

## Power Electronic Converters Modeling And Control With Case Studies Advanced Textbooks In Control And Signal Processing

Power electronic converters can be broadly classified as AC to DC, DC to AC, DC to DC and AC to AC converters. AC to AC converters can be further classified as AC Controllers or AC regulators, Cycloconverters and Matrix converters. AC controllers and cycloconverters are fabricated using Silicon Controlled Rectifiers (SCR) whereas matrix converters are built using semiconductor bidirectional switches. This text book provides a summary of AC to AC Converter modelling excluding AC controllers. The software Simulink® by Mathworks Inc., USA is used to develop the models of AC to AC Converters presented in this text book. The term model in this text book refers to SIMULINK model. This text book is mostly suitable for researchers and practising professional engineers in the industry working in the area of AC to AC converters. Features Provides a summary of AC to AC Converter modelling excluding AC controllers Includes models for three phase AC to three phase AC matrix converters using direct and indirect space vector modulation algorithm Presents new applications such as single and dual programmable AC to DC rectifier with derivations for output voltage Displays Hardware-in-the Loop simulation of a three phase AC to single phase AC matrix converter Provides models for three phase multilevel matrix converters, Z-source Direct and Quasi Z-source Indirect matrix converters; a model for speed control and brake by plugging of three phase induction motor and separately excited DC motors using matrix converter; a model for a new single phase and three phase sine wave direct AC to AC Converter without a DC link using three winding transformers and that for a square wave AC to square wave AC converter using a DC link; models for variable frequency, variable voltage AC to AC power supply; models for Solid State Transformers using Dual Active Bridge topology and a new direct AC to AC Converter topology; and models for cycloconverters and indirect matrix converters

Power Electronics and Motor Drive Systems is designed to aid electrical engineers, researchers, and students to analyze and address common problems in state-of-the-art power electronics technologies. Author Stefanos Manias supplies a detailed discussion of the theory of power electronics circuits and electronic power conversion technology systems, with common problems and methods of analysis to critically evaluate results. These theories are reinforced by simulation examples using well-known and widely available software programs, including SPICE, PSIM, and MATLAB/SIMULINK. Manias expertly analyzes power electronic circuits with basic power semiconductor devices, as well as the new power electronic converters. He also clearly and comprehensively provides an analysis of modulation and output voltage, current control techniques, passive and active filtering, and the characteristics and gating circuits of different power semiconductor switches, such as BJTs, IGBTs, MOSFETs, IGCTs, MCTs and GTOs. Includes step-by-step analysis of power electronic systems Reinforced by simulation examples using SPICE, PSIM, and MATLAB/SIMULINK Provides 110 common problems and solutions in power electronics technologies

This book covers the fundamentals of power electronic converter modeling and control, digital simulation, and experimental studies in the area of renewable energy systems and AC/DC microgrid. Recent advanced control methods for voltage source inverters (VSIs) and the hierarchical controlled islanded microgrid are discussed, including the mathematical modeling, controller synthesis, parameter selection and multi-scale stability analysis, and consensus-based control strategies for the microgrid and microgrid clusters. The book will be an invaluable technical reference for practicing engineers and researchers working in the areas of renewable energy, power electronics, energy internet, and smart grid. It can also be utilized as reference book for undergraduate and postgraduate students in electrical engineering.

Converter-Based Dynamics and Control of Modern Power Systems addresses the ongoing changes and challenges in rotating masses of synchronous generators, which are transforming dynamics of the electrical system. These changes make it more important to consider and understand the role of power electronic systems and their characteristics in shaping the subtleties of the grid and this book fills that knowledge gap. Balancing theory, discussion, diagrams, mathematics, and data, this reference provides the information needed to acquire a thorough overview of resilience issues and frequency definition and estimation in modern power systems. This book offers an overview of classical power system dynamics and identifies ways of establishing future challenges and how they can be considered at a global level to overcome potential problems. The book is designed to prepare future engineers for operating a system that will be driven by electronics and less by electromechanical systems. Includes theory on the emerging topic of electrical grids based on power electronics Creates a good bridge between traditional theory and modern theory to support researchers and engineers Links the two fields of power systems and power electronics in electrical engineering

