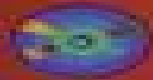
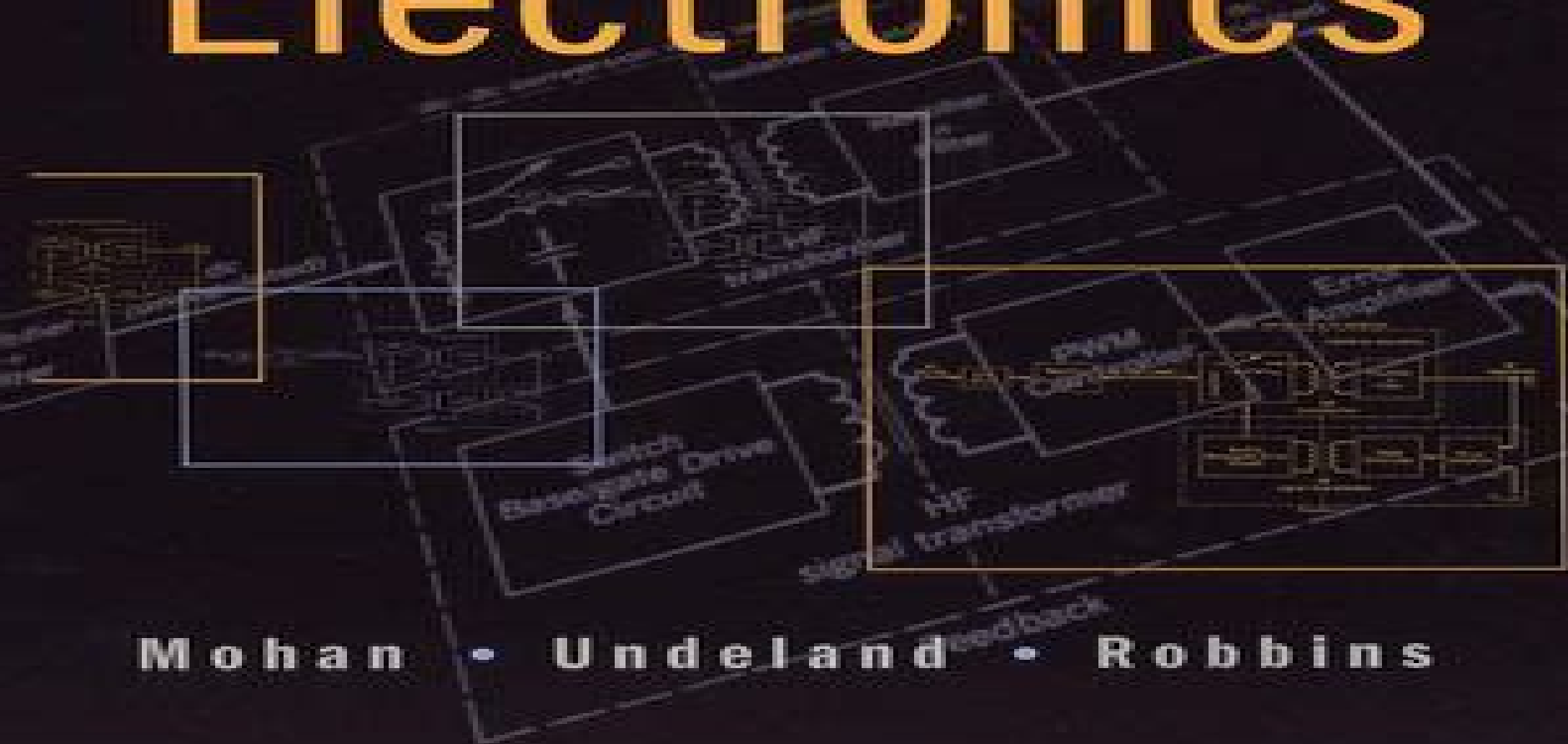


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# Power Electronics

CONVERTERS,  
APPLICATIONS,  
AND DESIGN



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# Power Electronics Converters Applications And Design 3rd Edition

