

Isolated Current Shunt And Voltage Measurement For Motor

The oceans cover 70% of the terrestrial surface, and exert a pervasive influence on the Earth's environment but their nature is poorly recognized. Knowing the ocean's role deeply and understanding the complex, physical, biological, chemical and geological systems operating within it represent a major challenge to scientists today. Seafloor observatories offer scientists new opportunities to study multiple, interrelated natural phenomena over time scales ranging from seconds to decades, from episodic to global and long-term processes. Seafloor Observatories poses the important and apparently simple question, "How can continuous and reliable monitoring at the seafloor by means of Seafloor Observatories extend exploration and improve knowledge of our planet?" The book leads the reader through: the present scientific challenges to be addressed with seafloor observatories the technical solutions for their architecture an excursus on worldwide ongoing projects and programmes some relevant scientific multidisciplinary results and a presentation of new and interesting long-term perspectives for the coming years. Current results will yield significant improvements and exert a strong impact not only on our present knowledge of our planet but also on human evolution.

As new technologies are created and advances are made with the ongoing research efforts, power system harmonics has become a subject of great interest. The author presents these nuances with real-life case studies, comprehensive models of power system components for harmonics, and EMTP simulations. Comprehensive coverage of power system harmonics Presents new harmonic mitigation technologies In-depth analysis of the effects of harmonics Foreword written by Dr. Jean Mahseredijan, world renowned authority on simulations of electromagnetic transients and harmonics Volume is indexed by Thomson Reuters CPCI-S (WoS). The present volumes provide up-to-date, comprehensive and world-class state-of-the art knowledge concerning manufacturing science and engineering, focusing on Automation Equipment and Systems. The 633 peer-reviewed papers are grouped into 16 chapters: Material Section; Mechatronics; Industrial Robotics and Automation; Machine Vision; Sensor Technology; Measurement Control Technologies and Intelligent Systems; Transmission and Control of Fluids; Mechanical Control and Information Processing Technology; Embedded Systems; Advanced Forming Manufacturing and Equipment; NEMS/MEMS Technology and Equipment; Micro-Electronic Packaging Technology and Equipment; Advanced NC Techniques and Equipment; Power and Fluid Machinery; Energy Machinery and Equipment; Construction Machinery and Equipment.

This book presents deep analysis of machine control for different applications, focusing on its implementation in embedded systems. Necessary peripherals for various microcontroller families are analysed for machine control and software architecture patterns for high-quality software development processes in motor control units are described. Abundant figures help the reader to understand the theoretical, simulation and practical implementation stages of machine control. Model-based design, used as a mathematical and visual approach to construction of complex control algorithms, code generation that eliminates hand-coding errors, and co-simulation tools such as Simulink, PSIM and finite element analysis are discussed. The simulation and verification tools refine, and retest the models without having to resort to prototype construction. The book shows how a voltage source inverter can be designed with tricks, protection elements, and space vector modulation. Practical Control of Electric Machines: Model-Based Design and Simulation is based on the author's experience of a wide variety of systems in domestic, automotive and industrial environments, and most examples have implemented and verified controls. The text is ideal for readers looking for an insight into how electric machines play an important role in most real-life applications of control. Practitioners and students preparing for a career in control design applied in electric machines will benefit from the book's easily understood theoretical approach to complex machine control. The book contains mathematics appropriate to various levels of experience, from the student to the academic and the experienced professional. Advances in Industrial Control reports and encourages the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

This second volume discusses state-of-the-art applications of equivalent-circuit models as they pertain to solving problems in battery management and control. Readers are provided information on how to use models from Volume I to control battery packs, along with discussion of fundamental flaws in current approaches. In addition, Volume II introduces the ideas of physics-based optimal battery controls and explains why they can be superior to the state-of-the-art equivalent-circuit controls.

At Clinton Engineer Works -Tennessee Eastman Corporation, a mass spectrograph was operated in an evacuated tank between the pole faces of a large electromagnet to separate the isotopes of uranium. The mass spectrograph consisted of an ion source, an accelerating-electrode system to draw the ions at uniform velocity into the evacuated space, a liner to define a space of uniform electric-field intensity through which the ions passed, and a receiver to collect the separated isotopic ions. The source was operated at a potential positive with respect to the liner; part of the accelerating-electrode system was operated at a potential negative with respect to the liner; and the liner and receiver both operated at the same potential. Quantity production of these isotopes necessitated high currents to maintain the desired potentials, and the voltage applied necessitated rigid protection measures.