Explore the latest power electronics principles, practices, and applications This electrical engineering guide offers comprehensive coverage of design, modeling, simulation, and control for power electronics. The book describes real-world applications for the technology and features case studies worked out in both MATLAB and Simulink. Presented in an accessible style, Power Electronics Step-by-Step: Design, Modeling, Simulation, and Control focuses on the latest technologies, such as DC-based systems, and emphasizes the averaging technique for both simulation and modeling. You will get photos, diagrams, flowcharts, graphs, equations, and tables that illustrate each topic. Circuit components Non-isolated DC/DC conversion Power analysis DC to single-phase AC conversion Single-phase AC to DC conversion Galvanic isolated DC/DC conversion Power conversion for three-phase AC Bidirectional power conversion Averaging model for simulation Dynamic modeling of DC/DC converters Regulation of voltage and current

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

Simulation of Power Electronics Converters Using PLECS® is a guide to simulating a power electronics circuit using the latest powerful software for power electronics circuit simulation purposes. This book assists engineers gain an increased understanding

of circuit operation so they can, for a given set of specifications, choose a topology, select appropriate circuit component types and values, estimate circuit performance, and complete the design by ensuring that the circuit performance will meet specifications even with the anticipated variations in operating conditions and circuit component values. This book covers the fundamentals of power electronics converter simulation, along with an analysis of power electronics converters using PLECS. It concludes with real-world simulation examples for applied content, making this book useful for all those in the electrical and electronic engineering field. Contains unique examples on the simulation of power electronics converters using PLECS® Includes explanations and guidance on all included simulations for re-doing the simulations Incorporates analysis and design for rapidly creating power electronics circuits with high accuracy

In this original book on model predictive control (MPC) for power electronics, the focus is put on high-power applications with multilevel converters operating at switching frequencies well below 1 kHz, such as medium-voltage drives and modular multi-level converters. Consisting of two main parts, the first offers a detailed review of three-phase power electronics, electrical machines, carrier-based pulse width modulation, optimized pulse patterns, state-of-the-art converter control methods and the principle of MPC. The second part is an in-depth treatment of MPC methods that fully exploit the performance potential of high-power converters. These control methods combine the fast control responses of deadbeat control with the optimal steady-state performance of optimized pulse patterns by resolving the antagonism between the two. MPC is expected to evolve into the control method of choice for power electronic systems operating at low pulse numbers with multiple coupled variables and tight operating constraints it. Model Predictive Control of High Power Converters and Industrial Drives will enable to reader to learn how to increase the power capability of the converter, lower the current distortions, reduce the filter size, achieve very fast transient responses and ensure the reliable operation within safe operating area constraints. Targeted at power electronic practitioners working on control-related aspects as well as control engineers, the material is intuitively accessible, and the mathematical formulations are augmented by illustrations, simple examples and a book companion website featuring animations. Readers benefit from a concise and comprehensive treatment of MPC for industrial power electronics, enabling them to understand, implement and advance the field of high-performance MPC schemes.

DC/DC conversion techniques have undergone rapid development in recent decades. With the pioneering work of authors Fang Lin Luo and Hong Ye, DC/DC converters have now been sorted into their six generations, and by a rough count, over 800 different topologies currently exist, with more being developed each year. Advanced DC/DC Converters, Second Edition offers a concise, practical presentation of DC/DC converters, summarizes the spectrum of conversion technologies, and presents new ideas and more than 200 new topologies. Beginning with background material on DC/DC conversion, the book later discusses both voltage lift and super-lift converters. It then proceeds through each generation, including the groundbreaking sixth generation—converters developed by the authors that can be cascaded for high voltage transfer gain. This new edition updates every chapter and offers three new chapters. The introduction of the super-lift technique is an outstanding achievement in DC/DC conversion technology, and the ultra-lift technique and hybrid split-capacitor/inductor applied in Super-Lift Luo-Converters are introduced in Chapters 7 and 8. In Chapter 9, the authors have theoretically defined a new concept, Energy Factor (EF), researched the relations between EF and the mathematical modelling for power DC/DC converters, and demonstrated the modeling method for two converters. More than 320 figures, 60 tables, and 500 formulae allow the reader to more easily grasp the overall structure of advanced DC/DC converters, provide fast access to precise data, and help them to quickly determine the values of their own circuit components. Modern power electronic converters are involved in a very broad spectrum of applications: switched-mode power supplies, electrical-machine-motion-control, active power filters, distributed power generation, flexible AC transmission systems, renewable energy conversion systems and vehicular technology, among them. Power Electronics Converters Modeling and Control teaches the reader how to analyze and model the behavior of converters and so to improve their design and control. Dealing with a set of confirmed algorithms specifically developed for use with power converters, this text is in two parts: models and control methods. The first is a detailed exposition of the most usual power converter models: · switched and averaged models; · small/large-signal models; and · time/frequency models. The second focuses on three groups of control methods: · linear control approaches normally associated with power converters; · resonant controllers because of their significance in grid-connected applications; and · nonlinear control methods including feedback linearization, stabilizing, passivity-based, and variable-structure control. Extensive case-study illustration and end-of-chapter exercises reinforce the study material. Power Electronics Converters Modeling and Control addresses the needs of graduate students interested in power electronics, providing a balanced understanding of theoretical ideas coupled with pragmatic tools based on control engineering practice in the field. Academics teaching power electronics will find this an attractive course text and the practical points make the book useful for self tuition by engineers and other practitioners wishing to bring their knowledge up to date.

