



Power Electronics

with **MATLAB[®]**

L. Ashok Kumar
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This practically-oriented, all-inclusive guide covers the essential concepts of power electronics through MATLAB examples and Simulations. The in-depth explanation of important topics including digital control, power electronic applications, and electrical drives make it a valuable reference for the readers. The experiments and applications based on MATLAB models using fuzzy logic and neural networks are included for better understanding. Engrossing discussion of concepts such as diac, light-emitting diode, thyristors, power MOSFET and static induction transistor, this offers an enlightening experience to the readers.

With numerous solved examples, exercises, review questions, and GATE questions, the undergraduate and graduate students of electrical and electronics engineering will find this text useful.

Key features

- Covers the fundamental concepts of power electronics including semiconductors, power supplies, converters and inverters
- Includes useful projects and formulas for readers
- Plenty of MATLAB examples, Simulink and solved examples for conceptual understanding
- Competitive exam questions with hints

Supporting content and additional material available on the web at:
www.cambridge.org/9781316642313 and www.cambridgeindia.org

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Power Electronics with MATLAB®

Power electronics play an important role in the functioning of AC drives, semiconductors, power supplies, converters and inverters. The aim of studying the tools and techniques of power electronics is to obtain familiarity with advanced electronic applications and systems. With this aim in mind, this textbook is designed specifically for undergraduate and graduate students of electrical and electronics engineering, and electronics and communication engineering. It presents the fundamental concepts of power electronics including semiconductor devices, rectifiers, inverters, converters, choppers and cyclo-converters. It provides a comprehensive discussion on power electronic drives and electrical circuits. The latest developments including diac, diode, light-emitting diode, thyristors, power MOSFET and static induction transistor are also discussed in detail.

The book elaborates the essential concepts with the MATLAB examples and simulations. Plenty of applications based on MATLAB models using fuzzy logic and neural networks are interspersed throughout the text. Numerous solved examples, practice questions, objective type questions and review questions are provided at the end of each chapter.

The text can also serve as a reference book for researchers who need preliminary knowledge of the design and investigation of power electronic circuits.

L. Ashok Kumar is Professor in the Department of Electrical and Electronics Engineering at PSG College of Technology, Coimbatore. He has authored six books and has completed sixteen Government of India funded projects and is currently working on five projects. His areas of interest include wearable electronics, power electronics and drives, smart grids, solar PV and wind energy systems.

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To our families

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Preface

Unlike electronic systems that transmit and process signals and data, power electronics involves the processing of substantial amounts of electrical energy. The power range begins with tens of watts to a few hundred watts in the common AC/DC converter (rectifier) used in consumer electronic devices such as battery chargers, personal computers or television sets. In the industry, a common application such as the Variable Speed Drive (VSD), which is used to control an induction motor, has a power range that starts from a few hundred watts and can go upto tens of megawatts.

Beginnning with high-vacuum and gas-filled diode thermionic rectifiers, and triggered devices such as the thyatron and ignitron, the field has evolved to a stage where it can be said that today power electronics is the application of solid-state electronics to the control and conversion of electric power. Steady improvements in the voltage and current handling capacity of solid state devices have made this possible.

During the past few decades the technical aspect of power electronics and drives has gone through significant scientific progression. Many inventions in strategy, apparatus, circuit, control and systems have made power electronics a formidable technology during this period. MATLAB helps learners understand the field because it integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. This book introduces this promising technology with MATLAB/SIMULINK in Power Electronic Circuits. It addresses the progress of early semiconductor devices and then moves on to introduce recently developed high-performance power semiconductor switching devices and their applications using MATLAB/SIMULINK. It also gives a condensed review of the current power electronic circuits and their outcomes.

The ultimate purpose of this book is to help engineering students engage in energy conversion on the up-to-date electronic applications. It covers almost all features and

facilities of MATLAB/SIMULINK and their influence in Power Electronic Circuits like Rectifiers, Inverters, Converters, Choppers, Cyclo converters etc.

The book is recommended as an introductory handbook for starters and as a text book for undergraduate and postgraduate engineering students. It can also serve as a reference book for researchers who need preliminary knowledge of the design and investigation of Power Electronic Circuits.

Contents

<i>Figures</i>	<i>xv</i>
<i>Tables</i>	<i>xxv</i>
<i>Acknowledgements</i>	<i>xxvii</i>
<i>Preface</i>	<i>xxix</i>
1. Introduction to MATLAB	
1.1 Introduction and Outlook	1
1.2 How to Start with MATLAB?	2
1.2.1 Installing and activation	3
1.3 MATLAB: A Calculator	4
1.3.1 Basic arithmetic operations	5
1.3.2 Assigning values to variables	6
1.4 Basic Features of MATLAB	10
1.4.1 Investigation of a MATLAB function	10
1.4.2 Mathematical functions	10
1.4.3 Vector and matrix operations	12
1.4.4 Arrays	21
1.4.5 Basic plotting	24
1.5 Programming with MATLAB	26
1.5.1 Creating M-files	26
1.5.2 M-file functions	27
1.5.3 Control structures and operators	28
1.5.4 Debugging M-files	31
1.5.5 Creating plots	32

