

教育部高等教育司推荐

国外优秀信息科学与技术系列教学用书

电力电子学

——变换器、应用和设计

第3版

影印版

Power Electronics

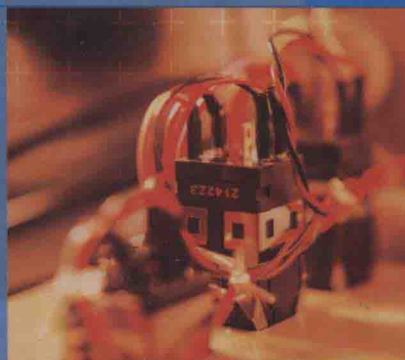
Converters, Applications, And Design

Third Edition

- Mohan
- Undeland
- Robbins



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本套教学用书的特点:

- 权威性——教育部高等教育司推荐、教育部高等学校信息科学与技术引进教材专家组遴选
- 系统性——覆盖电子信息、通信类、自动化专业主干课程
- 先进性——著名通信专家近两年的最新著作，内容体系先进
- 经济性——价格与国内自编教材相当，是国内引进教材价格最低的

本书分为七部分，共三十章。第一部分为概述；第二部分为通用电力电子电路；第三部分为电源应用；第四部分为电机驱动应用；第五部分为其他应用，包括民用与工业应用、电力应用、电力接口的优化；第六部分为半导体器件；第七部分为实用变换器设计。本书配套一张光盘，内容主要包括：可作为作业和自学内容的大量有难度的习题；为深入掌握基本概念而增加的基于PSPICE的虚拟实验；最新的磁元件的设计方法；每一章的难点和重点部分的幻灯片。这些为教师备课和学生考试前的复习提供了很大的帮助。本书内容全面，几乎涉及了电力电子学的各个领域，包括各种应用领域，内

容非常实用。本书可作为高等院校电气工程、自动化等专业本科生“电力电子技术”课程的教材使用，也可供有关工程技术人员参考。

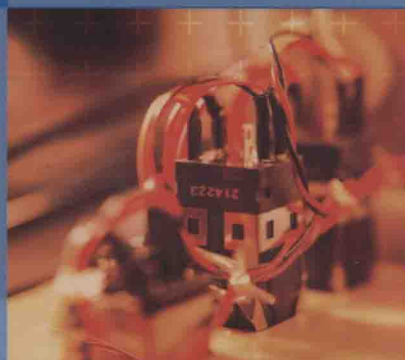
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电力电子学

——变换器、应用和设计

第3版 影印版

Power Electronics

Converters, Applications, And Design

Third Edition

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前 言

20 世纪末，以计算机和通信技术为代表的信息科学和技术对世界经济、科技、军事、教育和文化等产生了深刻影响。信息科学技术的迅速普及和应用，带动了世界范围信息产业的蓬勃发展，为许多国家带来了丰厚的回报。

进入 21 世纪，尤其随着我国加入 WTO，信息产业的国际竞争将更加激烈。我国信息产业虽然在 20 世纪末取得了迅猛发展，但与发达国家相比，甚至与印度、爱尔兰等国家相比，还有很大差距。国家信息化的发展速度和信息产业的国际竞争能力，最终都将取决于信息科学技术人才的质量和数量。引进国外信息科学和技术优秀教材，在有条件的学校推动开展英语授课或双语教学，是教育部为加快培养大批高质量的信息技术人才采取的一项重要举措。

为此，教育部要求由高等教育出版社首先开展信息科学和技术教材的引进试点工作。同时提出了两点要求，一是要高水平，二是要低价格。在高等教育出版社和信息科学技术引进教材专家组的努力下，经过比较短的时间，第一批引进的 20 多种教材已经陆续出版。这套教材出版后受到了广泛的好评，其中有不少是世界信息科学技术领域著名专家、教授的经典之作和反映信息科学技术最新进展的优秀作品，代表了目前世界信息科学技术教育的一流水平，而且价格也是最优惠的，与国内同类自编教材相当。

这项教材引进工作是在教育部高等教育司和高教社的共同组织下，由国内信息科学技术领域的专家、教授广泛参与，在对大量国外教材进行多次遴选的基础上，参考了国内和国外著名大学相关专业的课程设置进行系统引进的。其中，John Wiley 公司出版的贝尔实验室信息科学研究中心副总裁 Silberschatz 教授的经典著作《操作系统概念》，是我们经过反复谈判，做了很多努力才得以引进的。William Stallings 先生曾编写了在美国深受欢迎的信息科学技术系列教材，其中有多种教材获得过美国教材和学术著作者协会颁发的计算机科学与工程教材奖，这批引进教材中就有他的两本著作。留美中国学者 Jiawei Han 先生的《数据挖掘》是该领域中具有里程碑意义的著作。由达特茅斯学院的 Thomas Cormen 和麻省理工学院、哥伦比亚大学几位学者共同编著的经典著作《算法导论》，在经历了 11 年的锤炼之后于 2001 年出版了第二版。目前任教于美国 Massachusetts 大学的 James Kurose 教授，曾在美国三所高校先后 10 次获得杰出教师或杰出教学奖，由他主编的《计算机网络》出版后，以其体系新颖、内容先进而倍受欢迎。在努力降低引进教材售价方面，高等教育出版社做了大量和细致的工作。这套引进的教材体现了权威性、系统性、先进性和经济性等特点。

