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THE POWER ELECTRONICS HANDBOOK

INDUSTRIAL ELECTRONICS SERIES

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CRC PRESS

Boca Raton London New York Washington, D.C.

Library of Congress Cataloging-in-Publication Data

The power electronics handbook / edited by Timothy L. Skvarenina.
p. cm. — (Industrial electronics series)
Includes bibliographical references and index.
ISBN 0-8493-7336-0 (alk. paper)
1. Power electronics. I. Skvarenina, Timothy L. II. Series.

TK7881.15 .P673 2001
621.31′7—dc21 2001043047

Visit the CRC Press Web site at www.crcpress.com

International Standard Book Number 0-8493-7336-0
Library of Congress Card Number 2001043047
Printed in the United States of America 1 2 3 4 5 6 7 8 9 0
Printed on acid-free paper

Preface

Introduction

The control of electric power with power electronic devices has become increasingly important over the last 20 years. Whole new classes of motors have been enabled by power electronics, and the future offers the possibility of more effective control of the electric power grid using power electronics. *The Power Electronics Handbook* is intended to provide a reference that is both concise and useful for individuals, ranging from students in engineering to experienced, practicing professionals. The Handbook covers the very wide range of topics that comprise the subject of power electronics blending many of the traditional topics with the new and innovative technologies that are at the leading edge of advances being made in this subject. Emphasis has been placed on the practical application of the technologies discussed to enhance the value of the book to the reader and to enable a clearer understanding of the material. The presentations are deliberately tutorial in nature, and examples of the practical use of the technology described have been included.

The contributors to this Handbook span the globe and include some of the leading authorities in their areas of expertise. They are from industry, government, and academia. All of them have been chosen because of their intimate knowledge of their subjects as well as their ability to present them in an easily understandable manner.

Organization

The book is organized into three parts. Part I presents an overview of the semiconductor devices that are used, or projected to be used, in power electronic devices. Part II explains the operation of circuits used in power electronic devices, and Part III describes a number of applications for power electronics, including motor drives, utility applications, and electric vehicles.

The Power Electronics Handbook is designed to provide both the young engineer and the experienced professional with answers to questions involving the wide spectrum of power electronics technology covered in this book. The hope is that the topical coverage, as well as the numerous avenues to its access, will effectively satisfy the reader's needs.

Acknowledgments

First and foremost, I wish to thank the authors of the individual sections and the editorial advisors for their assistance. Obviously, this handbook would not be possible without them. I would like to thank all the people who were involved in the preparation of this handbook at CRC Press, especially Nora Konopka and Christine Andreasen for their guidance and patience. Finally, my deepest appreciation goes to my wife Carol who graciously allows me to pursue activities such as this despite the time involved.

The Editor

Timothy L. Skvarenina received his B.S.E.E. and M.S.E.E. degrees from the Illinois Institute of Technology in 1969 and 1970, respectively, and his Ph.D. in electrical engineering from Purdue University in 1979. In 1970, he entered active duty with the U.S. Air Force, where he served 21 years, retiring as a lieutenant colonel in 1991. During his Air Force career, he spent 6 years designing, constructing, and inspecting electric power distribution projects for a variety of facilities. He also was assigned to the faculty of the Air Force Institute of Technology (AFIT) for 3 years, where he taught and researched conventional power systems and pulsed-power systems, including railguns, high-power switches, and magnetocumulative generators. Dr. Skvarenina received the Air Force Meritorious Service Medal for his contributions to the AFIT curriculum in 1984. He also spent 4 years with the Strategic Defense Initiative Office (SDIO), where he conducted and directed large-scale systems analysis studies. He received the Department of Defense Superior Service Medal in 1991 for his contributions to SDIO.

In 1991, Dr. Skvarenina joined the faculty of the School of Technology at Purdue University, where he currently teaches undergraduate courses in electrical machines and power systems, as well as a graduate course in facilities engineering. He is a senior member of the IEEE; a member of the American Society for Engineering Education (ASEE), Tau Beta Pi, and Eta Kappa Nu; and a registered professional engineer in the state of Colorado.

Dr. Skvarenina has been active in both IEEE and ASEE. He has held the offices of secretary, vice-chair, and chair of the Central Indiana chapter of the IEEE Power Engineering Society. At the national level he is a member of the Power Engineering Society Education Committee. He has also been active in the IEEE Education Society, serving as an associate editor of the *Transactions on Education* and co-program chair for the 1999 and 2003 Frontiers in Education Conferences. For his activity and contributions to the Education Society, he received the IEEE Third Millennium Medal in 2000.