**Fang Lin Luo,Hong Ye**



## **Power Electronics Converters Applications And Design 3rd Edition :**

**Power Electronics Handbook** Muhammad H. Rashid, 2010-07-19 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 *Power Electronics* Ned Mohan, Tore M. Undeland, William P. Robbins, 2003 CD ROM contains PSpice based simulation to illustrate basic concepts magnetic component design program PowerPoint slides to summarise topics companion web site available

**Modellierung und Python-Simulation von Magneten für Anwendungen in der Leistungselektronik** Shivkumar V. Iyer, 2024-07-29 Dieses Buch beschreibt die Rolle des Magnetismus in der Elektrotechnik ausgehend von den grundlegendsten physikalischen Gesetzen die in Simulationsmodelle umgewandelt wurden Dadurch können Elektrotechnikstudierende durch Beispiele und Übungen lernen Der Autor entmystifiziert ein Thema das viele Elektroingenieure als selbstverständlich betrachten und gibt den Lesern Werkzeuge an die Hand um zu verstehen wie jede magnetische Komponente funktioniert Er beschreibt magnetische Bauteile wie Induktoren und Transformatoren in einfach verständlicher Sprache Mathematische Gleichungen im Zusammenhang mit den grundlegenden physikalischen Gesetzen werden im Detail erläutert ebenso wie die physikalische Bedeutung der Gleichungen Jede Anwendung wird durch eine Simulation unterstützt Alle Simulationen werden unter Verwendung kostenloser und quelloffener Software auf Python Basis durchgeführt was den Inhalt dieses Buches universell zugänglich macht

**Advanced Electric Drive Vehicles** Ali Emadi, 2014-10-24 Electrification is an evolving paradigm shift in the transportation industry toward more efficient higher performance safer smarter and more reliable vehicles There is in fact a clear trend to move from internal combustion engines ICEs to more integrated electrified powertrains Providing a detailed overview of this growing area Advanced Electric Drive Vehicles begins with an introduction to the automotive industry an explanation of the need for electrification and a presentation of the fundamentals of conventional vehicles and ICEs It then proceeds to address the major components of electrified vehicles i.e. power electronic converters electric machines electric motor controllers and energy storage systems This comprehensive work Covers more electric vehicles MEVs hybrid electric vehicles HEVs plug in hybrid electric vehicles PHEVs range extended electric vehicles REEVs and all electric vehicles EVs including battery electric vehicles BEVs and fuel cell vehicles FCVs Describes the electrification technologies applied to nonpropulsion loads such as power steering and air

conditioning systems Discusses hybrid battery ultra capacitor energy storage systems as well as 48 V electrification and belt driven starter generator systems Considers vehicle to grid V2G interface and electrical infrastructure issues energy management and optimization in advanced electric drive vehicles Contains numerous illustrations practical examples case studies and challenging questions and problems throughout to ensure a solid understanding of key concepts and applications Advanced Electric Drive Vehicles makes an ideal textbook for senior level undergraduate or graduate engineering courses and a user friendly reference for researchers engineers managers and other professionals interested in transportation electrification

**Power Electronics** Fang Lin Luo,Hong Ye,2018-01-02 Power Electronics is a large size technology mainly covering four categories the AC DC rectifiers DC DC converters DC AC inverters and AC AC converters This book offers approximately 100 novel topologies of all four The applications are used in sustainable energy generation areas such as distributed generation DG micro grid MG smart grid SG systems and electrical vehicles EV With case studies from GE AEG Simplatroll Ltd and Chinese Power Manufacturing Co the reader will be exposed to practical applications in industry and real world settings This new edition features an entirely new chapter on best switching angles to obtain lowest THD for multilevel DC AC inverters Additionally all chapters have been updated and include homework problems throughout