The first book of its kind, Power Converters and AC Electrical Drives with Linear Neural Networks systematically explores the application of neural networks in the field of power electronics, with particular emphasis on the sensorless control of AC drives. It presents the classical theory based on space-vectors in identification, discusses control of electrical drives and power converters, and examines improvements that can be attained when using linear neural networks. The book integrates power electronics and electrical drives with artificial neural networks (ANN). Organized into four parts, it first deals with voltage source inverters and their control. It then covers AC electrical drive control, focusing on induction and permanent magnet synchronous motor drives. The third part examines theoretical aspects of linear neural networks, particularly the neural EXIN family. The fourth part highlights original applications in electrical drives and power quality, ranging from neural-based parameter estimation and sensorless control to distributed generation systems from renewable sources and active power filters. Simulation and experimental results are provided to validate the theories. Written by experts in the field, this state-of-the-art book requires basic knowledge of electrical machines and power electronics, as well as some familiarity with control systems, signal processing, linear algebra, and numerical analysis. Offering multiple paths through the material, the text is suitable for undergraduate and postgraduate students, theoreticians, practicing engineers, and researchers involved in applications of ANNs.

Filling the need for a reference that explains the behavior of power electronic converters, this book provides information currently unavailable in similar texts on power electronics. Clearly organized into four parts, the first treats the dynamics and control of conventional converters, while the second part covers the dynamics and control of DC-DC converters in renewable energy applications, including an introduction to the sources as well as the design of current-fed converters applying duality-transformation methods. The third part treats the dynamics and control of three-phase rectifiers in voltage-sourced applications,

and the final part looks at the dynamics and control of three-phase inverters in renewable-energy applications. With its future-oriented perspective and advanced, first-hand knowledge, this is a prime resource for researchers and practicing engineers needing a ready reference on the design and control of power electronic converters.

DC-DC converters require negative feedback to provide a suitable output voltage or current for the load. Obtaining a stable output voltage or current in the presence of disturbances like input voltage changes and/or output load changes seems impossible without some form of control. This book shows how simple controllers such as Proportional-Integral (PI) can turn into a robust controller by correct selection of its parameters. Kharitonov's theorem is an important tool toward this end. This book consists of two parts. The first part shows how one can obtain the interval plant model of a DC-DC converter. The second part introduces the Kharitonov's theorem. Kharitonov's theorem is an analysis tool rather than a design tool. Some case studies show how it can be used as a design tool. The prerequisite for reading this book is a first course on feedback control theory and power electronics. Presents Fundamentals of Modeling, Analysis, and Control of Electric Power Converters for Power System Applications Electronic (static) power conversion has gained widespread acceptance in power systems applications; electronic power converters are increasingly employed for power conversion and conditioning, compensation, and active filtering. This book presents the fundamentals for analysis and control of a specific class of high-power electronic converters—the three-phase voltage-sourced converter (VSC). Voltage-Sourced Converters in Power Systems provides a necessary and unprecedented link between the principles of operation and the applications of voltage-sourced converters. The book: Describes various functions that the VSC can perform in electric power systems Covers a wide range of applications of the VSC in electric power systems—including wind power conversion systems Adopts a systematic approach to the modeling and control design problems Illustrates the control design procedures and expected performance based on a comprehensive set of examples and digital computer time-domain simulation studies This comprehensive text presents effective techniques for mathematical modeling and control design, and helps readers understand the procedures and analysis steps. Detailed simulation case studies are included to highlight the salient points and verify the designs. Voltage-Sourced Converters in Power Systems is an ideal reference for senior undergraduate and graduate students in power engineering programs, practicing engineers who deal with grid integration and operation of distributed energy resource units, design engineers, and researchers in the area of electric power generation, transmission, distribution, and utilization.