Within ASEE, Dr. Skvarenina has been an active member of the Energy Conversion and Conservation Division, serving in a series of offices including division chair. In 1999, he was elected by the ASEE membership to the Board of Directors for a 2-year term as Chair, Professional Interest Council III. In June 2000, he was elected by the Board of Directors as Vice-President for Profession Interest Councils for the year 2000–2001.

Dr. Skvarenina is the principal author of a textbook, *Electric Power and Controls* , published in 2001. He has authored or co-authored more than 25 papers in the areas of power systems, power electronics, pulsed-power systems, and engineering education.

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Contents

PART I Power Electronic Devices

1 Power Electronics
- 1.1 Overview *Kaushik Rajashekara*
- 1.2 Diodes *Sohail Anwar*
- 1.3 Schottky Diodes *Sohail Anwar*
- 1.4 Thyristors *Sohail Anwar*
- 1.5 Power Bipolar Junction Transistors *Sohail Anwar*
- 1.6 MOSFETs *Vrej Barkhordarian*
- 1.7 General Power Semiconductor Switch Requirements *Alex Q. Huang*
- 1.8 Gate Turn-Off Thyristors *Alex Q. Huang*
- 1.9 Insulated Gate Bipolar Transistors *Alex Q. Huang*
- 1.10 Gate-Commutated Thyristors and Other Hard-Driven GTOs *Alex Q. Huang*
- 1.11 Comparison Testing of Switches *Alex Q. Huang*

PART II Power Electronic Circuits and Controls

2 DC-DC Converters
- 2.1 Overview *Richard Wies, Bipin Satavalekar, and Ashish Agrawal*
- 2.2 Choppers *Javad Mahdavi, Ali Agah, and Ali Emadi*
- 2.3 Buck Converters *Richard Wies, Bipin Satavalekar, and Ashish Agrawal*
- 2.4 Boost Converters *Richard Wies, Bipin Satavalekar, and Ashish Agrawal*
- 2.5 Cúk Converter *Richard Wies, Bipin Satavalekar, and Ashish Agrawal*
- 2.6 Buck–Boost Converters *Daniel Jeffrey Shortt*

3 AC-AC Conversion *Sándor Halász*
- 3.1 Introduction
- 3.2 Cycloconverters
- 3.3 Matrix Converters

4 Rectifiers
- 4.1 Uncontrolled Single-Phase Rectifiers *Sam Guccione*
- 4.2 Uncontrolled and Controlled Rectifiers *Mahesh M. Swamy*
- 4.3 Three-Phase Pulse-Width-Modulated Boost-Type Rectifiers *Ana Stankovic*

5 Inverters
5.1 Overview *Michael Giesselmann*
5.2 DC-AC Conversion *Attila Karpati*
5.3 Resonant Converters *István Nagy*
5.4 Series-Resonant Inverters *Dariusz Czarkowski*
5.5 Resonant DC-Link Inverters *Michael B. Ropp*
5.6 Auxiliary Resonant Commutated Pole Inverters *Eric Walters and Oleg Wasynczuk*

6 Multilevel Converters *Keith Corzine*
6.1 Introduction
6.2 Multilevel Voltage Source Modulation
6.3 Fundamental Multilevel Converter Topologies
6.4 Cascaded Multilevel Converter Topologies
6.5 Multilevel Converter Laboratory Examples
6.6 Conclusion

7 Modulation Strategies
7.1 Introduction *Michael Giesselmann*
7.2 Six-Step Modulation *Michael Giesselmann*
7.3 Pulse Width Modulation *Michael Giesselmann*
7.4 Third Harmonic Injection for Voltage Boost of SPWM Signals *Michael Giesselmann*
7.5 Generation of PWM Signals Using Microcontrollers and DSPs *Michael Giesselmann*
7.6 Voltage-Source-Based Current Regulation *Michael Giesselmann*
7.7 Hysteresis Feedback Control *Hossein Salehfar*
7.8 Space-Vector Pulse Width Modulation *Hamid A. Toliyat and Tahmid Ur Rahman*

8 Sliding-Mode Control of Switched-Mode Power Supplies *Giorgio Spiazzi and Paolo Mattavelli*
8.1 Introduction
8.2 Introduction to Sliding-Mode Control
8.3 Basics of Sliding-Mode Theory
8.4 Application of Sliding-Mode Control to DC-DC Converters—Basic Principle
8.5 Sliding-Mode Control of Buck DC-DC Converters
8.6 Extension to Boost and Buck–Boost DC-DC Converters
8.7 Extension to Cúk and SEPIC DC-DC Converters
8.8 General-Purpose Sliding-Mode Control Implementation
8.9 Conclusions

