Fundamentals Of Power Electronics Second Edition 2nd Second Edition By Erickson Robert W Maksimovic Dragan Published By Springer 2001

This book comprises the refereed proceedings of the International Conference, AIM/CCPE 2012, held in Bangalore, India, in April 2012. The papers presented were carefully reviewed and selected from numerous submissions and focus on the various aspects of research and development activities in computer science, information technology, computational engineering, mobile communication, control and instrumentation, communication system, power electronics and power engineering.

A unique combination of theoretical knowledge and practical analysis experience Derived from Yoshihide Hases Handbook of Power Systems Engineering, 2nd Edition, this book provides readers with everything they need to know about power system dynamics. Presented in three parts, it covers power system theories, computation theories, and how prevailed engineering platforms can be utilized for various engineering works. It features many illustrations based on ETAP to help explain the knowledge within as much as possible. Recompiling all the chapters from the previous book, Power System Dynamics with Computer Based Modeling and Analysis offers nineteen new and improved content with updated information and all new topics, including two new chapters on circuit analysis which help engineers with non-electrical engineering backgrounds. Topics covered include: Essentials of Electromagnetism; Complex Number Notation (Symbolic Method) and Laplace-transform; Fault Analysis Based on Symmetrical Components; Synchronous Generators; Induction-motor; Transformer; Breaker; Arrester; Overhead-line; Power cable; Steady-State/Transient/Dynamic Stability; Control governor; AVR; Directional Distance Relay and R-X Diagram; Lightning and Switching Surge Phenomena; Insulation Coordination; Harmonics; Power Electronics Applications (Devices, PE-circuit and Control) and more. Combines computer modeling of power systems, including analysis techniques, from an engineering consultants perspective Uses practical analytical software to help teach how to obtain the relevant data, formulate what-if cases, and convert data analysis into meaningful information Includes mathematical details of power system analysis and power system dynamics Power System Dynamics with Computer-Based Modeling and Analysis will appeal to all power system engineers as well as engineering and electrical engineering students.

Trying to meet the requirements in the field, present book treats different fuzzy control architectures both in terms of the theoretical design and in terms of comparative validation studies in various applications, numerically simulated or experimentally developed. Through the subject matter and through the inter and multidisciplinary content, this book is addressed mainly to the researchers, doctoral students and students interested in developing new applications of intelligent control, but also to the people who want to become familiar with the control concepts based on fuzzy techniques. Bibliographic resources used to perform the work includes books and articles of present interest in the field, published in prestigious journals and publishing houses, and websites dedicated to various applications of fuzzy control. Its structure and the presented studies include the book in the category of those who make a direct connection between theoretical developments and practical applications, thereby constituting a real support for the specialists in artificial intelligence, modelling and control fields.

This book reviews numerous research papers published in the last fifteen years in the area of current injection based rectifiers. A partial list of coverage includes analysis of various magnetic current injection devices, the third harmonic current injection, injection networks, and optimal current injection. The book will be of interest to professionals involved in design of low-harmonic three-phase rectifiers, as well as students and researchers.

A revised guide to the theory and implementation of CMOS analog and digital IC design The fourth edition of CMOS: Circuit Design, Layout, and Simulation is an updated guide to the practical design of both analog and digital integrated circuits. The author—a noted expert on the topic—offers a contemporary review of a wide range of analog/digital circuit blocks including: phase-locked-loops, delta-sigma sensing circuits, voltage/current references, op-amps, the design of data converters, and switching power supplies. CMOS includes discussions that detail the trade-offs and considerations when designing at the transistor-level. The companion website contains numerous examples for many computer-aided design (CAD) tools. Using the website enables readers to recreate, modify, or simulate the design examples presented throughout the book. In addition, the author includes hundreds of end-of-chapter problems to enhance understanding of the content presented. This newly revised edition: • Provides in-depth coverage of both analog and digital transistor-level design techniques • Discusses the design of phase- and delay-locked loops, mixed-signal circuits, data converters, and circuit noise • Explores real-world process parameters, design rules, and layout examples • Contains a new chapter on Power Electronics Written for students in electrical and computer engineering and professionals in the field, the fourth edition of CMOS: Circuit Design, Layout, and Simulation is a practical guide to understanding analog and digital transistor-level design theory and techniques.