**Power Electronics, A First Course** Ned Mohan,Siddharth Raju,2023-01-12 POWER ELECTRONICS A FIRST COURSE Enables students to understand power electronics systems as one course in an integrated electric energy systems curriculum Power Electronics A First Course provides instruction on fundamental concepts related to power electronics to undergraduate electrical engineering students beginning with an introductory chapter and moving on to discussing topics such as switching power poles switch mode dc dc converters and feedback controllers The authors also cover diode rectifiers power factor correction PFC circuits and switch mode dc power supplies Later chapters touch on soft switching in dc dc power converters voltage and current requirements imposed by various power applications dc and low frequency sinusoidal ac voltages thyristor converters and the utility applications of harnessing energy from renewable sources Power Electronics A First Course is the only textbook that is integrated with hardware experiments and simulation results The simulation files are available on a website associated with this textbook The hardware experiments will be available through a University of Minnesota startup at a low cost In Power Electronics A First Course readers can expect to find detailed information on Availability of various power semiconductor devices that are essential in power electronic systems plus their switching characteristics and various tradeoffs Common foundational unit of various converters and their operation plus fundamental concepts for feedback control illustrated by means of regulated dc dc converters Basic concepts associated with magnetic circuits to develop an understanding of inductors and transformers needed in power electronics Problems associated with hard switching and some of the practical circuits where this problem can be minimized with soft switching Power Electronics A First Course is an ideal textbook for Junior Senior Undergraduate students in Electrical and Computer Engineering ECE It

is also valuable to students outside of ECE such as those in more general engineering fields Basic understanding of electrical engineering concepts and control systems is a prerequisite Advances in Induction and Microwave Heating of Mineral and Organic Materials Stanisław Grundas,2011-02-14 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 **Power Converters, Drives and Controls for Sustainable Operations** S. Ganesh Kumar,Marco Rivera Abarca,S. K. Pattanaik,2023-07-25 POWER CONVERTERS DRIVES AND CONTROLS FOR SUSTAINABLE OPERATIONS Written and edited by a group of experts in the field this groundbreaking reference work sets the standard for engineers students and professionals working with power converters drives and controls offering the scientific community a way towards combating sustainable operations The future of energy and power generation is complex Demand is increasing and the demand for cleaner energy and electric vehicles EVs is increasing with it With this increase in demand comes an increase in the demand for power converters Part one of this book is on switched mode converters and deals with the need for power converters their topologies principles of operation their steady state performance and applications Conventional topologies like buck boost buck boost converters inverters multilevel inverters and derived topologies are covered in part one with their applications in fuel cells photovoltaics PVs and EVs Part two is concerned with electrical machines and converters used for EV applications Standards for EV charging infrastructure and wireless charging methodologies are addressed The last part deals with the dynamic model of the switched mode converters In any DC DC converter it is imperative to control the output voltage as desired Such a control may be achieved in a variety of ways While several types of control strategies are being evolved the popular method of control is through the duty cycle of the switch at a constant switching frequency This part of the book briefly reviews the conventional control theory and builds on the same to develop advanced techniques in the closed loop control of switch mode power converters SMPC such as sliding mode control passivity based control model predictive control MPC fuzzy logic control FLC and backstepping control A standard reference work for veteran engineers scientists and technicians this outstanding new volume is also a valuable introduction to new hires and students Useful to academics researchers engineers students technicians and other industry professionals it is a must have for any library High-Power Converters and AC Drives Bin Wu,Mehdi Narimani,2017-01-17 A comprehensive reference of the latest developments in MV drive technology in the area of power converter topologies This new edition reflects the recent technological advancements in the MV drive industry such as advanced multilevel converters and drive configurations It includes three new chapters Control of Synchronous Motor Drives Transformerless MV Drives and Matrix Converter Fed Drives In addition there are extensively