1.6	Circuit Descriptions	33
1.6.1	Format and layout	33
1.6.2	Electrical circuit description	34
1.6.3	Simulink library browser	34
1.6.4	Circuit elements	39
1.6.5	DC analysis	41
1.6.6	AC analysis	42
1.7	Examples of MATLAB Simulations	45
1.7.1	Steady state analysis of a linear circuit	45
1.7.2	Resonant switch converter using metal oxide semiconductor field effect transistor (MOSFET)	46
1.7.3	Gate turn off (GTO) thyristor-based converter	47
1.7.4	Regulation of zener diode	49
1.7.5	Regulation of pulse generator using thyristor converter	50
1.8	Other Types Circuit Simulators	52
1.8.1	PSpice	52
1.8.2	LabVIEW	52
1.8.3	PSIM	52
1.8.4	Scilab	53
1.8.5	VisSim	53
1.9	Merits and Demerits of MATLAB	54
1.9.1	Merits	54
1.9.2	Demerits	54
	<i>Summary</i>	54
	<i>Review Questions</i>	54
	<i>Practice Questions</i>	55
	<i>Multiple Choice Questions</i>	57
2.	MATLAB Simulation of Power Semiconductor Devices	
2.1	Introduction and Outlook	60
2.2	Why is Power Electronics Important?	61
2.3	Features of Power Electronics	61
2.4	Applications of Power Electronics	63
2.5	Power Semiconductor Devices in MATLAB/Simulink	64
2.5.1	Power diode and its characteristics	66
2.5.2	Zener diode	73
2.5.3	Fast recovery diode	75
2.5.4	Thyristors	76
2.5.5	Power MOSFET	100

2.5.6	Gate turn off thyristors	102
2.5.7	Insulated-gate bipolar transistor (IGBT)	105
2.6	Other Semiconductor Devices	107
2.6.1	DIAC	107
2.6.2	TRIAC	107
2.6.3	MOS controlled thyristor	108
2.6.4	Integrated gate-commutated thyristors	108
2.7	MATLAB/Simulink Model of Semiconductor Devices in Electronics	109
2.7.1	Schottky diode	109
2.7.2	Bipolar junction transistors	111
2.7.3	MOSFET	113
2.7.4	IGBT	114
2.8	Gate Triggering Methods	116
2.8.1	Resistance firing circuit	116
2.8.2	Resistance–capacitance firing circuit	117
2.8.3	UJT firing circuit	118
2.8.4	Pulse transformers	119
2.8.5	Optocoupler	119
2.8.6	Ramp–pedestrian triggering	120
2.9	Comparison of Power Semiconductor Devices with Industry Applications	120
2.9.1	Other devices	122
	<i>Summary</i>	125
	<i>Solved Examples</i>	125
	<i>Practice Questions</i>	141
	<i>Review Questions</i>	142
	<i>Multiple Choice Questions</i>	143

3. Phase-Controlled Rectifiers Using MATLAB (AC–DC Converters)

3.1	Introduction	146
3.2	Rectification and Its Classification	147
3.2.1	Based on control characteristics	147
3.2.2	Based on period of conduction	152
3.2.3	Based on number of phases	153
3.2.4	Based on number of pulses	153
3.3	Selection of Components from the Simulink Library Browser	153
3.4	One Pulse Converters	155
3.4.1	Single-phase half-wave-controlled rectifiers	155
3.5	Two Pulse Converters	163

3.5.1	Single-phase full-wave bridge rectifiers	163
3.5.2	Single-phase midpoint bridge rectifiers	169
3.5.3	Single-phase semiconverter half-controlled bridge rectifiers	173
3.6	Three Pulse Converters	178
3.6.1	Three-phase half-wave-controlled rectifiers	178
3.6.2	Three-phase half-controlled bridge rectifier with RL load	181
3.7	Six Pulse Converters	183
3.7.1	Six pulse converter with R load	183
3.7.2	Six pulse converter with RL load	186
3.8	Dual Converter	187
3.9	Role of Source Inductance in Rectifier Circuits (L_s)	188
3.10	Applications of Controlled Rectifiers	189
	<i>Summary</i>	189
	<i>Solved Examples</i>	189
	<i>Objective Type Questions</i>	200
	<i>Review Questions</i>	203
	<i>Practice Questions</i>	204
4.	DC Choppers Using MATLAB (DC-DC Converters)	
4.1	Introduction	206
4.2	Choppers and their Classification	207
4.3	Control Strategies of Chopper	208
4.3.1	Pulse width modulation or constant frequency system	208
4.3.2	Variable frequency control or frequency modulation	208
4.3.3	Current limit control	209
4.4	Selection of Components from the Simulink Library Browser	209
4.5	Principle of Operation of a Step-down Chopper	211
4.6	Principle of Operation of a Step-up Chopper	212
4.7	Performance Parameters of Step-up and Step-down Choppers	213
4.8	Chopper Configuration	215
4.8.1	Type A chopper	216
4.8.2	Type B chopper	217
4.8.3	Type C chopper (regenerative chopper)	220
4.8.4	Type D chopper	222
4.8.5	Type E chopper	224
4.9	Switching Mode Regulators	226
4.9.1	Buck converter	226
4.9.2	Boost converter	228
4.9.3	Buck-boost converter	230