Fundamentals of Power ElectronicsSpringer Science & Business Media

Power electronics is the application of solid-state electronics to the control and conversion of electric power. It also refers to a subject of research in electronic and electrical engineering which deals with the design, control, computation and integration of nonlinear, time-varying energy-processing electronic systems with fast dynamics. The power electronics field has evolved beyond the status of comprising one or two special-topics courses. In the breadth versus depth tradeoff, it no longer makes sense for one textbook to attempt to cover all of these courses; indeed, each course should ideally employ a dedicated textbook. In the power electronics literature, much has been made of the incorporation of other disciplines such as circuits, electronic devices, control systems, magnetic, and power applications, into the power electronics field. Yet the field has evolved, and now is more than a mere collection of circuits and applications linked to the fundamentals of other disciplines. There is a set of fundamentals that are unique to the field of power electronics. It is

important to identify these fundamentals, and to explicitly academic conferences, and other affairs around these fundamentals. This book is organized around the fundamental principles, while the applications and circuits are introduced along the way as examples.

This book provides an in-depth treatment of the physics of operation of power semiconductor devices that are commonly used by the power electronics industry. Analytical models for explaining the operation of all power semiconductor devices are shown.

Discover the analytical foundations of electric machine, power electronics, electric drives, and electric power systems In Introduction to the Analysis of Electromechanical Systems, an accomplished team of engineers delivers an accessible and robust analysis of fundamental topics in electrical systems and electrical machine modeling oriented to their control with power converters. The book begins with an introduction to the electromagnetic variables in rotatory and stationary reference frames before moving onto descriptions of electric machines. The authors discuss direct current, round-rotor permanent-magnet alternating current, and induction machines, as well as brushless direct current and induction motor drives. Synchronous generators and various other aspects of electric power system engineering are covered as well, showing readers how to describe the behavior of electromagnetic variables and how to approach their control with modern power converters. Introduction to the Analysis of Electromechanical Systems presents analysis techniques at an introductory level and at sufficient detail to be useful as a prerequisite for higher level courses. It also offers supplementary materials in the form of online animations and videos to illustrate the concepts contained within. Readers will also enjoy: A thorough introduction to basic system analysis, including phasor analysis, power calculations, elementary magnetic circuits, stationary coupled circuits, and two- and three-phase systems Comprehensive explorations of the basics of electric machine analysis and power electronics, including switching-circuit fundamentals, conversion, and electromagnetic force and torque Practical discussions of power systems, including three-phase transformer connections, synchronous generators, reactive power and power factor correction, and discussions of transient stability Perfect for researchers and industry professionals in the area of power and electric drives, Introduction to the Analysis of Electromechanical Systems will also earn its place in the libraries of senior undergraduate and graduate students and professors in these fields.

The Industrial Electronics Handbook, Second Edition combines traditional and newer, more specialized knowledge that will help industrial electronics engineers develop practical solutions for the design and implementation of high-power applications. Embracing the broad technological scope of the field, this collection explores fundamental areas, including analog and digital circuits, electronics, electromagnetic machines, signal processing, and industrial control and communications systems. It also facilitates the use of intelligent systems—such as neural networks, fuzzy systems, and evolutionary methods—in terms of a hierarchical structure that makes factory control and supervision more efficient by addressing the needs of all production components. Enhancing its value, this fully updated collection presents research and global trends as published in the IEEE Transactions on Industrial Electronics Journal, one of the largest and most respected publications in the field. Power Electronics and Motor Drives facilitates a necessary shift from low-power electronics to the high-power varieties used to control electromechanical systems and other industrial applications. This volume of the handbook: Focuses on special high-power semiconductor devices Describes various electrical machines and motors, their principles of operation, and their limitations Covers power conversion and the high-efficiency devices that perform the necessary switchover between AC and DC Explores very specialized electronic circuits for the efficient control of electric motors Details other applications of power electronics, aside from electric motors—including lighting, renewable energy conversion, and automotive electronics Addresses power electronics used in very-high-power electrical systems to transmit energy Other volumes in the set: Fundamentals of Industrial Electronics Control and Mechatronics Industrial Communication Systems Intelligent Systems