This book outlines current research into the scientific modeling, experimentation, and remedial measures for advancing the reliability, availability, system robustness, and maintainability of Power Electronic Converter Systems (PECS) at different levels of complexity.

Control of Power Electronic Converters and Systems examines the theory behind power electronic converter control, including operation, modeling and control of basic converters. The book explores how to manipulate components of power electronics converters and systems to produce a desired effect by controlling system variables. Advances in power electronics enable new applications to emerge and performance improvement in existing applications. These advances rely on control effectiveness, making it essential to apply appropriate control schemes to the converter and system to obtain the desired performance.

Discusses different applications and their control Explains the most important controller design methods both in analog and digital Describes different important applications to be used in future industrial products Covers voltage source converters in significant detail Demonstrates applications across a much broader context

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.

In modern industries, electrical energy conversion systems consist of two main parts: electrical machines and power electronic converters. With global electricity use at an all-time high, uninterrupted operation of electrical power converters is essential.

Reliability in Power Electronics and Electrical Machines: Industrial Applications and Performance Models provides an in-depth analysis of reliability in electrical energy converters as well as strategies for designing dependable power electronic converters and electrical machines. Featuring a comprehensive discussion on the topics of reliability design and measurement, failure mechanisms, and specific issues pertaining to quality, efficiency, and durability, this timely reference source offers practical examples and research-based results for use by engineers, researchers, and advanced-level students.

Power Electronics Basics: Operating Principles, Design, Formulas, and Applications provides fundamental knowledge for the analysis and design of modern power electronic devices. This concise and user-friendly resource: Explains the basic concepts and most important terms of power electronics Describes the power assemblies, control, and passive components of semiconductor power switches Covers the control of power electronic devices, from mathematical modeling to the analysis of the electrical processes Addresses pulse-width modulation, power quality control, and multilevel, modular, and multicell power converter topologies Discusses line-commutated and resonant converters, as well as inverters and AC converters based on completely controllable switches Explores cutting-edge applications of power electronics, including renewable energy production and storage, fuel cells, and electric drives Power Electronics Basics: Operating Principles, Design, Formulas, and Applications supplies graduate students, industry professionals, researchers, and academics with a solid understanding of the underlying theory, while offering an overview of the latest achievements and development prospects in the power electronics industry.

Some power electronic converters are specifically designed to power equipment under a smoothed DC voltage. Therefore, the filtering part necessarily involves the use of auxiliary passive components (inductors and capacitors). This book deals with technical aspects such as classical separation between isolated and non-isolated power supplies, and soft switching through a special converter. It addresses the problem of regulating the output voltage of the switching power supplies in terms of modeling and obtaining transfer of SMPS functions. Power Electronics for Industry and Transport, Volume 3, offers a case study of an isolated flyback power which the complete design is presented: the active and passive components are sized based on the specifications initially set. Particular attention is given to the converter output capacitors and all the surrounding organs.

Introducing Essential notions in power electronics from both the theoretical and technological perspectives Detailed chapters with

a focus on switch-mode power supplies, another key area in which power electronics is used is in the supply of energy to a variety of electronic equipment for signal and information processing Presented from a user's perspective to enable you to apply the theory of power electronics to practical applications

In high power, high voltage electronics systems, a strategy to manage short timescale energy imbalances is fundamental to the system reliability. Without a theoretical framework, harmful local convergence of energy can affect the dynamic process of transformation, transmission, and storage which create an unreliable system. With an original approach that encourages understanding of both macroscopic and microscopic factors, the authors offer a solution. They demonstrate the essential theory and methodology for the design, modeling and prototyping of modern power electronics converters to create highly effective systems. Current applications such as renewable energy systems and hybrid electric vehicles are discussed in detail by the authors. Key features: offers a logical guide that is widely applicable to power electronics across power supplies, renewable energy systems, and many other areas analyses the short-scale (nano-micro second) transient phenomena and the transient processes in nearly all major timescales, from device switching processes at the nanoscale level, to thermal and mechanical processes at second level explores transient causes and shows how to correct them by changing the control algorithm or peripheral circuit includes two case studies on power electronics in hybrid electric vehicles and renewable energy systems Practitioners in major power electronic companies will benefit from this reference, especially design engineers aiming for optimal system performance. It will also be of value to faculty staff and graduate students specializing in power electronics within academia.

