The survey outcomes were analyzed to fine tune different curriculum options for this course for different engineering disciplines. Then, those options were integrated to create the final draft of the curriculum. The final draft of the curriculum was used as a layout to create a new textbook for this course.

Although no single text can perfectly meet the needs of every institution, diverse topics have been included to address the mixed survey response and allow this book to address the needs of lecturers in different institutions worldwide. The resulting textbook creates a prototype curriculum available to electrical engineering departments that are charged with providing an introduction to electrical engineering for non-EE majors. The goals of this new curriculum are to be attractive, motivational, and relevant to students by creating many application-based problems; and provide the optimal level of both range and depth of coverage of EE topics in a curriculum package.

The book features:

a. **Application-based examples:** A large number of application-based examples were selected from different engineering fields and are included in each chapter. They aim to bridge EE and diverse non-EE areas. These examples help to address the question: “why I should take this course?” Non-EE students will better understand: (1) why they should learn how to solve circuits; and; (2) what are the applications of solving circuits in mechanical, chemical, and civil engineering areas.

b. **PSpice lectures, examples, and problems:** The text offers a distributed approach for learning PSpice. A PSpice component is integrated in many chapters. Chapter 2 provides an initial tutorial, and new skills are added in Chapters 3–11. This part includes lectures that teach students how to use PSpice and can be considered as an embedded PC-based lab for the course. In addition, many PSpice-specific examples have been developed, which help students better understand the process of building a circuit and getting the desired results. There are also many end-of-chapter PSpice problems.

c. **Innovative chapters:** Based on our nationwide survey, the topics in these chapters have been highlighted by many professionals as important topics for this course. It should be noted that each instructor has the liberty to include or exclude some of these topics from his/her curriculum. Some topics include:

• **Chapter 1—Case Study:** This chapter presents the applications of electrical engineering components in mechanical engineering, chemical engineering, and civil engineering through real life scenarios. A bridge across these case studies and the topics that will be covered later in the book is maintained. The goal is to better motivate students by placing the concepts of electrical engineering in the context of their chosen fields of study. Each section of this chapter was been prepared by a different member of the faculty at Michigan Tech who contributed to the NSF project.
• **Chapter 7—Frequency Response with MATLAB and PSpice**: This chapter discusses the frequency response of circuits and introduces different types of filters and uses MATLAB and PSpice examples and end-of-chapter problems. This chapter creates an opportunity for students to learn some features of MATLAB software. In other words, this chapter promotes an integrated study using both PSpice and MATLAB.

• **Power Coverage: Chapters 9, 12, 13**—Based on our nationwide survey, and motivated by concerns about global warming and the need for clean energy, industry respondents requested a more thorough treatment of power. Thus, power coverage is supported by three chapters. Chapter 9 introduces the concept of three-phase systems, transmission lines, their equivalent circuits, and power transfer. Chapter 12 studies another important topic of energy transfer—transformers. Finally Chapter 13 studies the topic of motors and generators. This chapter offers the concept of motors and generators in a clear and concise approach. The chapter introduces applications of motors and generators and introduces many applications of both.

• **Chapter 15—Electrical Safety**: This unique chapter discusses interesting electric safety topics useful in the daily life of consumers or engineers working in the field.

d. **Examples and sorted end-of-chapter problems**: The book comes with more than 1100 examples and end-of-chapter problems (solutions included). End-of-chapter problems are sorted to help instructors select basic, average, and difficult problems.

e. **A complete solution manual**: A complete solutions manual for all problems will be available via download for all adopting professors.
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