Introduces chaos theory, its analytical methods and the means to apply chaos to the switching power supply design DC-DC converters are typical switching systems which have plenty of nonlinear behaviors, such as bifurcation and chaos. The nonlinear behaviors of DC-DC converters have been studied heavily over the past 20 years, yet researchers are still unsure of the practical application of bifurcations and chaos in switching converters. The electromagnetic interference (EMI), which resulted from the high rates of changes of voltage and current, has become a major design criterion in DC-DC converters due to wide applications of various electronic devices in industry and daily life, and the question of how to reduce the annoying, harmful EMI has attracted much research interest. This book focuses on the analysis and application of chaos to reduce harmful EMI of DC-DC converters. After a review of the fundamentals of chaos behaviors of DC-DC converters, the authors present some recent findings such as Symbolic Entropy, Complexity and Chaos Point Process, to analyze the characters of chaotic DC-DC converters. Using these methods, the statistic characters of chaotic DC-DC converters are extracted and the foundations for the following researches of chaotic EMI suppression are reinforced. The focus then transfers to estimating the power spectral density of chaotic PWM converters behind an introduction of basic principles of spectrum analysis and chaotic PWM technique. Invariant Density, and Prony and Wavelet analysis methods are suggested for estimating the power spectral density of chaotic PWM converters. Finally, some design-oriented applications provide a good example of applying chaos theory in engineering practice, and illustrate the effectiveness on suppressing EMI of the proposed chaotic PWM. Introduces chaos theory, its analytical methods and the means to apply chaos to the switching power supply design Approaches the subject in a systematic manner from analyzing method, chaotic phenomenon and EMI characteristics, analytical methods for chaos, and applying chaos to reduce EMI (electromagnetic interference) Highlights advanced research work in the fields of statistic characters of nonlinear behaviors and chaotic PWM technology to suppress EMI of switching converters Bridges the gap between numerical theory and real-world applications, enabling power electronics designers to both analyze the effects

of chaos and leverage these effects to reduce EMI

Fundamentals of Power Electronics, Third Edition, is an up-to-date and authoritative text and reference book on power electronics. This new edition retains the original objective and philosophy of focusing on the fundamental principles, models, and technical requirements needed for designing practical power electronic systems while adding a wealth of new material. Improved features of this new edition include: new material on switching loss mechanisms and their modeling; wide bandgap semiconductor devices; a more rigorous treatment of averaging; explanation of the Nyquist stability criterion; incorporation of the Tan and Middlebrook model for current programmed control; a new chapter on digital control of switching converters; major new chapters on advanced techniques of design-oriented analysis including feedback and extra-element theorems; average current control; new material on input filter design; new treatment of averaged switch modeling, simulation, and indirect power; and sampling effects in DCM, CPM, and digital control. Fundamentals of Power Electronics, Third Edition, is intended for use in introductory power electronics courses and related fields for both senior undergraduates and first-year graduate students interested in converter circuits and electronics, control systems, and magnetic and power systems. It will also be an invaluable reference for professionals working in power electronics, power conversion, and analog and digital electronics.

Special Features: · Power semiconductor devices are viewed from the physics, circuit, modeling and thermal viewpoints for a better understanding of the devices.· AC-DC, DC-DC, DC-AC converters and magnetic devices are treated from both the conceptual and design perspectives.· A separate chapter is included that addresses the analysis and design of linear regulators.· A chapter is included to address the modeling methods to obtain dynamic models of power electronics systems. The method of bond graph is introduced for modeling power electronics systems.· The design of discrete domain controllers in both classical and state space approach are included which addresses the needs of power electronic systems.· Optimal and robust control design methods as applied to power electronics systems are addressed.· Discrete numerical algorithms for digital implementation with respect to power electronics systems are addressed in a separate chapter.· A separate chapter is devoted to the thermal aspects like heat sink sizing for power electronics systems.· Design integration by specifying and designing for reliability with power electronics system examples is another unique feature of this book. · The appendices include the following:o Derivation of the area product for a saturable-core transformer.o Representative list of commonly used core types and their physical parameters.o Representative list of commonly used wire gauges.o Laplace transforms and z-transforms of few time domain signals.o List of specifications for the induction motor used for controller design.o Description of all the object parameters for various electronic components from the reliability prediction viewpoint. Pedagogy includes:o 600+ illustrations and line diagrams.o 480+ descriptive questions.o 440+ objective questions.o 200+ unsolved problems.o 50+ explanatory examples and solved problems.Companion CD contains:· Reliability prediction toolbox· Bond graph simulation toolbox· Several circuit and design examples About The Book: This book on power electronics spans a wide knowledge base such as power devices, drives, circuit topologies, magnetics, system modeling, control configurations, digital processing, thermal and reliability aspects. The book has been broadly divided into two types of topics viz. (a) circuit-oriented aspects and (b) system-oriented aspects. The first seven chapters deal with circuit-oriented aspects of power electronics systems and the remaining chapters deal with system-oriented aspects like controls and reliability.