A voltage converter changes the voltage of an electrical power source and is usually combined with other components to create a power supply. This title is devoted to the control of static converters, which deals with pulse-width modulation (PWM) techniques, and also discusses methods for current control. Various application cases are treated. The book is ideal for professionals in power engineering, power electronics, and electric drives industries, as well as practicing engineers, university professors, postdoctoral fellows, and graduate students.

A comprehensive guide to approaches to decoding, synthesizing and modeling pulse width modulation (PWM) converters Origin of Power Converters explores the original converter and provides a systematic examination of the development and modeling of power converters based on decoding and synthesizing approaches. The authors—noted experts on the topic—present an introduction to the origins of the converter and detail the fundamentals related to power the converter's evolution. They cover a range of converter synthesis approaches, synthesis of multi-stage/multi-level converters, extension of hard-switching converters to soft-switching ones, and determination of switch-voltage stresses in the converters. In later chapters, this comprehensive resource reviews conventional two-port network theory and the state-space averaged (SSA) modeling approach, from which systematic modeling approaches are based on the graft switch technique. In addition, the book reviews the converter layer scheme and some fundamental circuit theories. This important book:

- Contains a review of several typical transfer codes, such as step-down, step-up, step-up&down, and  $\pm$  step-up&down
- Describes the syntheses of pulse width modulation (PWM) converters such as voltage-fed z-source, current-fed z-source, quasi z-source, switched capacitor, and switched inductor converters
- Presents two application examples based on previously proposed modeling approaches

Written for academic researchers, graduate students, and seniors in power electronics, Origin of Power Converters provides a comprehensive understanding of the evolution of the converter and its applications.

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, dc 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.

An invaluable academic reference for the area of high-power converters, covering all the latest developments in the field High-power multilevel converters are well known in industry and academia as one of the preferred choices for efficient power conversion. Over the past decade, several power converters have been developed and commercialized in the form of standard and customized products that power a wide range of industrial applications. Currently, the modular multilevel converter is a fast-growing technology and has received wide acceptance from both industry and academia. Providing adequate technical background for graduate- and undergraduate-level teaching, this book includes a comprehensive analysis of the conventional and advanced modular multilevel converters employed in motor drives, HVDC systems, and power quality improvement. Modular Multilevel Converters: Analysis, Control, and Applications provides an overview of high-power converters, reference frame theory, classical control methods, pulse width modulation schemes, advanced model predictive control methods, modeling of ac drives, advanced drive control schemes, modeling and control of HVDC systems, active and reactive power control, power quality problems, reactive power, harmonics and unbalance compensation, modeling and control of static synchronous compensators (STATCOM) and unified power quality compensators. Furthermore, this book: Explores technical challenges, modeling, and control of various modular multilevel converters in a wide range of applications such as transformer and transformerless motor drives, high voltage direct current transmission systems, and power quality improvement Reflects the latest developments in high-power converters in medium-voltage motor drive systems Offers design guidance with tables, charts graphs, and MATLAB simulations Modular Multilevel Converters: Analysis, Control, and Applications is a valuable reference book for academic researchers, practicing engineers, and other professionals in the field of high power

converters. It also serves well as a textbook for graduate-level students.

Provides a step-by-step method for the development of a virtual interactive power electronics laboratory. The book is suitable for undergraduates and graduates for their laboratory course and projects in power electronics. It is equally suitable for professional engineers in the power electronics industry. The reader will learn to develop interactive virtual power electronics laboratory and perform simulations of their own, as well as any given power electronic converter design using SIMULINK with advanced system model and circuit component level model. Features Examples and Case Studies included throughout. Introductory simulation of power electronic converters is performed using either PSIM or MICROCAP Software. Covers interactive system model developed for three phase Diode Clamped Three Level Inverter, Flying Capacitor Three Level Inverter, Five Level Cascaded H-Bridge Inverter, Multicarrier Sine Phase Shift PWM and Multicarrier Sine Level Shift PWM. System models of power electronic converters are verified for performance using interactive circuit component level models developed using Simscape-Electrical, Power Systems and Specialized Technology block set. Presents software in the loop or Processor in the loop simulation with a power electronic converter examples.

