

ELECTROMAGNETIC MODELLING OF POWER ELECTRONIC CONVERTERS

J.A. Ferreira

foreword by
Thomas A. Lipo



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Electromagnetic Modelling Of Power Electronic Converters

Manuel Arias



Electromagnetic Modelling Of Power Electronic Converters:

Electromagnetic Modelling of Power Electronic Converters J.A. Ferreira, 2013-03-09 The era of the personal computer has without doubt permanently altered our life style in a myriad of ways The brain of the personal computer is the microprocessor together with RAM and ROM which makes the decisions needed for the computer to perform in the desired manner The microprocessor continues to evolve as increasingly complex tasks are required While not sharing the limelight of the microprocessor the heart of the personal computer namely the power supply is equally important since without the necessary source of power the microprocessor would be a useless piece of silicon The power supply of twenty years ago was much different than its modern day equivalent At the dawn of the personal computer era in the late 1970s power was obtained from a simple diode bridge However the need for smooth regulated DC at low voltage required at the same time both a bulky input transformer and a large dc side filter Those computer fans present at the birth of this industry can remember the large boxes housing our Altair Cromemco and Northstar computers which was made necessary largely because of the huge power supply It is not well appreciated but certainly true that the huge success of the Apple II computer in those days was due at least in part to the relatively slim profile of the machine This sleek appearance was largely due to the adoption of the then new and unproven switched mode power supply

Electromagnetic Modelling of Power Electronic Converters Jan Abraham Ferreira, 2014-01-15 Electromagnetic Modelling of Power Electronic Converters under Conditions of Appreciable Skin and Proximity Effects Jan Abraham Ferreira, 1987 **Electromagnetic Modelling of Power Electronic Converters Under Conditions of Appreciable Skin and Proximity Effects** Jan Abraham Ferreira, 1987

Transformers and Inductors for Power Electronics W.G. Hurley, W.H. Wölflé, 2013-04-29 Based on the fundamentals of electromagnetics this clear and concise text explains basic and applied principles of transformer and inductor design for power electronic applications It details both the theory and practice of inductors and transformers employed to filter currents store electromagnetic energy provide physical isolation between circuits and perform stepping up and down of DC and AC voltages The authors present a broad range of applications from modern power conversion systems They provide rigorous design guidelines based on a robust methodology for inductor and transformer design They offer real design examples informed by proven and working field examples Key features include emphasis on high frequency design including optimisation of the winding layout and treatment of non sinusoidal waveforms a chapter on planar magnetic with analytical models and descriptions of the processing technologies analysis of the role of variable inductors and their applications for power factor correction and solar power unique coverage on the measurements of inductance and transformer capacitance as well as tests for core losses at high frequency worked examples in MATLAB end of chapter problems and an accompanying website containing solutions a full set of instructors presentations and copies of all the figures Covering the basics of the magnetic components of power electronic converters this book is a comprehensive reference for students and professional

engineers dealing with specialised inductor and transformer design It is especially useful for senior undergraduate and graduate students in electrical engineering and electrical energy systems and engineers working with power supplies and energy conversion systems who want to update their knowledge on a field that has progressed considerably in recent years

Industrial Energy Management: Principles and Applications Giovanni Petrecca, 2012-12-06 Industrial Energy Management Principles and Applications provides an overall view of the energy management approach by following the stream of energy from factory boundaries to end users All topics are examined from the point of view of plant users rather than from that of designers and only the basic concepts necessary to clarify the operation of the plants are outlined Industrial Energy Management Principles and Applications is written both as a textbook for university courses in engineering and as a work of reference for professionals in energy management Readers are assumed to have a basic knowledge of thermodynamics heat and mass transfer electric systems and power electronics as well as computer programming This book can be used not only by technicians involved in the field of energy management but also by managers who may find it a useful tool for understanding investment proposals and even a spur to solicit new ones Industrial Energy Management Principles and Applications consists of 21 chapters concerning general principles of energy transformation and energy sources transformation plants such as electrical substations and boiler plants cogeneration plants electrical and thermal fluid distribution lines facilities plants such as pumps and fans air compressors cooling HVAC and lighting systems heat recovery equipment principles of energy auditing and accounting by using computers correlation between energy and waste education in the field At the end of the book a chapter has been dedicated to economic analysis of energy saving investments and evaluation is given of all the cases studied in the book