Written in plain language, Fundamentals of Power Electronics sets forth the basic principles of power electronics. Starting with the various types of devices, protection, and series and parallel operation of silicon controlled rectifiers, it details all the aspects of power electronics essential to building a strong foundation for the further study and practice of industrial or power electronics engineering. The author devotes considerable attention to a wide variety of applications, from AC and DC motors, heating, and welding to HVDC transmission and thyristor controlled electrical drives. Fundamentals of Power Electronics is filled with diagrams that clarify the concepts presented. Each chapter includes sections containing numerous examples and short questions with answers. An appendix furnishes a series of power electronics experiments that explore SCR characteristics, UJT firing circuits, voltage and current commutation, triac characteristics, and the RC triggering scheme of SCR.

The book offers comprehensive coverage of the broad range of scientific knowledge in the fields of advances in induction and microwave heating of mineral and organic materials. Beginning with industry application in many areas of practical application to mineral materials and ending with raw materials of agriculture origin the authors, specialists in different scientific area, present their results in the two sections: Section 1-Induction and Microwave Heating of Mineral Materials, and Section 2-Microwave Heating of Organic Materials.

Fundamentals of Power Electronics, Third Edition, is an up-to-date and authoritative text and reference book on power electronics. This new edition retains the original objective and philosophy of focusing on the fundamental principles, models, and technical requirements needed for designing practical power electronic systems while adding a wealth of new material. Improved features of this new edition include: new material on switching loss mechanisms and their modeling; wide bandgap semiconductor devices; a more rigorous treatment of averaging; explanation of the Nyquist stability criterion; incorporation of the Tan and Middlebrook model for current programmed control; a new chapter on digital control of switching converters; major new chapters on advanced techniques of design-oriented analysis including feedback and extra-element theorems; average current control; new material on input filter design; new treatment of averaged switch modeling, simulation, and indirect power; and sampling effects in DCM, CPM, and digital control. Fundamentals of Power Electronics, Third Edition, is intended for use in introductory power electronics courses and related fields for both senior undergraduates and first-year graduate students interested in converter circuits and electronics, control systems, and magnetic and power systems. It will also be an invaluable reference for professionals working in power electronics, power conversion, and analog and digital electronics. Includes an increased number of end

of chapter problems; Updated and reorganized, including three completely new chapters; Includes key principles and a rigorous treatment of topics.

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 500 different topologies currently exist, with more being developed each year. Advanced DC/DC Converters offers a concise, practical presentation of DC/DC converters, summarizing the spectrum of conversion technologies and presenting many new ideas and more than 100 new topologies. The treatment begins with background material on DC/DC conversion and discussions on 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. More than 320 figures, 60 tables, and 500 formulae allow you to more easily grasp the overall structure of advanced DC/DC converters, provide fast access to precise data, and help you quickly determine the values of your own circuit components. Nowhere else in the literature are DC/DC converters so logically sorted and systematically introduced. Nowhere else can you find detailed information on prototype topologies that represent a major contribution to modern power engineering.

Offering step-by-step, in-depth coverage, the new Third Edition of Power Electronics: Converters, Applications, and Design provides a cohesive presentation of power electronics fundamentals for applications and design in the power range of 500 kW or less. The text describes a variety of practical and emerging power electronic converters made feasible by the new generation of power semiconductor devices. The new edition is now enhanced with a new CD-ROM, complete with PSpice-based examples, a new magnetics design program, and PowerPoint slides.

"Electrostatic Precipitation" includes selected papers presented at the 11th International Conference on Electrostatic Precipitation. It presents the newest developments in electrostatic precipitation, flue gas desulphurization (FGD), selective catalytic reduction (SCR), and non-thermal plasma techniques for multi-pollutants emission control. Almost all outstanding scientists and engineers world-wide in the field will report their on-going researches. The book will be a useful reference for scientists and engineers to keep abreast of the latest developments in environmental science and engineering.

This textbook offers broad coverage of the subject of power electronics. Each topic is developed in sufficient depth to expose the fundamental principles, concepts, techniques, methods, and circuits necessary to understand power electronic systems. The applications are diverse enough to expose students to numerous types of systems. The authors have paid particular attention to developing examples and exercises that promote innovative ways of thinking about problems, methods of analysis, and the use of approximations.