revised chapters on Multilevel Voltage Source Inverters and Voltage Source Inverter Fed Drives This book includes a systematic analysis on a variety of high power multilevel converters illustrates important concepts with simulations and experiments introduces various megawatt drives produced by world leading drive manufacturers and addresses practical problems and their mitigations methods This new edition Provides an in depth discussion and analysis of various control schemes for the MV synchronous motor drives Examines new technologies developed to eliminate the isolation transformer in the MV drives Discusses the operating principle and modulation schemes of matrix converter MC topology and multi module cascaded matrix converters CMCs for MV drives and their application in commercial MV drives Bin Wu is a Professor and Senior NSERC Rockwell Automation Industrial Research Chair in Power Electronics and Electric Drives at Ryerson University Canada He is a fellow of Institute of Electrical and Electronics Engineers IEEE Engineering Institute of Canada EIC and Canadian Academy of Engineering CAE Dr Wu has published more than 400 papers and holds more than 30 granted pending US European patents He co authored several books including Power Conversion and Control of Wind Energy Systems and Model Predictive Control of Wind Energy Conversion Systems both by Wiley IEEE Press Mehdi Narimani is a Postdoctoral Research Associate with the Department of Electrical and computer Engineering at Ryerson University Canada and Rockwell Automation Canada He is a senior member of IEEE Dr Narimani is author co author of more than 50 technical papers and four US European patents issued pending review His current research interests include power conversion high power converters control of power electronics and renewable energy systems

**Recent Developments on Power Inverters** Ali Saghaforia, 2017-06-21 This book develops some methods and structures to improve the power inverters for different applications in a single phase or three phase output in recent years The reduction of the switching devices and multilevel inverters as changing structure for the power inverters and PDM and PWM methods as changing control methods for the power inverter are studied in this book Moreover power inverters are developed to supply open ended loads Furthermore the basic and advanced aspects of the electric drives that are control based are taught for induction motor IM based on power inverters suitable for both undergraduate and postgraduate levels The main objective of this book is to provide the necessary background to improve and implement the high performance inverters Once the material in this book has been mastered the reader will be able to apply these improvements in the power inverters to his or her problems for high performance power inverters

Simulation technischer linearer und nichtlinearer Systeme mit MATLAB/Simulink Josef Hoffmann, Franz Quint, 2014-08-19 Das Buch behandelt praxisrelevante Beispiele zur Simulation linearer und nichtlinearer Systeme mit MATLAB Simulink Mit der leistungsfähigen MATLAB Software werden Systeme beschrieben die weit über die bisherigen Anwendungen aus den Vorlesungen hinausgehen und relativ einfach sind so dass sie per Hand gelöst werden können Die Simulationen sind hauptsächlich mit der Erweiterung Simulink durchgeführt Das Modell wird graphisch durch Verbindung verschiedener Funktionsblöcke gebildet und stellt dadurch eine Abbildung des Systems dar Die Vorgänge im Modell können

dann verständlich und anschaulich verfolgt werden Der Einsatz von Simulink unterscheidet dieses Buch von den Konkurrenzwerken die MATLAB Simulationen enthalten

**Hybrid Electric Vehicle System Modeling and Control** Wei Liu, 2017-04-17 This new edition includes approximately 30% new materials covering the following information that has been added to this important work extends the contents on Li ion batteries detailing the positive and negative electrodes and characteristics and other components including binder electrolyte separator and foils and the structure of Li ion battery cell Nickel cadmium batteries are deleted adds a new section presenting the modelling of multi mode electrically variable transmission which gradually became the main structure of the hybrid power train during the last 5 years newly added chapter on noise and vibration of hybrid vehicles introduces the basics of vibration and noise issues associated with power train driveline and vehicle vibrations and addresses control solutions to reduce the noise and vibration levels Chapter 10 chapter 9 of the first edition is extended by presenting EPA and UN newly required test drive schedules and test procedures for hybrid electric mileage calculation for window sticker considerations In addition to the above major changes in this second edition adaptive charging sustaining point determination method is presented to have a plug in hybrid electric vehicle with optimum performance

**On the perspectives of SiC MOSFETs in high-frequency and high-power isolated DC/DC converters** Eial Awwad, Abdullah, 2020-08-11 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 Leistungsbauteile an ihre Materialgrenzen, die unter anderem mit der Temperaturbelastung, der Schaltfrequenz und der Blockierspannung in Zusammenhang stehen. In jüngster Zeit sind SiC-basierte Leistungselemente 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 Planar- und Doubletrench SiC MOSFETs verschiedener Hersteller. Die Auswirkungen unterschiedlicher Gatespannungen, Zwischenkreisspannungen und Temperaturen werden analysiert. Die Ergebnisse der Charakterisierung zeigen, dass die Bauteile berechnete Schalteleistungen 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 Junctiontemperatur, 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 Gatewiderstände werden ausgewertet. Zusätzlich wird die temperaturabhängige Kurzschlussfestigkeit 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, Leiterauführungen 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 einen Wirkungsgrad 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-Briicken-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