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This book provides an understanding of the nature of short-circuit currents, current interruption theories, circuit breaker

types, calculations according to ANSI/IEEE and IEC standards, theoretical and practical basis of short-circuit current sources, and the rating structure of switching devices. The book aims to explain the nature of short-circuit currents, the symmetrical components for unsymmetrical faults, and matrix methods of solutions, which are invariably used on digital computers. It includes innovations, worked examples, case studies, and solved problems.

Alternative Energy Systems: Electrical Integration and Utilisation covers the proceedings of the conference held at the Coventry (Lanchester) Polytechnic Coventry, England from 10th to 12th of September 1984. The book presents 24 papers that tackle alternative energy systems and their electrical integration and utilization. The text covers different alternative energy sources, such as hydro, solar, wind, wave, and waste materials. The book discusses the practical, technical, and economic aspects of alternatives energy systems and their electrical integration and utilization. The book will be of great use to individuals who are interested in the application of alternative energy systems.

This authoritative and up-to-date series provides a comprehensive review of the latest research results in quantitative nondestructive evaluation (NDE). Leading investigators working in government agencies, major industries, and universities present a broad spectrum of work extending from basic research to early engineering applications. 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 Leistungsbaueteile an einige inhärente Materialgrenzen, die unter anderem mit der Temperaturbelastung, der Schaltfrequenz und der Blockierspannung in Zusammenhang stehen. In jüngster Zeit sind SiC-basierte Leistungsbaueteile 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 überlegene 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 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 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-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. This book is based on the 18 tutorials presented during the 28th workshop on Advances in Analog Circuit Design. Expert designers present readers with information about a variety of topics at the frontier of analog circuit design, including next-generation analog-to-digital converters, high-performance power management systems and technology considerations for advanced IC design. For anyone involved in analog circuit research and development, this book will be a valuable summary of the state-of-the-art in these areas. Provides a summary of the state-of-the-art in analog circuit design, written by experts from industry and academia; Presents material in a tutorial-based format; Includes coverage of next-generation analog-to-digital converters, high-performance power management systems, and technology considerations for advanced IC design.

A thoroughly revised third edition of this widely praised, bestselling textbook presents a comprehensive systems-level perspective of electric and hybrid vehicles with emphasis on technical aspects, mathematical relationships and basic design guidelines. The emerging technologies of electric vehicles require the dedication of current and future engineers, so the target audience for the book is the young professionals and students in engineering eager to learn about the area. The book is concise and clear, its mathematics are kept to a necessary minimum and it contains a well-balanced set of contents of the complex technology. Engineers of multiple disciplines can either get a broader overview or explore in depth a particular aspect of electric or hybrid vehicles. Additions in the third edition include simulation-based design analysis of electric and hybrid vehicles and their powertrain components, particularly that of traction inverters, electric machines and motor drives. The technology trends to incorporate wide bandgap power electronics and reduced rare-earth permanent magnet electric machines in the powertrain components have been highlighted. Charging stations are a critical component for the electric vehicle infrastructure, and hence, a chapter on vehicle interactions with the power grid has been added. Autonomous driving is another emerging technology, and a chapter is included describing the autonomous driving system architecture and the hardware and software needs for such systems. The platform has been set in this book for system-level simulations to develop models using various softwares used in academia and industry, such as MATLAB®/Simulink, PLECS, PSIM, Motor-CAD and Altair Flux. Examples and simulation results are provided in this edition using these software tools. The third edition is a timely revision and contribution to the field of electric vehicles that has reached recently notable markets in a more and more environmentally sensitive world.

This revised and extended second edition covers problems concerning the design and realization of digital control algorithms for power electronics circuits using digital signal processing (DSP) methods. This book discusses signal processing, starting from analog signal acquisition, through conversion to digital form, methods of filtration and separation, and ending with pulse control of output power transistors. The book is focused on two applications for the considered methods of digital signal processing, a three-phase shunt active power filter and a digital class-D audio power

amplifier. The book bridges the gap between power electronics and digital signal processing. Many control algorithms and circuits for power electronics in the current literature are described using analog transmittances. This may not always be acceptable, especially if half of the sampling frequencies and half of the power transistor switching frequencies are close to the band of interest. Therefore in this book, a digital circuit is treated as a digital circuit with its own peculiar characteristics, rather than an analog circuit. This helps to avoid errors and instability. This edition includes a new chapter dealing with selected problems of simulation of power electronics systems together with digital control circuits. The book includes numerous examples using MATLAB and PSIM programs.

