
PREFACE

Power electronics and drives are enabling technologies but most undergraduates, at best, will take only one course in these subjects. Recognizing this reality, this book is intended to teach students both the fundamentals in the context of exciting new applications and the practical design to meet the following objectives simultaneously:

- Provide solid background in fundamentals to prepare students for advanced courses
- Teach design fundamentals so that students can be productive in industry from the very beginning

In this book, the topics listed below are carefully sequenced to maintain student interest throughout the course and to maintain continuity as much as possible.

1. Applications and Structure of Switch-Mode Power Electronics Systems
2. Practical Details of Implementing a Switching Power-Pole (the building block)
3. DC-DC Converters: Switching Details and their Average Dynamic Models
4. Designing the Feedback Controller in DC-DC Converters
5. Diode Rectifiers and their Design
6. Power-Factor-Correction Circuits (PFCs) including the Controller Design
7. Review of Magnetic Concepts
8. Transformer-Isolated Switch-Mode DC Power Supplies
9. Design of High-Frequency Inductors and Transformers
10. Soft-Switching in DC-DC Converters, and its applications in High-Frequency AC Synthesis in Induction Heating and Compact Fluorescent Lamps (CFLs)
11. Electric Motor Drives
12. Synthesis of DC and Low-Frequency Sinusoidal AC in Motor Drives and Uninterruptible Power Supplies (UPS)
13. Control of Electric Drives and UPS
14. Thyristor Converters
15. Utility Applications of Power Electronics

Instructor's Choice

In a fast pace course with proper student background, this book with all these topics can be covered from front-to-back in one semester. However, the material is arranged in such

a way that an instructor can either omit an entire topic or cover it quickly to provide just an overview using the PowerPoint-based slides on the accompanying CD, without interrupting the flow.

This book is designed to serve as a semester-course textbook in two different curricula: 1) in a Power Electronics course where there is a separate undergraduate course offered on electric machines and drives, and 2) in a Power Electronics and Drives course where only a single course is offered on both of these subjects. The selections of chapters under these two circumstances are suggested below.

Textbook in a Power Electronics Course. In this course, since a separate undergraduate course exists on electric machines and drives, Chapter 11 on Electric Motor Drives and Chapter 13 on Design of Feedback Controllers in Motor Drives can be omitted. Depending on the availability of time, the “deeper” chapters such as Chapter 6 on Power Factor Control, Chapter 9 on Design of High-Frequency Inductors and Transformers, and Chapter 10 on Soft-Switching Converters can be covered very quickly, mainly to provide an overview.

Textbook in a Power Electronics and Drives Course. Since this course is intended to provide a broader coverage in a single semester by covering topics in power electronics as well in electric drives, some of the “deeper” chapters in power electronics listed earlier can be safely omitted.

Simulations

In Power Electronics, simulations using PSpice can be extremely beneficial for reaffirming the fundamentals and in describing the design details by making realistic problems. However, simulations are presented on the accompanying CD-ROM such that not to get in the way of the fundamentals.

CD-ROM

The accompanying CD includes the following:

- Extremely useful for Instructors: PowerPoint-based slides are included for every chapter to quickly prepare lectures and to review the material in class. Students can print all the slides and bring to the classroom to take notes on.
- Simulations and design examples are ready-to-execute, using PSpice that is loaded on this accompanying CD-ROM.