The Field Orientation Principle in Control of Induction Motors Andrzej M. Trzynadlowski, 2013-11-27 The Field Orientation Principle was first formulated by Haase in 1968 and Blaschke in 1970 At that time their ideas seemed impractical because of the insufficient means of implementation However in the early eighties technological advances in static power converters and microprocessor based control systems made the high performance a c drive systems fully feasible Since then hundreds of papers dealing with various aspects of the Field Orientation Principle have appeared every year in the technical literature and numerous commercial high performance a c drives based on this principle have been developed The term vector control is often used with regard to these systems Today it seems certain that almost all d c industrial drives will be ousted in the foreseeable future to be in major part superseded by a c drive systems with vector controlled induction motors This transition has already been taking place in industries of developed countries Vector controlled a c drives have been proven capable of even better dynamic performance than d c drive systems because of higher allowable speeds and shorter time constants of a c motors It should be mentioned that the Field Orientation Principle can be used in control not only of induction asynchronous motors but of all kinds of synchronous motors as well Vector controlled drive systems with the so called brushless d c motors have found many applications in high

performance drive systems such as machine tools and industrial robots

State Estimation in Electric Power Systems A. Monticelli, 2012-12-06 State Estimation in Electric Power Systems A Generalized Approach provides for the first time a comprehensive introduction to the topic of state estimation at an advanced textbook level The theory as well as practice of weighted least squares WLS is covered with significant rigor Included are an in depth analysis of power flow basics proper justification of Stott's decoupled method observability theory and matrix solution methods In terms of practical application topics such as bad data analysis combinatorial bad data analysis and multiple snapshot estimation are covered The book caters both to the specialist as well as the newcomer to the field State estimation will play a crucial role in the emerging scenario of a deregulated power industry Many market decisions will be based on knowing the present state of the system accurately State Estimation in Electric Power Systems A Generalized Approach crystallizes thirty years of WLS state estimation theory and practice in power systems and focuses on techniques adopted by state estimation developers worldwide The book also reflects the experience of developing industrial grade state estimation software that is used in the USA South America and many other places in world

Modeling and Python Simulation of Magnetics for Power Electronics Applications Shivkumar V. Iyer, 2022-06-20 This book describes the role of magnetism in electrical engineering starting from the most basic laws of physics converted into simulation models such that electrical engineering students can learn by example and practice The author demystifies a topic that many electrical engineers take for granted providing readers the tools to be able to understand how any magnetic component works He describes magnetic components like inductors and transformers in simple understandable language Mathematical equations related to the basic laws of physics are described in detail along with the physical significance of the equations Every application is supported by a simulation All simulations are performed using free and open source software based on Python making the material in this book universally accessible

Analysis of Subsynchronous Resonance in Power Systems K.R. Padiyar, 2012-12-06

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Simulation Technology for Modern Power Electronics Hao Bai, Chen Liu, Dusan Majstorovic, Fei Gao, 2023-05-19 Real Time Simulation Technology for Modern Power Electronics provides an invaluable foundation and state of the art review on the most advanced implementations of real time simulation as it appears poised to revolutionize the modeling of power electronics The book opens with a discussion of power electronics device physic modeling component modeling and power converter modeling before addressing numerical methods to solve converter model emphasizing speed and accuracy It discusses both CPU based and FPGA based real time implementations and provides an extensive review of current applications including hardware in the loop and its case studies in the micro grid and electric vehicle applications The book closes with a review of the near and long term outlooks for the evolving technology Collectively the work provides a systematic resource for students researchers and engineers in the electrical engineering and other closely related fields Introduces the theoretical building blocks of real time power electronic simulation through advanced modern implementations Includes modern case studies and implementations across diverse applications including electric vehicle component testing and microgrid controller testing Discusses FPGA based real time simulation techniques complete with illustrative examples comparisons with CPU based simulation computational performance and co simulation architectures

