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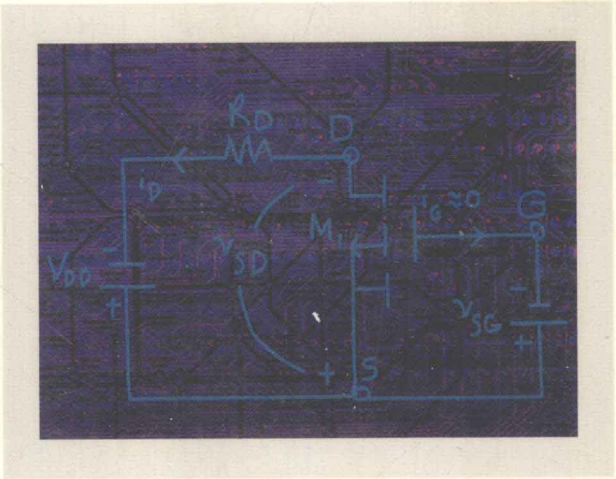
国外高校电子信息类优秀教材

微电子电路分析与设计

Microelectronic Circuits: Analysis and Design

（英文影印版）



Muhammad H. Rashid 著

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THOMSON BROOKS/COLE 汤姆森学习出版集团

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内 容 简 介

本书为国外高校电子信息类优秀教材(英文影印版)之一。

本书介绍了微电子电路的设计过程、特点和分析方法,并介绍了二极管及其应用、放大设备和放大器、数字逻辑门、集成电路及其应用。

本书可作为电气工程和计算机专业的本科生教材,也可供相关专业技术人员参考。

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(按姓氏笔画排序)

Preface

Semiconductor devices and integrated circuits are the backbone of modern technology, and thus the study of electronics—which deals with their characteristics and applications—is an integral part of the undergraduate curriculum for students majoring in electrical or computer engineering. Traditionally, the basic course in electronics has been a one-year (two-semester) course at most universities and colleges. However, with the emergence of new technologies and university-wide general education requirements, electrical engineering departments are under pressure to reduce basic electronics to a one-semester course. This book is designed to be used for either a one-semester or a two-semester course; the only prerequisite is a course in basic circuit analysis. A one-semester course would cover Chapters 1–11, in which the basic techniques for analyzing electronic circuits are introduced using integrated circuits as examples. In a two-semester course, the second semester would focus on detailed analysis of devices and circuits within the ICs.

The objectives of this book are as follows:

- To provide an understanding of the characteristics of semiconductor devices and commonly used integrated circuits
- To develop skills in analysis and design of both analog and digital circuits
- To familiarize students with various elements of the engineering design process, including formulation of specifications, analysis of alternative solutions, synthesis, decision making, iterations, consideration of cost factors, simulation, and tolerance issues.

This book adopts a top-down approach to the study of electronics, rather than the traditional bottom-up approach. In the classical bottom-up approach, the characteristics of semiconductor devices and ICs are studied first, and then the applications of ICs are introduced; such an approach generally requires a year of instruction, as it is necessary to cover all the essential materials in order to give students an overall knowledge of electronic circuits and systems. In the top-down approach used here, the ideal characteristics of IC packages are introduced to establish the design and analytical techniques, and then the characteristics and operation of devices and circuits within the ICs are studied to understand the imperfections and limitations of IC packages. This approach has the advantage of allowing the instructor to cover only the basic techniques and circuits in the first

semester, without going into detail on discrete devices. If the curriculum allows, the course can continue in the second semester with detailed analysis of discrete devices.

After an introduction to the design process in Chapter 1, the book may be divided into five parts:

- Chapters 2–3 on diodes and applications
- Chapters 4–7 on amplifying devices and amplifiers
- Chapters 8–11 on characteristics and analyses of electronic circuits
- Chapter 12 on digital logic gates
- Chapters 13–16 on integrated circuits and applications

A review of basic circuit analysis and an introduction to PSpice are included in the appendixes.

Modern semiconductor technology has evolved to such an extent that many analog and digital circuits are available in the form of integrated circuit packages. Manufacturers of these packages provide application notes, which can be used to implement circuit functions. Knowledge of the characteristics and operation of devices within the IC packages is essential, however, to understand the limitations of these ICs when they are interfaced as building blocks in circuit designs. Such knowledge also serves as the basis for developing future generations of IC packages.

Although the trend in IC technology suggests that discrete circuit design may disappear entirely in the future, transistor amplifiers (in large-scale or very-large-scale integrated forms) will continue to be the building blocks of ICs. Thus, transistor amplifiers are covered in Chapter 5, after the general types and specifications of amplifiers have been introduced in Chapter 4. Because diodes are the building blocks of many electronic circuits—and because the techniques for the analysis of diodes are similar to those for transistor amplifiers—diodes and their applications are addressed in detail in Chapters 2 and 3.

Mathematical derivations are kept to a minimum by using approximate circuit models of operational amplifiers, transistors, and diodes. The significance of these approximations is established by computer-aided analysis using PSpice. Important circuits are analyzed in worked-out examples in order to introduce the basic techniques and emphasize the effects of parameter variations. At the end of each chapter, review questions and problems test students' learning of the concepts developed in the chapter. Answers to selected problems appear in the back of the book.

In practice, the lectures and laboratory experiments run concurrently. If students' experimental results differ from the ideal characteristics because of the practical limitations of IC packages, students may become concerned. This concern may be addressed by a brief explanation of the causes of discrepancies. The experimental results, however, will not differ significantly from the theoretically obtained results.

Current ABET (Accreditation Board of Engineering and Technology) criteria require the integration of design and computer usage throughout the curriculum. After students have satisfied other ABET requirements in math, basic science, engineering science, general education electives, and free electives, they find that not many courses are available to satisfy the design requirements. The lack of opportunities for design credits in engineering curricula is a common concern. Electronics is generally the first electrical engineering course well suited to the integration of design components and computer usage. This book is structured to permit design content to constitute at least 50% of the course, and it integrates computer usage through PSpice. Many design examples use PSpice to verify the design requirements, and the numerous computer-aided design examples illustrate the usefulness of personal computers as design tools, especially in cases in which design variables are subjected to component tolerances and variations.

The CD-ROM bound into the back of this book contains tools that are designed to help the student learn about electronics more effectively. The CD includes

- the evaluation version of MicroSim PSpice® for Windows®-based computers and electronic copies of all the SPICE netlists printed in this book
- the evaluation version of the Student Edition of Electronics Workbench® for Windows®-based computers, which will load a set of files keyed to the book and allow students to work their own problems

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Any comments and suggestions regarding this book are welcome. They should be sent to

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