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# POWER ELECTRONICS

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Converters, Applications,  
and Design

THIRD EDITION

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# PREFACE

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## **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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This article in its original form was written by Bimal K. Bose (University of Tennessee, Knoxville) in 2014. This article gives a brief historical review of the evolution of power electronics over the past 100-plus years. It includes electrical machines, mercury-arc rectifiers, gas tube electronics, MAs, power semiconductor devices, converter circuits, and motor drives. Wherever possible it gives the name of the inventor and the year of invention for important technologies. It is important to note