**Modeling and Control of Power Electronics Converter System for Power Quality Improvements** Sanjeet Kumar Dwivedi, Shailendra Jain, Krishna Kumar Gupta, Pradyumn Chaturvedi, 2018-08-17 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

**Basics of Electrical Machines** Prof. D. K. Palwalia, Dr. U. K. Kalla, Dr. R. K. Kumawat, 2025-01-01 *Emerging Capabilities and Applications of Wireless Power Transfer* Triviño-Cabrera, Alicia, Aguado, José A., 2018-09-21 Technologies that enable powering a device without the need for being connected with a cable to the grid are gaining attention in recent years due to the advantages that they provide They are a commodity to users and provide additional functionalities that promote autonomy among the devices *Emerging Capabilities and Applications of Wireless Power Transfer* is an essential reference source that analyzes the different applications of wireless power transfer technologies and how the technologies are adapted to fulfill the electrical magnetic and design based requirements of different applications Featuring research on topics such as transfer technologies circuit analysis and inductive power transfer this book is a vital resource for academicians electrical engineers scientists researchers and industry professionals seeking coverage on device power and creating autonomy through alternative power options for devices

Microgrids and Local Energy Systems Nick Jenkins, 2021-12-15 This book addresses important topical questions of microgrids and local energy systems It begins with an investigation of the electrical protection of microgrids followed by a study of the power converters used and the utilization of multi objective optimization for the selection of component ratings Subsequent chapters address peer to peer energy trading in microgrids local district heating and cooling systems neighborhood generators used to supplement the utility electricity supplies in Iraq and regulatory impediments to micro wind generation in the United States

*Pulse-Width Modulated DC-DC Power Converters* Marian K. Kazimierczuk, 2015-08-24 PWM DC DC power converter technology underpins many energy conversion systems including renewable energy circuits active power factor correctors battery chargers portable devices and LED drivers Following the

success of Pulse Width Modulated DC DC Power Converters this second edition has been thoroughly revised and expanded to cover the latest challenges and advances in the field Key features of 2nd edition Four new chapters detailing the latest advances in power conversion focus on small signal model and dynamic characteristics of the buck converter in continuous conduction mode voltage mode control of buck converter small signal model and characteristics of the boost converter in the discontinuous conduction mode and electromagnetic compatibility EMC Provides readers with a solid understanding of the principles of operation synthesis analysis and design of PWM power converters and semiconductor power devices including wide band gap power devices SiC and GaN Fully revised Solutions for all end of chapter problems available to instructors via the book companion website Step by step derivation of closed form design equations with illustrations Fully revised figures based on real data With improved end of chapter summaries of key concepts review questions problems and answers biographies and case studies this is an essential textbook for graduate and senior undergraduate students in electrical engineering Its superior readability and clarity of explanations also makes it a key reference for practicing engineers and research scientists

**Microwave and RF Vacuum Electronic Power Sources** Richard G. Carter, 2018-04-12 Do you design and build vacuum electron devices or work with the systems that use them Quickly develop a solid understanding of how these devices work with this authoritative guide written by an author with over fifty years of experience in the field Rigorous in its approach it focuses on the theory and design of commercially significant types of gridded linear beam crossed field and fast wave tubes Essential components such as waveguides resonators slow wave structures electron guns beams magnets and collectors are also covered as well as the integration and reliable operation of devices in microwave and RF systems Complex mathematical analysis is kept to a minimum and Mathcad worksheets supporting the book online aid understanding of key concepts and connect the theory with practice Including coverage of primary sources and current research trends this is essential reading for researchers practitioners and graduate students working on vacuum electron devices

**Technologies for Electrical Power Conversion, Efficiency, and Distribution: Methods and Processes** Antchev, Mihail, 2009-12-31 This book presents an overall description of electrical energy conversion technologies and required power electronic converters Provided by publisher

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