

### Features

In spite of the numerous textbooks on circuit analysis available in the market, students often find the course difficult to learn. The main objective of this book is to present circuit analysis in a manner that is clearer, more interesting, and easier to understand than earlier texts. This objective is achieved in the following ways:

- A course in circuit analysis is perhaps the first exposure students have to electrical engineering. We have included several features to help students feel at home with the subject. Each chapter opens with either a historical profile of some electrical engineering pioneers to be mentioned in the chapter or a career discussion on a subdiscipline of electrical engineering. An introduction links the chapter with the previous chapters and states the chapter's objectives. The chapter ends with a summary of the key points and formulas.
- All principles are presented in a lucid, logical, step-by-step manner. We try to avoid wordiness and superfluous detail that could hide concepts and impede understanding the material.
- Important formulas are boxed as a means of helping students sort what is essential from what is not; and to ensure that students clearly get the gist of the matter, key terms are defined and highlighted.
- Marginal notes are used as a pedagogical aid. They serve multiple uses—hints, cross-references, more exposition, warnings, reminders, common mistakes, and problem-solving insights.
- Thoroughly worked examples are liberally given at the end of every section. The examples are regarded as part of the text and are explained clearly, without asking the reader to fill in missing steps. Thoroughly worked examples give students a good understanding of the solution and the confidence to solve problems themselves. Some of the problems are solved in two or three ways to facilitate an understanding and comparison of different approaches.
- To give students practice opportunity, each illustrative example is immediately followed by a practice problem with the answer. The students can follow the example step-by-step to solve the practice problem without flipping pages or searching the end of the book for answers. The practice prob-

lem is also intended to test students' understanding of the preceding example. It will reinforce their grasp of the material before moving to the next section.

- In recognition of ABET's requirement on integrating computer tools, the use of *PSpice* is encouraged in a student-friendly manner. Since the Windows version of *PSpice* is becoming popular, it is used instead of the MS-DOS version. *PSpice* is covered early so that students can use it throughout the text. Appendix D serves as a tutorial on *PSpice for Windows*.
- The operational amplifier (op amp) as a basic element is introduced early in the text.
- To ease the transition between the circuit course and signals/systems courses, Fourier and Laplace transforms are covered lucidly and thoroughly.
- The last section in each chapter is devoted to applications of the concepts covered in the chapter. Each chapter has at least one or two practical problems or devices. This helps students apply the concepts to real-life situations.
- Ten multiple-choice review questions are provided at the end of each chapter, with answers. These are intended to cover the little "tricks" that the examples and end-of-chapter problems may not cover. They serve as a self-test device and help students determine how well they have mastered the chapter.

### Organization

This book was written for a two-semester or three-semester course in linear circuit analysis. The book may also be used for a one-semester course by a proper selection of chapters and sections. It is broadly divided into three parts.

- Part 1, consisting of Chapters 1 to 8, is devoted to dc circuits. It covers the fundamental laws and theorems, circuit techniques, passive and active elements.
- Part 2, consisting of Chapters 9 to 14, deals with ac circuits. It introduces phasors, sinusoidal steady-state analysis, ac power, rms values, three-phase systems, and frequency response.
- Part 3, consisting of Chapters 15 to 18, is devoted to advanced techniques for network analysis. It provides a solid introduction to the Laplace transform, Fourier series, the Fourier transform, and two-port network analysis.

The material in three parts is more than sufficient for a two-semester course, so that the instructor

must select which chapters/sections to cover. Sections marked with the dagger sign (†) may be skipped, explained briefly, or assigned as homework. They can be omitted without loss of continuity. Each chapter has plenty of problems, grouped according to the sections of the related material, and so diverse that the instructor can choose some as examples and assign some as homework. More difficult problems are marked with a star (\*). Comprehensive problems appear last; they are mostly applications problems that require multiple skills from that particular chapter.

The book is as self-contained as possible. At the end of the book are some appendixes that review solutions of linear equations, complex numbers, mathematical formulas, a tutorial on *PSpice for Windows*, and answers to odd-numbered problems. Answers to all the problems are in the solutions manual, which is available from the publisher.

### Prerequisites

As with most introductory circuit courses, the main prerequisites are physics and calculus. Although familiarity with complex numbers is helpful in the later part of the book, it is not required.

### Supplements

**Solutions Manual**—an Instructor's Solutions Manual is available to instructors who adopt the text. It contains complete solutions to all the end-of-chapter problems.

**Transparency Masters**—over 200 important figures are available as transparency masters for use as overheads.

**Student CD-ROM**—100 circuit files from the book are presented as *Electronics Workbench* (EWB) files; 15–20 of these files are accessible using the free demo of *Electronics Workbench*. The students are able to experiment with the files. For those who wish to fully unlock all 100 circuit files, EWB's full version may be purchased from Interactive Image Technologies for approximately \$79.00. The CD-ROM also contains a selection of problem-solving, analysis and design tutorials, designed to further support important concepts in the text.

**Problem-Solving Workbook**—a paperback workbook is for sale to students who wish to practice their problem solving techniques. The workbook contains a discussion of problem solving strategies and 150 additional problems with complete solutions provided.

**Online Learning Center (OLC)**—the Web site for the book will serve as an online learning center for students as a useful resource for instructors. The OLC

will provide access to:

- 300 test questions—for instructors only
- Downloadable figures for overhead

- presentations—for instructors only

- Solutions manual—for instructors only

- Web links to useful sites

- Sample pages from the Problem-Solving Workbook

- PageOut Lite—a service provided to adopters who want to create their own Web site. In just a few minutes, instructors can change the course syllabus into a Web site using PageOut Lite.

The URL for the web site is [www.mhhe.com.alexander](http://www.mhhe.com.alexander). Although the textbook is meant to be self-explanatory and act as a tutor for the student, the personal contact involved in teaching is not to be forgotten. The book and supplements are intended to supply the instructor with all the pedagogical tools necessary to effectively present the material.

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Please address comments and corrections to the publisher.

**C. K. Alexander and M. N. O. Sadiku**

## A NOTE TO THE STUDENT

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This may be your first course in electrical engineering. Although electrical engineering is an exciting and challenging discipline, the course may intimidate you. This book was written to prevent that. A good textbook and a good professor are an advantage—but you are the one who does the learning. If you keep the following ideas in mind, you will do very well in this course.

- This course is the foundation on which most other courses in the electrical engineering curriculum rest. For this reason, put in as much effort as you can. Study the course regularly.
- Problem solving is an essential part of the learning process. Solve as many problems as you can. Begin by solving the practice problem following each example, and then proceed to the end-of-chapter problems. The best way to learn is to solve a lot of problems. An asterisk in front of a problem indicates a challenging problem.
- *Spice*, a computer circuit analysis program, is used throughout the textbook. *PSpice*, the personal computer version of *Spice*, is the popular standard circuit analysis program at most uni-

versities. *PSpice for Windows* is described in Appendix D. Make an effort to learn *PSpice*, because you can check any circuit problem with *PSpice* and be sure you are handing in a correct problem solution.

- Each chapter ends with a section on how the material covered in the chapter can be applied to real-life situations. The concepts in this section may be new and advanced to you. No doubt, you will learn more of the details in other courses. We are mainly interested in gaining a general familiarity with these ideas.
- Attempt the review questions at the end of each chapter. They will help you discover some “tricks” not revealed in class or in the textbook.

A short review on finding determinants is covered in Appendix A, complex numbers in Appendix B, and mathematical formulas in Appendix C. Answers to odd-numbered problems are given in Appendix E.

Have fun!

**C.K.A. and M.N.O.S.**