Modeling and Control of Power Electronics Converter Systems for Power Quality Improvements provides grounded theory for the modeling, analysis and control of different converter topologies that improve the power quality of mains. Intended for researchers and practitioners working in the field, topics include modeling equations and the state of research to improve power quality converters. By presenting control methods for different converter topologies and aspects related to multi-level inverters and specific analysis related to the AC interface of drives, the book helps users by putting a particular emphasis on different control algorithms that enhance knowledge and research work. Present In-depth coverage of modeling and control methods for different converter topology Includes a particular emphasis on different control algorithms to give readers an easier understanding Provides a results and discussion chapter and MATLAB simulation to support worked examples and real-life application scenarios

DC-DC converters have many applications in the modern world. They provide the required power to the communication backbones, they are used in digital devices like laptops and cell phones, and they have widespread applications in electric cars, to just name a few. DC-DC converters require negative feedback to provide a suitable output voltage or current for the load. Obtaining a stable output voltage or current in presence of disturbances such as: input voltage changes and/or output load changes seems impossible without some form of control. This book tries to train the art of controller design for DC-DC converters. Chapter 1 introduces the DC-DC converters briefly. It is assumed that the reader has the basic knowledge of DC-DC converter (i.e., a basic course in power electronics). The reader learns the disadvantages of open loop control in Chapter 2. Simulation of DC-DC converters with the aid of Simulink® is discussed in this chapter as well. Extracting the dynamic models of DC-DC converters is studied in Chapter 3. We show how MATLAB® and a software named KUCA can be used to do the cumbersome and error-prone process of modeling automatically. Obtaining the transfer functions using PSIM® is studied as well. These days, softwares are an integral part of engineering sciences. Control engineering is not an exception by any means. Keeping this in mind, we design the controllers using MATLAB® in Chapter 4. Finally, references are provided at the end of each chapter to suggest more information for an interested reader. The intended audiences for this book are practice engineers and academicians.

Modeling of photovoltaic sources and their emulation by means of power electronic converters are challenging issues. The former is tied to the knowledge of the electrical behavior of the PV generator; the latter consists in its realization by a suitable power amplifier. This extensive introduction to the modeling of PV generators and their emulation by means of power electronic converters will aid in understanding and improving design and set up of new PV plants. The main benefit of reading Photovoltaic Sources is the ability to face the emulation of photovoltaic generators obtained by the design of a suitable equipment in which voltage and current are the same as in a real source. This is achieved according to the following steps: the source electrical behavior modeling, the power converter design, including its control, for the laboratory emulator. This approach allows the reader to cope with the creation of an indoor virtual photovoltaic plant, in which the environmental conditions can be imposed by the user, for testing real operation including maximum power point tracking, partial shading, control for the grid or load interfacing, etc. Photovoltaic Sources is intended to meet the demands of postgraduate level students, and should prove useful to professional engineers and researchers dealing with the problems associated with modeling and emulation of photovoltaic sources.

Discusses the application of mathematical and engineering tools for modeling, simulation and control oriented for energy systems, power electronics and renewable energy This book builds on the background knowledge of electrical circuits, control of dc/dc converters and inverters, energy conversion and power electronics. The book shows readers how to apply computational methods for multi-domain simulation of energy systems and power electronics engineering problems. Each chapter has a brief introduction on the theoretical background, a description of the problems to be solved, and objectives to be achieved. Block diagrams, electrical circuits, mathematical analysis or computer code are covered. Each chapter concludes with discussions on what should be learned, suggestions for further studies and even some experimental work. Discusses the mathematical formulation of system equations for energy systems and power electronics aiming state-space and circuit oriented simulations Studies the interactions between MATLAB and Simulink models and functions with real-world implementation using microprocessors and microcontrollers Presents numerical integration techniques, transfer-function modeling, harmonic analysis and power quality performance assessment Examines existing software such as, MATLAB/Simulink, Power Systems Toolbox and PSIM to simulate power electronic circuits including the use of renewable energy sources such as wind and solar sources The simulation files are available for readers who register with the Google Group: power-electronics-interfacing-energy-conversion-systems@googlegroups.com. After your registration you will receive information in how to access the simulation files, the

Google Group can also be used to communicate with other registered readers of this book.