This timely book provides you with a solid understanding of battery management systems (BMS) in large Li-Ion battery packs, describing the important technical challenges in this field and exploring the most effective solutions. You find in-depth discussions on BMS topologies, functions, and complexities, helping you determine which permutation is right for your application. Packed with numerous graphics, tables, and images, the book explains the OC whysOCO and OC howsOCO of Li-Ion BMS design, installation, configuration and troubleshooting. This hands-on resource includes an unbiased description and comparison of all the off-the-shelf Li-Ion BMSs available today. Moreover, it explains how using the correct one for a given application can help to get a Li-Ion pack up and running in little time at low cost."

Encouraged by the response to the first edition and to keep pace with recent developments, Fundamentals of Electrical Drives, Second Edition incorporates greater details on semi-conductor controlled drives, includes coverage of permanent magnet AC motor drives and switched reluctance motor drives, and highlights new trends in drive technology. Contents were chosen to satisfy the changing needs of the industry and provide the appropriate coverage of modern and conventional drives. With the large number of examples, problems, and solutions provided, Fundamentals of Electrical Drives, Second Edition will continue to be a useful reference for practicing engineers and for those preparing for Engineering Service Examinations.

Electrical and Electronic Measurement and Instrumentation' is one of the core subjects taught to Electrical, Electronic and Instrumentation students at B.Tech and other equivalent levels. The content of this book has been prepared after consulting the syllabuses of a large number of Indian universities. Although books are available on this subject, it was felt necessary to prepare the one that exactly responds to the students' learning needs and to create their interest in this subject. Thus, the presentation here has been especially made simple and easy to understand.

The awareness of environment protection is a great achievement of humans; an expression of self-awareness. Even though the idea of living while protecting the environment is not new, it has never been so widely and deeply practiced by any nations in history like it is today. From the late 90s in the last century, the surprisingly fast dev

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. It has many applications in our every day life such as air-conditioners, electric cars, subway 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. Designed to appeal to a new generation of engineering professionals, Power Electronics Handbook, 3rd Edition features four new chapters covering renewable energy, energy transmission, energy storage, as well as an introduction to Distributed and Cogeneration (DCG) technology, including gas turbines, gensets, microturbines, wind turbines, variable speed generators, photovoltaics and fuel cells, has been gaining momentum for quite some time now. smart grid technology. With this book readers should be able to provide technical design leadership on assigned power electronics design projects and lead the design from the concept to production involving significant scope and complexity. Contains 45 chapters covering all aspects of power electronics and its applications Three new chapters now including coverage Energy Sources, Energy Storage and Electric Power Transmission Contributions from more than fifty leading experts spanning twelve different countries

This textbook is intended for engineering students taking courses in power electronics, renewable energy sources, smart grids or static power converters. It is also appropriate for students preparing a capstone project where they need to understand, model, supply, control and specify the grid side power converters. The main goal of the book is developing in students the skills that are required to design, control and use static power converters that serve as an interface between the ac grid and renewable power sources. The same skills can be used to design, control and use the static power converters used within the micro-grids and nano-grids, as the converters that provide the interface between such grids and the external grid. The author's approach starts with basic functionality and the role of grid connected power converters in their typical applications, and their static and dynamic characteristics. Particular effort is dedicated to developing simple, concise, intuitive and easy-to-use mathematical models that summarize the essence of the grid side converter dynamics. Mathematics is reduced to a necessary minimum, solved examples are used extensively to introduce new concepts, and exercises are used to test mastery of new skills.

The advent of lithium ion batteries has brought a significant shift in the area of large format battery systems. Previously limited to heavy and bulky lead-acid storage batteries, large format batteries were used only where absolutely necessary as a means of energy storage. The improved energy density, cycle life, power capability, and durability of lithium ion cells has given us electric and hybrid vehicles with meaningful driving range and performance, grid-tied energy storage systems for integration of renewable energy and load leveling, backup power systems and other applications. This book discusses battery management system (BMS) technology for large format lithium-ion battery packs from a systems perspective. This resource covers the future of BMS, giving us new ways to generate, use, and store energy, and free us from the perils of non-renewable energy sources. This book provides a full update on BMS technology, covering software, hardware, integration, testing, and safety.