Market_Desc: · Electrical Engineering Students · Electrical Engineering Instructors· Power Electronics Engineers Special Features: · Easy to follow step-by-step in depth treatment of all the theory.· Computer simulation chapter describes the role of computer simulations in power electronics. Examples and problems based on Pspice and MATLAB are included.· Introductory chapter offers a review of basic electrical and magnetic circuit concepts.· A new CD-ROM contains the following:· Over 100 of new problems of varying degrees of difficulty for homework assignments and self-learning.· PSpice-based simulation examples, which illustrate basic concepts and help in design of converters.· A newly-developed magnetic component design program that demonstrates design trade-offs.· PowerPoint-based slides, which will improve the learning experience and the ease of using the book About The Book: The text includes cohesive presentation of power electronics fundamentals for applications and design in the power range of 500 kW or less. It describes a variety of practical and emerging power electronic converters made feasible by the new generation of power semiconductor devices. Topics included in this book are an expanded discussion of diode rectifiers and thyristor converters as well as chapters on heat sinks, magnetic components which present a step-by-step design approach and a computer simulation of power electronics which introduces numerical techniques and commonly used simulation packages such as PSpice, MATLAB and EMTP.

An exploration of the state-of-the-art in power conversion techniques and power semiconductor devices, this edition features a bottom-down approach, covering the characteristics of power semiconductor devices first and then the fundamentals of conversion techniques. It also examines the characteristics of modern ower semiconductor devices such as SCrs, BJTs, MOSFETs, SITs, SITHs, IGBTs and MCTs.

This comprehensive introduction to power semiconductor devices, their characteristics, and their ratings will take you step-by-step through the most important topics in the field. Highly applications-oriented, this course presents the student with six projects which offer the opportunity to simulate results on a computer using software such as SPICE or PSpice. This course is ideal for engineers, engineering managers, technicians, and anyone with an interest in the theory, analysis, design, or applications of power electronics circuits and systems.

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This fully updated textbook provides complete coverage of electrical circuits and introduces students to the field of energy conversion technologies, analysis and design. Chapters are designed to equip students with necessary background material in such topics as devices, switching circuit analysis techniques, converter types, and methods of conversion. The book contains a large number of examples, exercises, and problems to help enforce the material presented in each chapter. A detailed discussion of resonant and softswitching dc-to-dc converters is included along with the addition of new chapters covering digital control, non-linear control, and micro-inverters for power electronics applications. Designed for senior undergraduate and graduate electrical engineering students, this book provides students with the ability to analyze and design power electronic circuits used in various industrial applications.

The branch of electronics which seeks to apply solid state electronics for the purpose of controlling and converting electrical power is known as power electronics. There are primarily two areas of applications of power electronics such as switches or amplifiers. Ideally, switches should not dissipate any power while they are open or closed. The current in amplifiers varies continuously depending upon the controlled input. Some of the systems which are based on power electronics are AC/DC converters, DC/AC converters, DC/DC converters and AC/AC converters. Inverters are a type of devices which are used to convert DC to AC. This book discusses the fundamentals as well as modern approaches of power electronics. Those in search of information to further their knowledge will be greatly assisted by it. Coherent flow of topics, student-friendly language and extensive use of examples make this book an invaluable source of knowledge.

Power Quality in Power Systems and Electrical Machines, Second Edition helps readers understand the causes and effects of power quality problems and provides techniques to mitigate these problems. Power quality is a measure of deviations in supply systems and their components, and affects all connected electrical and electronic equipment, including computers, TV monitors, and lighting. In this book analytical and measuring techniques are applied to power quality problems as they occur in central power stations and distributed generation such as alternative power systems. Provides theoretical and practical insight into power quality problems; most books available are either geared to theory or

practice only Problems and solutions at the end of each chapter dealing with practical applications Includes application examples implemented in SPICE, Mathematica, and MATLAB

There are several families of DC/DC converters comprising hundreds of different topologies. Sorting through the various properties and characteristics is obviously a daunting task. Culled from the pages of the groundbreaking Advanced DC/DC Converters, this book provides a focused, concise overview of more than 80 topologies, developed by the authors, of essential DC/DC converters. The authors begin with an introduction to the basics of DC/DC conversion technology, then present an in-depth analysis of voltage-lift and super-lift converters. This book also includes a brand new chapter on the revolutionary ultra-lift Luo-converter. Several experimental and simulation results clearly illustrate the concepts.