Modern power electronic converters are involved in a very broad spectrum of applications: switched-mode power supplies, electrical-machine-motion-control, active power filters, distributed power generation, flexible AC transmission systems, renewable energy conversion systems and vehicular technology, among them. Electronic power conversion has gained widespread acceptance in power systems applications, electronic power converters are increasingly employed for power conversion and conditioning, compensation, and active filtering. This book presents the fundamentals for analysis and control of a specific class of high-power electronic converters-the three-phase voltage-sourced converter. Voltage-sourced converters in power systems provides a necessary and unprecedented link between the principles of operation and the applications of voltage-sourced converters. Power Electronics Converters Modelling and Control teaches the reader how to analyse and model the behaviour of converters and so to improve their design and control. Dealing with a set of confirmed algorithms specifically developed for use with power converters.

As concerns about climate change, energy prices, and energy security loom, regulatory and research communities have shown growing interest in alternative energy sources and their integration into distributed energy systems. However, many of the candidate microgeneration and associated storage systems cannot be readily interfaced to the 50/60 Hz grid. In Power Electronic Converters for Microgrids, Sharkh and Abu-Sara introduce the basics and practical concerns of analyzing and designing such micro-generation grid interface systems. Readers will become familiar with methods for stably feeding the larger grid, importing from the grid to charge on-site storage, disconnecting from the grid in case of grid failure, as well as connect multiple microgrids while sharing their loads appropriately. Sharkh and Abu-Sara introduce not only the larger context of the technology, but also present potential future applications, along with detailed case studies and tutorials to help the reader effectively engineer microgrid systems.

Control of Power Electronic Converters and Systems, Volume 3, explores emerging topics in the control of power electronics and converters, including the theory behind control, and the practical operation, modeling, and control of basic power system models. This book introduces the most important controller design methods, including both analog and digital procedures. This reference explains the dynamic characterization of terminal behavior for converters, as well as preserving the stability and power quality of modern power systems. Useful for engineers in emerging applications of power electronic converters and those combining control design methods into different applications in power electronics technology. Addressing controller interactions - in light of increasing renewable energy integration and related challenges with stability and power quality - is becoming more frequent in power converters and passive components. Discusses different applications and their control in integrated renewable energy systems Introduces the most important controller design methods, both in analog and digital Describes different important applications to be used in future industrial products Explains the dynamic characterization of terminal behavior for converters

Impedance Source Power Electronic Converters brings together state of the art knowledge and cutting edge techniques in various stages of research related to the ever more popular impedance source converters/inverters. Significant research efforts are underway to develop commercially viable and technically feasible, efficient and reliable power converters for renewable energy, electric transportation and for various industrial applications. This book provides a detailed understanding of the concepts, designs, controls, and application demonstrations of the impedance source converters/inverters. Key features: Comprehensive analysis of the impedance source converter/inverter topologies, including typical topologies and derived topologies. Fully explains the design and control techniques of impedance source converters/inverters, including hardware design and control parameter design for corresponding control methods. Presents the latest power conversion solutions that aim to advance the role of power electronics into industries and sustainable energy conversion systems. Compares impedance source converter/inverter applications in renewable energy power generation and electric vehicles as well as different industrial applications. Provides an overview of existing challenges, solutions and future trends. Supported by calculation examples, simulation models and results. Highly accessible, this is an invaluable resource for researchers, postgraduate/graduate students studying power electronics and its application in industry and renewable energy conversion as well as practising R&D engineers. Readers will be able to apply the presented material for the future design of the next generation of efficient power electronic converters/inverters.

This book covers power electronics, in depth, by presenting the basic principles and application details, which can be used both as a textbook and reference book. Introduces a new method to present power electronics converters called Power Blocks Geometry (PBG) Applicable for courses focusing on power electronics, power electronics converters, and advanced power converters Offers a comprehensive set of simulation results to help understand the circuits presented throughout the book

This book covers advancements of power electronic converters and their control techniques for grid integration of large-scale renewable energy sources and electrical vehicles. Major emphasis are on transformer-less direct grid integration, bidirectional power transfer, compensation of grid power quality issues, DC system protection and grounding, interaction in mixed AC/DC system, AC and DC system stability, magnetic design for high-frequency high power density systems with advanced soft magnetic materials, modelling and simulation of mixed AC/DC system, switching strategies for enhanced efficiency, and protection and reliability for sustainable grid integration. This book is an invaluable resource for professionals active in the field of renewable energy and power conversion.

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