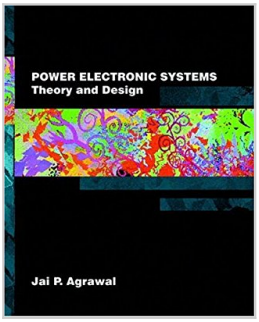

Power Electronic Systems: Theory and Design

By Jai P. Agrawal

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For one- or two-semester undergraduate courses in Power Electronics.With numerous design examples, illustrations and problems, as well as clearly defined learning objectives for each chapter, the text presents an easy-to-understand development of theory and engineering design aspects of power electronic systems. It provides a conceptual foundation across several disciplines, including electronic devices and circuits, signals and systems, motor drives and control systems. The text then addresses topics unique to power electronics, such as power utilization, quality, interfacing, and design issues. MATLAB is used throughout the text as a tool for enhancing the understanding of converter operation modes by simplifying the necessary mathematical calculations. The text is aimed for the undergraduate courses in engineering programs. It will be above the level of the courses in the technology programs.

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Editorial Review

From the Inside Flap
PREFACE

The field of power electronics encompasses the application of fundamental concepts in several disciplines: electronic devices and circuits, signals and systems, motor drives, and control systems. A course in power electronics should tie together all these diverse fundamental concepts into a consolidated core and add the considerations of power utilization, quality, interfacing, and design issues, which are special to the field of power electronics. This book is written with the above focus in mind with a conscious effort to simplify mathematics by use of MATLAB™ and to concentrate on developing a robust understanding of the subject. This book is intended as a textbook for a course on power electronics for junior and senior undergraduate students in electrical engineering programs. It could also serve as a self-learning book for practicing engineers. The prerequisites for this book are courses on electrical circuits and systems, electronic devices and circuits, and mathematics courses in calculus, differential equations, Fourier series and transformations, and linear algebra.

This book, intended for a one- or two-semester course, is divided into four parts. Part I presents an overview of the field of power electronics and the review of important mathematical concepts such as determining the average and rms values and the harmonic profile of waveforms, which are essential for understanding the rest of the chapters.

Part II provides an understanding of components used in the design of power electronics circuits in the generic categories of power diodes, transistors, and thyristors. Design of current sources, inductors, and transformers illustrated using design examples. Concepts are introduced for power losses during switching transitions, and on-state and off-state of semiconductor devices. This part also introduces the driver and protection circuits for each device discussed.

Part III discusses the classes of switch-mode converters: dc-dc, dc-ac, ac-dc, ac-ac, and the resonant converters. The focus is on topologies, performance measures, and performance characteristics.

Part IV covers the application systems such as power factor correction, electric utility interfacing, converter control, power supply, electronic ballast, and motor drives. This part also presents practical design issues such as temperature control, selection of heat sinks, protection, packaging, shielding, and layout.

Each chapter contains several, design examples to reinforce the concept learned, which illustrate the decision choices and selection of components. MATLAB® has been used extensively in these examples and also in the elaboration of the converter operation. PSPICE® simulation examples are included wherever possible.

Chapters 1 and 2 provide review and focus on the characteristics of components used in power electronic circuits. Chapters 3 to 5, on semiconductor switching components, may be covered at a faster pace if students have a strong prerequisite in semiconductor devices. Chapters 6 to 11 form the core of the course. Chapters 12, 14, and 15 discuss the design requirements of some specific illustrations and, therefore, can be covered at a faster rate. Chapter 16 on thermal and other design issues, in my opinion, must not be excluded. Chapter 13 presents the development of average and statespace average models of power converter systems followed by the derivation of the transfer function. It is left to instructor's discretion whether to cover it in the undergraduate course or not.

Several reviewers provided valuable assistance during the development of this text, and I am grateful for their input. They are Charles L. Bachman, Southern Polytechnic State University; Shamala Chickamenahalli, Wayne State University; Alexander E. Emanuel, Worcester Polytechnic Institute; Michael L. Holcombe, Purdue University; Rickie L. Miller, Ferris State University; Medhat M. Morcos, Kansas State University; and Shekhar Pradhan, Bluefield State College. As a final note, I am grateful to my wife Vaidehi, my children Sanjay, Vivek and Kshama for their patience and encouragement during the time I devoted to writing and revising this book.

Jai P. Agrawal

From the Back Cover

Divided into four parts, the book presents an array of design examples and problems to keep up with current trends, and satisfies a portion of the ABET design requirements for accreditation. It stands out as a comprehensive, practical, and current textbook in power electronics.

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Users Review

From reader reviews:

Richard Puccio:

This Power Electronic Systems: Theory and Design are usually reliable for you who want to be a successful person, why. The key reason why of this Power Electronic Systems: Theory and Design can be one of the great books you must have is giving you more than just simple reading through food but feed a person with information that maybe will shock your preceding knowledge. This book is handy, you can bring it everywhere and whenever your conditions in the e-book and printed types. Beside that this Power Electronic Systems: Theory and Design giving you an enormous of experience such as rich vocabulary, giving you trial run of critical thinking that we realize it useful in your day exercise. So , let's have it and luxuriate in reading.

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