In many university curricula, the power electronics field has evolved beyond the status of comprising one or two special-topics courses. Often there are several courses dealing with the power electronics field, covering the topics of converters, motor drives, and power devices, with possibly additional advanced courses in these areas as well. There may also be more traditional power-area courses in energy conversion, machines, and power systems. In the breadth vs. depth tradeoff, it no longer makes sense for one textbook to attempt to cover all of these courses; indeed, each course should ideally employ a dedicated textbook. This text is intended for use in introductory power electronics courses on converters, taught at the senior or first-year graduate level. There is sufficient material for a one year course or, at a faster pace with some material omitted, for two quarters or one semester. The first class on converters has been called a way of enticing control and electronics students into the power area via the "back door". The power electronics field is quite broad, and includes fundamentals in the areas of • Converter circuits and electronics • Control systems • Magnetics • Power applications • Design-oriented analysis This wide variety of areas is one of the things which makes the field so interesting and appealing to newcomers. This breadth also makes teaching the field a challenging undertaking, because one cannot assume that all students enrolled in the class have solid prerequisite knowledge in so many areas.

Magnetic Components for Power Electronics concerns the important considerations necessary in the choice of the optimum magnetic component for power electronic applications. These include the topology of the converter circuit, the core material, shape, size and others such as cost and potential component suppliers. These are all important for the design engineer due to the emergence of new materials, changes in supplier management and the examples of several component choices. Suppliers using this volume will also understand the needs of designers. Highlights include: Emphasis on recently introduced new ferrite materials, such as those operating at megahertz frequencies and under higher DC drive conditions; Discussion of amorphous and nanocrystalline metal materials; New technologies such as resonance converters, power factors correction (PFC) and soft switching; Catalog information from over 40 magnetic component suppliers; Examples of methods of component choice for ferrites, amorphous nanocrystalline materials; Information on suppliers management changes such as those occurring at Siemens, Philips, Thomson and Allied-Signal; Attention to the increasingly important concerns about EMI. This book should be especially helpful for power electronic circuit designers, technical executives, and material science engineers involved with power electronic components.

Increasing demand for efficiency and power density pushes Si-based devices to some of their inherent material limits, including those related to temperature operation, switching frequency, and blocking voltage. Recently, SiC-based power devices are promising candidates for high-power and high-frequency switching applications. Today, SiC MOSFETs are commercially available from several manufacturers. Although technology affiliated with SiC MOSFETs is improving rapidly, many challenges remain, and some of them are investigated in this work. The research work in this dissertation is divided into the three following parts. Firstly, the static and switching characteristics of the state-of-the-art 1.2 kV planar and double-trench SiC MOSFETs from two different manufacturers are evaluated. The effects of different biasing voltages, DC link voltages, and temperatures are analysed. The characterisation results show that the devices exhibit superior switching performances under different operating conditions. Moreover, several aspects of using the SiC MOSFET’s body diode in a DC/DC converter are investigated, comparing the body-diodes of planar and double-trench devices. Reverse recovery is evaluated in switching tests considering the case temperature, switching rate, forward current, and applied voltage. Based on the measurement results, the junction temperature is estimated to guarantee safe operation. A simple electro-thermal model is proposed in order to estimate the maximum allowed switching frequency based on the thermal design of the SiC devices. Using these results, hard- and soft-switching converters are designed, and devices are characterised as being in continuous operation at a very high switching frequency of 1 MHz. Thereafter, the SiC MOSFETs are operated in a continuous mode in a 10 kW / 100-250 kHz buck converter, comparing synchronous rectification, the use of the body diode, and the use of an external Schottky diode. Further, the parallel operation of the planar devices is considered. Thus, the paralleling of SiC MOSFETs is investigated before comparing the devices in continuous converter operation. In this regard, the impact of the most common mismatch parameters on the static and dynamic current sharing of the transistors is evaluated, showing that paralleling of SiC MOSFETs is feasible. Subsequently, an analytical model of SiC MOSFETs for switching loss optimisation is proposed. The analytical model exhibits relatively close agreement with measurement results under different test conditions. The proposed model tracks the oscillation effectively during both turn-on and –off transitions. This has been achieved by considering the influence of the most crucial parasitic elements in both power and gate loops. In the second part, a comprehensive short-circuit ruggedness evaluation focusing on different failure modes of the planar and double-trench SiC devices is presented. The effects of different biasing voltages, DC link voltages, and gate resistances are evaluated. Additionally, the temperature-dependence of the short-circuit capability is evaluated, and the associated failure modes are analysed. Subsequently, the design and test of two different methods for overcurrent protection are proposed. The desaturation technique is applied to the SiC MOSFETs and compared to a second method that depends on the stray inductance of the devices. Finally, the