A theoretical and technical guide to the electric vehicle lithium-ion battery management system Covers the timely topic of battery management systems for lithium batteries. After introducing the problem and basic background theory, it discusses battery modeling and state estimation. In addition to theoretical modeling it also contains practical information on charging and discharging control technology, cell equalisation and application to electric vehicles, and a discussion of the key technologies and research methods of the lithium-ion power battery management system. The author systematically expounds the theory knowledge included in the lithium-ion battery management systems and its practical application in electric vehicles, describing the theoretical connotation and practical application of the battery management systems. Selected graphics in the book are directly derived from the real vehicle tests. Through comparative analysis of the different system structures and different graphic symbols, related concepts are clear and the understanding of the battery management systems is enhanced. Contents include: key technologies and the difficulty point of vehicle power battery management system; lithium-ion battery performance modeling and simulation; the estimation theory and methods of the lithium-ion battery state of charge, state of energy, state of health and peak power; lithium-ion battery charge and discharge control technology; consistent evaluation and equalization techniques of the battery pack; battery management system design and application in electric vehicles. A theoretical and technical guide to the electric vehicle lithium-ion battery management system Using simulation technology, schematic diagrams and case studies, the basic concepts are described clearly and offer detailed analysis of battery charge and discharge control principles Equips the reader with the understanding and concept of the power battery, providing a clear cognition of the application and management of lithium ion batteries in electric vehicles Arms audiences with lots of case studies Essential reading for Researchers and professionals working in energy technologies, utility planners and system engineers.

Provides an original, detailed, and practical description of current interruption transients, origins, and the circuits involved, and shows how they can be calculated Based on a course that has been presented by the author worldwide, this book teaches readers all about interruption transients calculation—showing how they can be calculated using only a hand calculator and Excel. It covers all the current interruption cases that occur on a power system and relates oscillatory circuit (transients) and symmetrical component theory to the practical calculation of current interruption transients as applied to circuit breaker application. The book explains all cases first in theory, and then illustrates them with practical examples. Topics featured in Current Interruption Transients Calculation, Second Edition include: RLC Circuits; Pole Factor Calculation; Terminal Faults; Short Line Faults; Inductive Load Switching; and Capacitive Load Switching. The book also features numerous appendices that cover: Differential Equations; Principle of Duality; Useful Formulae; Euler's Formula; Asymmetrical Current-Calculating Areas Under Curves; Shunt Reactor Switching; and Generator Circuit Breaker TRVs. Offers a clear explanation of how to calculate transients without the use of specialist software, showing how four basic circuits can represent all transients Describes every possible current interruption case that can arise on a power system, explaining them through theory and practical examples Analyses oscillatory circuit (transients) and symmetrical component theory in detail Takes a practical approach to the subject so engineers can use the knowledge in circuit breaker applications Current Interruption Transients Calculation, Second Edition is an ideal book for power electrical engineers, as well as transmission and distribution staff in the areas of planning and system studies, switchgear application, specification and testing, and commissioning and system operation.

This comprehensive, two-volume resource provides a thorough introduction to lithium ion (Li-ion) technology. Readers get a hands-on understanding of Li-ion technology, are guided through the design and assembly of a battery, through deployment, configuration and testing. The book covers dozens of applications, with solutions for each application provided. Volume One focuses on the Li-ion cell and its types, formats, and chemistries. Cell arrangements and issues, including series (balance) and parallel (fusing, inrush current) are also discussed. Li-ion Battery Management Systems are explored, focusing on types and topologies, functions, and selection. Battery design, assembly, deployment, troubleshooting and repair are also discussed, along with modular batteries, split batteries and battery arrays. Written by a prominent expert in the field and packed with over 500 illustrations, these volumes contain solutions to practical problems, making it useful for both the novice and experienced practitioners.

Fundamental to the planning, design, and operating stages of any electrical engineering endeavor, power system analysis continues to be shaped by dramatic advances and improvements that reflect today's changing energy needs. Highlighting the latest directions in the field, Power System Analysis: Short-Circuit Load Flow and Harmonics, Second Edition includes investigations into arc flash hazard analysis and its migration in electrical systems, as well as wind power generation and its integration into utility systems. Designed to illustrate the practical application of power system analysis to real-world problems, this book provides detailed descriptions and models of major electrical equipment, such as transformers, generators, motors, transmission lines, and power cables. With 22 chapters and 7 appendices that feature new figures and mathematical equations, coverage includes: Short-circuit analyses, symmetrical components, unsymmetrical faults, and matrix methods Rating structures of breakers Current interruption in AC circuits, and short-circuiting of rotating machines Calculations according to the new IEC and ANSI/IEEE standards and methodologies Load flow, transmission lines and cables, and reactive power flow and control Techniques of optimization, FACT controllers, three-phase load flow, and optimal power flow A step-by-step guide to harmonic generation and related analyses, effects, limits, and mitigation, as well as new converter topologies and practical harmonic passive filter designs—with examples More than 2000 equations and figures, as well as solved examples, cases studies, problems, and references Maintaining the structure, organization, and simplified language of the first edition, longtime power system engineer J.C. Das seamlessly melds coverage of theory and practical applications to explore the most commonly required short-circuit, load-flow, and harmonic analyses. This book requires only a beginning knowledge of the per-unit system, electrical circuits and machinery, and matrices, and it offers significant updates and additional information, enhancing technical content

and presentation of subject matter. As an instructional tool for computer simulation, it uses numerous examples and problems to present new insights while making readers comfortable with procedure and methodology.