Digital Control of Electrical Drives Slobodan N. Vukosavic, 2007-07-26 Digital Control of Electrical Drives offers insight into electric drives and their usage in motion control environment It provides links among electrical machine and control theory practical hardware aspects programming issues and application specific problems The book prepares the reader to understand the key elements of motion control systems analyze and design discrete time speed and position controllers set adjustable feedback parameters and evaluate closed loop performances Basic engineering principles are used to derive the controller structure in an intuitive manner so that designs are easy to comprehend modify and extend Digital Control of Electrical Drives helps the reader acquire practical skills in designing discrete time speed and position controllers Each chapter is followed by a set of Matlab and Simulink tools which help readers master the phases of design tuning simulation and evaluation of discrete time controllers and foresee the effects of control solution on the overall motion control system Readers will also understand the present performance limits of digital motion controllers *High-Frequency Magnetic*

Components Marian K. Kazimierczuk, 2011-08-24 If you are looking for a complete study of the fundamental concepts in magnetic theory read this book No other textbook covers magnetic components of inductors and transformers for high frequency applications in detail This unique text examines design techniques of the major types of inductors and transformers used for a wide variety of high frequency applications including switching mode power supplies SMPS and resonant circuits It describes skin effect and proximity effect in detail to provide you with a sound understanding of high

frequency phenomena As well as this you will discover thorough coverage on integrated inductors and the self capacitance of inductors and transformers with expressions for self capacitances in magnetic components criteria for selecting the core material as well as core shape and size and an evaluation of soft ferromagnetic materials used for magnetic cores winding resistance at high frequencies expressions for winding and core power losses when non sinusoidal inductor or transformer current waveforms contain harmonics Case studies practical design examples and procedures using the area product method and the geometry coefficient method are expertly combined with concept orientated explanations and student friendly analysis Supplied at the end of each chapter are summaries of the key concepts review questions and problems the answers to which are available in a separate solutions manual Such features make this a fantastic textbook for graduates senior level undergraduates and professors in the area of power electronics in addition to electrical and computer engineering This is also an inimitable reference guide for design engineers of power electronics circuits high frequency transformers and inductors in areas such as SMPS and RF power amplifiers and circuits

Synchronized Phasor Measurements and Their Applications A.G. Phadke,J.S. Thorp,2008-08-15 This book provides an account of the field of synchronized Phasor Measurement technology its beginning its technology and its principal applications It covers wide Area Measurements WAM and their applications The measurements are done using GPS systems and eventually will replace the existing technology The authors created the field about twenty years ago and most of the installations planned or now in existence around the world are based on their work

Control of Power Electronic Converters and Systems: Volume 4 Frede Blaabjerg,2024-02-24 Control of Power Electronic Converters and Systems Volume Four covers emerging topics in the control of power electronics and converters not covered in previous volumes including emerging power converter topologies storage systems battery chargers and the smart transformer This updated edition specifically focuses on emerging power converter topologies and discusses very recent advances and topics with applications in power electronics and formidable probable dynamics Chapters include modeling of power converters and their control with supportive simulations and additional experimental results Anyone looking for fundamental knowledge regarding new trends in power electronics by application and also ready to use models and methodologies in their design control and testing will find this the next invaluable resource in this highly regarded series Combines essential control design methods and trends with different applications of power convertor topologies Includes global perspectives case studies and real examples from different applications and their control Features ready to use models and methodologies in power electronic application their design control and testing