benefits of using SiC devices in continuous high-frequency, high-power DC/DC converters is experimentally evaluated. In this regard, a design optimisation of a high-frequency transformer is introduced, and the impact of different core materials, conductor designs, and winding arrangements are evaluated. A ZVZCS Phase-Shift Full-Bridge unidirectional DC/DC converter is proposed, using only the parasitic leakage inductance of the transformer. Experimental results for a 10 kW, (100-250) kHz prototype indicate an efficiency of up to 98.1% for the whole converter. Furthermore, an optimized control method is proposed to minimise the circulation current in the isolated bidirectional dual active bridge DC/DC converter, based on a modified dual-phase-shift control method. This control method is also experimentally compared with traditional single-phase shift control, yielding a significant improvement in efficiency. The experimental results confirm the theoretical analysis and show that the proposed control can enhance the overall converter efficiency and expand the ZVZCS range. Die steigende Nachfrage nach Effizienz und Leistungsdichte bringt Si-basierte eistungsbauteile an einige inhärente Materialgrenzen, die unter anderem mit der Temperaturbelastung, der Schaltfrequenz und der Blockierspannung in Zusammenhang stehen. In jüngster Zeit sind SiC-basierte Leistungsbauelemente vielversprechende Kandidaten für Hochleistungs- und Hochfrequenzanwendungen. Aktuell sind SiC-MOSFETs von mehreren Herstellern im Handel erhältlich. Obwohl sich die Technologie der SiC-MOSFETs rasch verbessert, werden viele Herausforderungen bestehen bleiben. Einige dieser Herausforderungen werden in dieser Arbeit untersucht. Die Untersuchungen in dieser Dissertation gliedern sich in die drei folgenden Teile: Im ersten Teil erfolgt, die statische und die transiente Charakterisierung der aktuellen 1,2 kV Planarund Doubletrench SiC-MOSFETs verschiedener Hersteller. Die Auswirkungen unterschiedlicher Gatespannungen, Zwischenkreisspannungen und Temperaturen werden analysiert. Die Ergebnisse der Charakterisierung zeigen, dass die Bauteile überlegene Schaltleistungen unter verschiedenen Betriebsbedingungen aufweisen. Darüber hinaus wird der Einsatz der internen SiC-Bodydioden in einem DC/DC-Wandler untersucht, wobei die Unterschiede zwischen Planar- und Doppeltrench-Bauteilen aufgezeigt werden. Das Reverse-Recovery-Verhalten wird unter Berücksichtigung der Gehäusetemperatur, der Schaltgeschwindigkeit, des Durchlassstroms und der angelegten Spannung bewertet. Anhand der Messergebnisse wird die Sperrschichttemperatur geschätzt, damit ein sicherer Betrieb gewährleistet ist. Ein einfaches elektrothermisches Modell wird vorgestellt, um die maximal zulässige Schaltfrequenz auf der Grundlage des thermischen Designs der SiC-Bauteile abzuschätzen. Anhand dieser Ergebnisse werden hart- und weichschaltende Umrichter konzipiert und die Bauteile werden im Dauerbetrieb mit einer sehr hohen Schaltfrequenz von 1 MHz untersucht. Danach werden die SiC-MOSFETs im Dauerbetrieb in einem 10 kW / 100-250 kHz-Tiefsetzsteller betrieben. Dabei wird die Synchrongleichrichtung, die Verwendung der internen Diode und die Verwendung einer externen Schottky-Diode verglichen. Außerdem wird die Parallelisierung von SiC-MOSFETs untersucht, bevor die Parallelschaltung der verschiedenen Bauelemente ebenso im kontinuierlichen Konverterbetrieb verglichen wird. Es wird der Einfluss der häufigsten Parametervariationen auf die statische und dynamische Stromaufteilung der Transistoren analysiert, was zeigt, dass eine Parallelisierung von SiC-MOSFETs möglich ist. Anschließend wird ein analytisches Modell der SiC-MOSFETs zur Schaltverlustoptimierung vorgeschlagen. Das analytische Modell zeigt eine relativ enge Übereinstimmung mit den Messergebnissen unter verschiedenen Testbedingungen. Das vorgeschlagene Modell bildet die Schwingungen sowohl beim Ein- als auch beim Ausschalten effektiv nach. Dies wurde durch die Berücksichtigung der wichtigsten parasitären Elemente in Strom- und Gatekreisen erreicht. Im zweiten Teil wird eine umfassende Bewertung der Kurzschlussfestigkeit mit Fokus auf verschiedene Ausfallmodi der planaren und double-trench SiC-Bauelemente vorgestellt. Die Auswirkungen unterschiedlicher Gatespannungen, Zwischenkreisspannungen und Gate-Widerstände werden ausgewertet. Zusätzlich wird die temperaturabhängige Kurzschlussfähigkeit ausgewertet und die zugehörigen Fehlerfälle werden analysiert. Anschließend wird die Auslegung und Prüfung von zwei verschiedenen Verfahren zum Überstromschutz evaluiert. Die „Desaturation“-Technik wird auf SiC-MOSFETs angewendet und mit einer zweiten Methode verglichen, welche die parasitäre Induktivität der Bauelemente nutzt. Schließlich wird der Nutzen des Einsatzes von SiC-Bauteilen in kontinuierlichen Hochfrequenz-Hochleistungs-DC/DC-Wandlern experimentell untersucht. In diesem Zusammenhang wird eine Designoptimierung eines Hochfrequenztransformators vorgestellt und der Einfluss verschiedener Kernmaterialien, Leiterausführungen und Wicklungsanordnungen wird bewertet. Es wird ein unidirektionaler ZVZCS Vollbrücken-DC/DC-Wandler vorgestellt, der nur die parasitäre Streuinduktivität des Transformators verwendet. Experimentelle Ergebnisse für einen 10 kW, (100-250) kHz Prototyp zeigen einenWirkungsgrad von bis zu 98,1% für den gesamten Umrichter. Abschließend wird ein optimiertes Regelverfahren verwendet, welches auf einem modifizierten Dual-Phase-Shift-Regelverfahren basiert, um den Kreisstrom im isolierten bidirektionalen Dual-Aktiv-Brücken-DC/DC-Wandler zu minimieren. Diese Regelmethode wird experimentell mit der herkömmlichen Single-Phase-Shift-Regelung verglichen. Hierbei zeigt sich eine deutliche Effizienzsteigerung durch die neue Regelmethode. Die experimentellen Ergebnisse bestätigen die theoretische Analyse und zeigen, dass die vorgeschlagene Regelung den Gesamtwirkungsgrad des Umrichters erhöhen und den ZVZCS-Bereich erweitern kann. After nearly a decade of success owing to its thorough coverage, abundance of problems and examples, and practical use of simulation and design, Power-Switching Converters enters its second edition with new and updated material, entirely new design case studies, and expanded figures, equations, and homework problems. This textbook is ideal for senior undergraduate or graduate courses in power electronic converters, requiring only systems analysis and basic electronics courses. The only text of such detail to also include the use of PSpice and step-by-step designs and simulations, Power-Switching Converters, Second Edition covers basic topologies, basic control techniques, and closed-loop control and stability. It also includes two new chapters on interleaved converters and switched capacitor converters, and the authors have added discrete-time modeling to the dynamic analysis of switching converters. The final two chapters are dedicated to simulation and complete design examples, respectively. PSpice examples and MATLAB scripts