教育部也希望国内和国外的出版商积极参与此项工作，共同促进中国信息技术教育和信息产业的发展。我们在与外商的谈判工作中，不仅要坚定不移地引进国外最优秀的教材，而且还要千方百计地将版权转让费降下来，要让引进教材的价格与国内自编教材相当，让广大教师和学生负担得起。中国的教育市场巨大，外国出版公司和国内出版社要通过扩大发行数量取得效益。

在引进教材的同时，我们还应做好消化吸收，注意学习国外先进的教学思想和教学方法，提高自编教材的水平，使我们的教学和教材在内容体系上，在理论与实践的结合上，在培养学生的动手能力上能有较大的突破和创新。

目前，教育部正在全国 35 所高校推动示范性软件学院的建设和实施，这也是加快培养信息科学技术人才的重要举措之一。示范性软件学院要立足于培养具有国际竞争力的实用性软件人才，与国外知名高校或著名企业合作办学，以国内外著名 IT 企业为实践教学基地，聘请国内外知名教授和软件专家授课，还要率先使用引进教材开展教学。

我们希望通过这些举措，能在较短的时间，为我国培养一大批高质量的信息技术人才，提高我国软件人才的国际竞争力，促进我国信息产业的快速发展，加快推动国家信息化进程，进而带动整个国民经济的跨越式发展。

教育部高等教育司

二〇〇二年三月

To Our Families . . .
Mary, Michael, and Tara
Mona, Hilde, and Arne
Joanne and Jon

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PREFACE

MEDIA-ENHANCED THIRD EDITION

The first edition of this book was published in 1989 and the second edition in 1995. The basic intent of this edition, as in the two previous editions, is to provide a cohesive presentation of power electronics fundamentals for applications and design in the power range of 500 kW or less where a huge market exists and where the demand for power electronic engineers is likely to exist. This book has been adopted as a textbook at many universities around the world; it is for this reason that the text in this book has not been altered in any way. However, a CD-ROM has been added, which both the instructors and students will find very useful. This CD-ROM contains the following:

1. A large number of new problems with varying degrees of challenges have been added for homework assignments and self-learning.
2. PSpice-based simulation examples have been added to illustrate basic concepts and help in the design of converters. PSpice® is an ideal simulation tool in power electronics education.
3. A newly developed magnetic component design program has been included. This program is extremely useful in showing design trade-offs; for example, influence of switching frequency on the size of inductors and transformers.
4. For all chapters in this book, PowerPoint-based slides are included and can be printed. These should be helpful to instructors in organizing their lectures and to students in taking notes in class on printed copies and for a quick review before examinations.

ORGANIZATION OF THE BOOK

This book is divided into seven parts.

Part 1 presents an introduction to the field of power electronics, an overview of power semiconductor switches, a review of pertinent electric and magnetic circuit concepts, and a generic discussion of the role of computer simulations in power electronics.

Part 2 discusses the generic converter topologies that are used in most applications. The actual semiconductor devices (transistors, diode, and so on) are assumed to be ideal, thus allowing us to focus on the converter topologies and their applications.

Part 3 discusses switch-mode dc and uninterruptible power supplies. Power supplies represent one of the major applications of power electronics.

Part 4 considers motor drives, which constitute another major applications area.

Part 5 includes several industrial and commercial applications in one chapter. Another chapter describes various high-power electric utility applications. The last chapter in this part of the book examines the harmonics and EMI concerns and remedies for interfacing power electronic systems with electric utilities.

Part 6 discusses the power semiconductor devices used in power electronic converters, including diodes, BJTs, MOSFETs, thyristors, GTOs, IGBTs, and MCTs.

Part 7 discusses the practical aspects of power electronic converter design, including snubber circuits, drive circuits, circuit layout, and heat sinks. An extensive new chapter on the design of high-frequency inductors and transformers has been added.

SOLUTIONS MANUAL

As with the former editions of this book, a Solutions Manual with completely worked-out solutions to all the problems (including those on the CD-ROM) is available to instructors. It can be requested from the Wiley web page: <http://www.wiley.com/college/mohan>.

ACKNOWLEDGMENTS

We wish to thank all the instructors who have allowed us this opportunity to write the third edition of our book by adopting its first and second editions. We express our sincere appreciation to the Wiley Executive Editor Bill Zobrist for his persistence in keeping us on schedule.

Ned Mohan
Tore M. Undeland
William P. Robbins

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