Control of Power Electronic Converters and Systems Frede Blaabjerg,2018-04-27 Control of Power Electronic Converters Volume Two gives the theory behind power electronic converter control and discusses the operation modelling and control of basic converters The main components of power electronics systems that produce a desired effect energy conversion robot motion etc by controlling system variables voltages and currents are thoroughly

covered Both small mobile phones computer power supplies and very large systems trains wind turbines high voltage power lines and their power ranges from the Watt to the Gigawatt are presented and explored Users will find a focused resource on how to apply innovative control techniques for power converters and drives Discusses different applications and their control Explains the most important controller design methods both in analog and digital Describes different but important applications that can be used in future industrial products Covers voltage source converters in significant detail

Demonstrates applications across a much broader context Modelling and Simulation of Power Electronic Converter

Dominated Power Systems in PowerFactory Francisco M. Gonzalez-Longatt, José Luis Rueda Torres, 2020-11-02 This book provides an overview of power electronic converters for numerical simulations based on DIgSILENT PowerFactory It covers the working principles key assumptions and implementation of models of different types of these power systems The book is divided into three main parts the first discusses high voltage direct currents while the second part examines distribution systems and micro grids Lastly the third addresses the equipment and technologies used in modelling and simulation Each chapter includes practical examples and exercises and the accompanying software illustrates essential models principles and performance using DIgSILENT PowerFactory Exploring various current topics in the field of modelling power systems this book will appeal to a variety of readers ranging from students to practitioners **Design and Control of Power**

Converters 2020 Manuel Arias, 2021-06-04 In this book nine papers focusing on different fields of power electronics are gathered all of which are in line with the present trends in research and industry Given the generality of the Special Issue the covered topics range from electrothermal models and losses models in semiconductors and magnetics to converters used in high power applications In this last case the papers address specific problems such as the distortion due to zero current detection or fault investigation using the fast Fourier transform all being focused on analyzing the topologies of high power high density applications such as the dual active bridge or the H bridge multilevel inverter All the papers provide enough insight in the analyzed issues to be used as the starting point of any research Experimental or simulation results are presented to validate and help with the understanding of the proposed ideas To summarize this book will help the reader to solve specific problems in industrial equipment or to increase their knowledge in specific fields **Fundamentals of Power**

Electronics Kaushal Dhawan, 2025-02-20 Fundamentals of Power Electronics offers a comprehensive exploration of principles applications and advancements in power electronics We provide a valuable resource for students engineers and researchers to understand the fundamental concepts and practical aspects of power electronic systems We cover a wide range of topics including semiconductor devices power electronic converters control techniques and applications in renewable energy electric vehicles and industrial systems Complex concepts are presented clearly and accessibly with step by step explanations illustrative examples and detailed diagrams to aid comprehension Real world examples and case studies demonstrate the application of power electronics in various industries offering insights into design considerations

performance optimization and troubleshooting techniques Each chapter is structured to facilitate learning with learning objectives summaries review questions and problem solving exercises to reinforce understanding and retention of key concepts The book incorporates the latest advancements in power electronics technology including wide bandgap semiconductors digital control techniques and emerging applications such as wireless power transfer and Internet of Things IoT devices Fundamentals of Power Electronics is an essential guide for mastering power electronics and its applications in today s technological landscape Artificial Intelligence, Data Science and Applications Yousef Farhaoui, Amir Hussain, Tanzila Saba, Hamed Taherdoost, Anshul Verma, 2024-01-29 This book is to provide a comprehensive reference for professionals in the field of data science and applications artificial intelligence big data IoT and blockchain In summary this book is expected to function as a helpful resource and manual enabling readers to navigate the intricate domain of artificial intelligence the Internet of things IoT and blockchain in smart environments This book covers many topics related to integrating AI IoT blockchain and smart environments It begins by laying a solid foundation introducing each technology s fundamental concepts and principles Subsequent chapters explore applications and real world use cases demonstrating how AI IoT and blockchain can effectively address critical challenges within data science and applications

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