are available for download from the CRC Web site. These are useful for the simulation of students' designs. Class slides are also available on the Internet. Instructors will appreciate the breadth and depth of the material, more than enough to adapt into a customized syllabus. Students will similarly benefit from the more than 440 figures and over 1000 equations, ample homework problems, and case studies presented in this book.

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Power electronics, which is a rapidly growing area in terms of research and applications, uses modern electronics technology to convert electric power from one form to another, such as ac-dc, dc-dc, dc-ac, and ac-ac with a variable output magnitude and frequency. Power electronics has many applications in our every day life such as air-conditioners, electric cars, sub-way trains, motor drives, renewable energy sources and power supplies for computers. This book covers all aspects of switching devices, converter circuit topologies, control techniques, analytical methods and some examples of their applications. * 25% new content * Reorganized and revised into 8 sections comprising 43 chapters * Coverage of numerous applications, including uninterruptable power supplies and automotive electrical systems * New content in power generation and distribution, including solar power, fuel cells, wind turbines, and flexible transmission

With the growth of renewable energy sources, microgrids have become a key component in the distribution of power to localized areas while connected to the traditional grid or operating in a disconnected island mode. Based on the extensive real-world experience of the authors, this cutting-edge resource provides a basis for the design, installation, and day-by-day management of microgrids. Professionals find coverage of the critical aspects they need to understand, from the initial planning and the selection of the most appropriate technologies and equipment, to optimal management and real-time control. Moreover, this forward-looking book places emphasis on new architectures of the energy systems of the future. Written in accessible language with practical examples, the book explains advanced topics such as optimization algorithms for energy management systems, control issues for both on-grid and island mode, and microgrid protection. Practitioners are also provided with a complete vision for the deployment of the microgrid in smart cities.