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Easy-To-Understand Primer Is Good Intro To High-Power Electronics

Introduction to Power Electronics, Paul H. Chappell, Artech House, Boston, London, 2014, 199 pages, hardback; ISBN-13 978-1-60807-719-9.

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The author of this introduction to power electronics is an associate professor at the U. of Southampton, UK. The book focuses on basic topics and really is at the introductory level: diodes, transistors, thyristors, heating and cooling, high-power converters and inverters, to rephrase some chapter titles. The book leans heavily toward high-power electronics because it dwells on thyristors, phase-controlled thyristor converters, and cycloconverters. It also includes the motor-drives side of power electronics for large motors. Electric train applications come to my mind, and this book would be good for new engineering recruits working on locomotives or subway trains, or ships or other electric vehicles including cars and trucks nowadays.

The terminology in the book ("forced commutation", for instance) is generic GE talk, such as would be found at the GE locomotive works in Erie, Pennsylvania or among the people who constitute a diffusion of motor-drive knowledge out of GE headquarters in Schenectady, New York where it originated—leading people such as Thomas Lipo or Donald Novotny from the U. of WI at Madison, or Allan Plunkett from GE (one of my earlier motor-drive mentors), or Paul Krauss of Purdue U., who made the final advancement to basic motor theory and wrote the "book of record" for *The Analysis of Electric Machinery*, McGraw-Hill, 1986. (It is a national tragedy that this book is out of print, yet it is available as a paperback reprint by mailing a very reasonable $33 US to: Military Stores/Armory Bookstore, Purdue University, 1511 Armory Building, Room B1, West Lafayette, IN 47907-1511, USA). But I digress somewhat.

The author presents basic ideas fairly clearly, such as the ideal switch, an explanation I have given my non-electronics wife who understood it; so will anyone who reads Chappell's explanation. Other topics of the book are gate drive circuits, switching loss derivation, quasistatic and transient thermal resistance, three-phase converters and rectifiers with switch sequencing ("commutation"), the four power quadrants of motor-drives, five-plus pages on cycloconverters—converters of bipolar (ac) waveforms to bipolar waveforms of lower frequency— the bridge circuits for single- and three-phase inverters, and the PWM concept. Inductive-load driver circuits are given some consideration—all very basic—with the need for clamp diodes. The basic equations for the buck (CP) and boost (CA) PWM-switch configurations of converters are worked out, with basic waveforms.

Somehow, some medical electronics (defibrillator and transcranial magnetic stimulator) appears in chapter ten on "Systems and Methods". The medical examples delve into underdamped circuit dynamics to a basic extent. "Supply synchronization" appears to be preparation for power-factor control (PFC) but PFC is not developed as such in the book. The reader is prepared to see the value of PFC and the reasoning behind PFC design schemes. The book continues with a smattering of other topics—probably within the interest or experience of the author—and then ends with a chapter 11 of "Examples". The examples given are clear and useful, and span the concepts previously presented. The index is sufficient.

This book is best read by technicians and engineers in other areas of electronics who are interested in high-power (> 20 kW) power electronics. It would have marginal value to those who are seriously interested in mastering mainstream power electronics, either converters or motion-control electronics, for there are other books that cover these topics more completely and in more depth. However, for beginners entering the high-power niches, this book should give a useful start.

About The Author

Dennis Feucht has been involved in power electronics for 25 years, designing motor-drives and power converters. He has an instrument background from Tektronix, where he designed test and measurement equipment and did research in Tek Labs. He has lately been doing current-loop converter modeling and converter optimization.

To read Dennis' reviews of other texts on power supply design, magnetics design and related topics, see How2Power's Power Electronics Book Reviews.