Maintaining a stable level of power quality in the distribution network is a growing challenge due to increased use of power electronics converters in domestic, commercial and industrial sectors. Power quality deterioration is manifested in increased losses; poor utilization of distribution systems; mal-operation of sensitive equipment and disturbances to nearby consumers, protective devices, and communication systems. However, as the energy-saving benefits will result in increased AC power processed through power electronics converters, there is a compelling need for improved understanding of mitigation techniques for power quality problems. This timely book comprehensively identifies, classifies, analyses and quantifies all associated power quality problems, including the direct integration of renewable energy sources in the distribution system, and systematically delivers mitigation techniques to overcome these problems. Key features: Emphasis on in-depth learning of the latest topics in power quality extensively illustrated with waveforms and phasor diagrams. Essential theory supported by solved numerical examples, review questions, and unsolved numerical problems to reinforce understanding. Companion website contains solutions to unsolved numerical problems, providing hands-on experience. Senior undergraduate and graduate electrical engineering students and instructors will find this an invaluable resource for education in the field of power quality. It will also support continuing professional development for practicing engineers in distribution and transmission system operators.

This wide-ranging presentation of applied superconductivity, from fundamentals and materials right up to the details of many applications, is an essential reference for physicists and engineers in academic research as well as in industry. Readers looking for a comprehensive overview on basic effects related to superconductivity and superconducting materials will expand their knowledge and understanding of both low and high T_c superconductors with respect to their application. Technology, preparation and characterization are covered for bulk, single crystals, thin films as well as electronic devices, wires and tapes. The main benefit of this work lies in its broad coverage of significant applications in magnets, power engineering, electronics, sensors and quantum metrology. The reader will find information on superconducting magnets for diverse applications like particle physics, fusion research, medicine, and biomagnetism as well as materials processing. SQUIDs and their usage in medicine or geophysics are thoroughly covered, as are superconducting radiation and particle detectors, aspects on superconductor digital electronics, leading readers to quantum computing and new devices.

With distributed generation interconnection power flow becoming bidirectional, culminating in network problems, smart grids aid in electricity generation, transmission, substations, distribution and consumption to achieve a system that is clean, safe (protected), secure, reliable, efficient, and sustainable. This book illustrates fault analysis, fuses, circuit breakers, instrument transformers, relay technology, transmission lines protection setting using DIGSILENT Power Factory. Intended audience is senior undergraduate and graduate students, and researchers in power systems, transmission and distribution, protection system broadly under electrical engineering.

This title evaluates the performance, safety, efficiency, reliability and economics of a power delivery system. It emphasizes the use and interpretation of computational data to assess system operating limits, load level increases, equipment failure and mitigating procedures through computer-aided analysis to maximize cost-effectiveness.

This comprehensive, two-volume resource provides a thorough introduction to lithium ion (Li-ion) technology. Readers get a hands-on understanding of Li-ion technology, are guided through the design and assembly of a battery, through deployment, configuration and testing. The book covers dozens of applications, with solutions for each application provided. Volume Two focuses on small batteries in consumer products and power banks, as well as large low voltage batteries in stationary or mobile house power, telecom, residential, marine and microgrid. Traction batteries, including passenger, industrial, race vehicles, public transit, marine, submarine and aircraft are also discussed. High voltage stationary batteries grid-tied and off-grid are presented, exploring their use in grid quality, arbitrage and back-up, residential, microgrid, industrial, office buildings. Finally, the book explores what happens when accidents occur, so readers may avoid these mistakes. Written by a prominent expert in the field and packed with over 500 illustrations, these volumes contain solutions to practical problems, making it useful for both the novice and experienced practitioners.

Passive components; Passive circuits; Active components; Audio frequency signals and reproduction; Passive signal processing and signal transmission, Active signal processing in the frequency domain; Active signal processing in the time domain; Radio frequency circuits; Signal sources; Power supplies; Tricks of the trade; Appendices; Index.

Indoor photovoltaics (IPV) is the most promising power source for indoor electronic devices, especially sensor devices and edge nodes for the Internet of Things, and it will gain considerable interest due to the development of the field. This field of photovoltaics differs to other fields due to irradiance and spectral distribution conditions as well as the (close to) energy autarkic field conditions. The book provides the engineer and researcher with guidelines, provides a comprehensive overview over theoretical models, efficiencies, application design, and first available products.

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