Part III Applications and Systems Considerations

9 DC Motor Drives *Ralph Staus*
- 9.1 DC Motor Basics
- 9.2 DC Speed Control
- 9.3 DC Drive Basics
- 9.4 Transistor PWM DC Drives
- 9.5 SCR DC Drives

10 AC Machines Controlled as DC Machines (Brushless DC Machines/Electronics) *Hamid A. Toliyat and Tilak Gopalarathnam*
- 10.1 Introduction
- 10.2 Machine Construction
- 10.3 Motor Characteristics
- 10.4 Power Electronic Converter
- 10.5 Position Sensing
- 10.6 Pulsating Torque Components
- 10.7 Torque-Speed Characteristics
- 10.8 Applications

11 Control of Induction Machine Drives *Daniel Logue and Philip T. Krein*
- 11.1 Introduction
- 11.2 Scalar Induction Machine Control
- 11.3 Vector Control of Induction Machines
- 11.4 Summary

12 Permanent-Magnet Synchronous Machine Drives *Patrick L. Chapman*
- 12.1 Introduction
- 12.2 Construction of PMSM Drive Systems
- 12.3 Simulation and Model
- 12.4 Controlling the PMSM
- 12.5 Advanced Topics in PMSM Drives

13 Switched Reluctance Machines *Iqbal Husain*
- 13.1 Introduction
- 13.2 SRM Configuration
- 13.3 Basic Principle of Operation
- 13.4 Design
- 13.5 Converter Topologies
- 13.6 Control Strategies
- 13.7 Sensorless Control
- 13.8 Applications

14 Step Motor Drives *Ronald H. Brown*
14.1 Introduction
14.2 Types and Operation of Step Motors
14.3 Step Motor Models
14.4 Control of Step Motors

15 Servo Drives *Sándor Halász*
15.1 DC Drives
15.2 Induction Motor Drives

16 Uninterruptible Power Supplies *Laura Steffek, John Hacklesmiller, Dave Layden, and Brian Young*
16.1 UPS Functions
16.2 Static UPS Topologies
16.3 Rotary UPSs
16.4 Alternate AC and DC Sources

17 Power Quality and Utility Interface Issues
17.1 Overview *Wayne Galli*
17.2 Power Quality Considerations *Timothy L. Skvarenina*
17.3 Passive Harmonic Filters *Badrul H. Chowdhury*
17.4 Active Filters for Power Conditioning *Hirofumi Akagi*
17.5 Unity Power Factor Rectification *Rajapandian Ayyanar and Amit Kumar Jain*

18 Photovoltaic Cells and Systems *Roger Messenger*
18.1 Introduction
18.2 Solar Cell Fundamentals
18.3 Utility Interactive PV Applications
18.4 Stand-Alone PV Systems

19 Flexible, Reliable, and Intelligent Electrical Energy Delivery Systems *Alexander Domijan, Jr. and Zhidong Song*
19.1 Introduction
19.2 The Concept of FRIENDS
19.3 Development of FRIENDS
19.4 The Advanced Power Electronic Technologies within QCCs
19.5 Significance of FRIENDS
19.6 Realization of FRIENDS
19.7 Conclusions

20 Unified Power Flow Controllers *Ali Feliachi, Azra Hasanovic, and Karl Schoder*
20.1 Introduction
20.2 Power Flow on a Transmission Line

20.3 UPFC Description and Operation
20.4 UPFC Modeling
20.5 Control Design
20.6 Case Study
20.7 Conclusion
Acknowledgment

21 More-Electric Vehicles *Ali Emadi and Mehrdad Ehsani*
21.1 Aircraft *Ali Emadi and Mehrdad Ehsani*
21.2 Terrestrial Vehicles *Ali Emadi and Mehrdad Ehsani*

22 Principles of Magnetics *Roman Stemprok*
22.1 Introduction
22.2 Nature of a Magnetic Field
22.3 Electromagnetism
22.4 Magnetic Flux Density
22.5 Magnetic Circuits
22.6 Magnetic Field Intensity
22.7 Maxwell's Equations
22.8 Inductance
22.9 Practical Considerations

23 Computer Simulation of Power Electronics *Michael Giesselmann*
23.1 Introduction
23.2 Code Qualification and Model Validation
23.3 Basic Concepts—Simulation of a Buck Converter
23.4 Advanced Techniques—Simulation of a Full-Bridge (H-Bridge) Converter
23.5 Conclusions