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Control Systems for Power Electronics

A Practical Guide

 Springer

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ISSN 2191-530X ISSN 2191-5318 (electronic)
SpringerBriefs in Applied Sciences and Technology
ISBN 978-81-322-2327-6 ISBN 978-81-322-2328-3 (eBook)
DOI 10.1007/978-81-322-2328-3

Library of Congress Control Number: 2015934946

Springer New Delhi Heidelberg New York Dordrecht London
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Printed on acid-free paper

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Foreword

It has been a few years since I have been working with the authors of this book on the field of control systems and power electronics. We have executed challenging programs together and during our conversations we often touched upon a requirement for a practical text on this subject. It gives me immense pleasure to write the foreword for this book and seeing a thought converted into productive action.

This book is different from existing books on *Control Systems for Power Electronics* in a way that it is not scholarly, but is a practical-oriented compilation, replete with simple industry case studies. The illustrations are lucid and supported with simulations for various conditions and topologies adding a lot of value for the reader. The simulations and the accompanying colored illustrations make the complicated concepts easy to understand giving the reader a comprehensive understanding of the subject. The visual insights are extremely helpful and do not make it necessary for the reader to be extensively engaged on mathematics of control theory. I recommend this book for all readers in this domain across research, academics, and industry.

I enjoyed this book and hope you enjoy it too!

Anusheel Nahar, CEO
Controltrix Corp

Preface

The scope of the book covers most of the aspects as a primer on power electronics starting from a simple diode bridge to a DC–DC convertor using PWM control. The thyristor-bridge and the mechanism of forming a closed-loop system are discussed in Chaps. 1–3. The concepts are applied in Chap. 4 as a case study for buck converter which uses MOSFETs as switching devices and the closed-loop system is elaborated in Chap. 5. Chapter 6 is focused on the embedded system basics and the implementation of controls in the digital domain. The reader will find it easy to work on the practical control systems with microcontroller implementation.

The primary intent of this book is to help the reader gain an accelerated learning path to practical control system engineering and transform control theory to an implementable control system through electronics. Illustrations are provided for most of the examples with fundamental mathematics along with simulations of the systems with their relevant equations and stability calculations.

There are books elaborating on power electronics devices, power electronics applications, microcontrollers, and control system theory which can be used as a reference by the reader. The difference between specialized books and this book is that this book focuses on building practical blocks leveraging a basic understanding of electronic devices, simulations, and microcontrollers.

After reading this book, engineers will have a sound understanding of practical control system engineering. This will help them apply their domain knowledge to real product development.

Acknowledgments

This book is an on the job approach to implementing control system theory to a practical control system for various applications. It has been an arduous effort to translate our learning to development of practical control systems in the analog and digital world and the prime motive of this book is the thought that some of the learnings can be consolidated to give a head start to a practicing engineer.

We have learned much through our experience in various organizations over the years, working with brilliant colleagues and facing technical challenges in our everyday work.

Our sincere thanks to our colleagues at Crompton Greaves, General Electric, Emerson with whom our decades of association enlightened us on various aspects of this subject. Our special thanks to Shijin Krishna, who meticulously worked on the equations and helped through the proofreading with all his patience.

Our special thanks to Somachand Kattige and Rathish Gangadharan, who spent their precious time reviewing the text and suggesting improvements.

To our family and friends who had enormous patience to stand by us during this period of writing during weekends and late nights and encouraging us to go the last mile in making the book as flawless as possible.

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Learn from the Experts

This book is intended for beginners in control systems and also for professional engineers who work on controlling machines using the blend of power electronics and embedded control. Having gone through the learning curve and not found any concise material we decided to put together our limited learnings for our own reference and also for the larger forums.

The primary intent of this material is to get expertise in practical control system engineering with a motive of transforming control theory to an implementable control system in a microcontroller and electronics.

About the Authors



nals. He holds a Master's qualification from XLRI.

Mahesh Patil is a technopreneur and has led teams focusing on cutting edge technologies working for Multinational companies like General Electric, Crompton Greaves and has his own startup. He has built high performing start-up teams for electric vehicles, embedded services, expertise in building strategic alliances with high-tech companies. His experiences include product development for Industrial, Energy, and Automotive sectors working for large MNCs and also his own start-up organization. He is six sigma certified and has published papers in various international jour-



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