Power Quality Problems and Mitigation Techniques

Electrical Generation and Distribution Systems and Power Quality Disturbances

Terrorism and the Electric Power Delivery System

This book presents a solid theoretical foundation of the modern mitigation technologies employed in the power quality arena, and provides an overview of the most recent challenges in this field. The book introduces the advanced concepts associated with power quality to engineers and students. It will make an excellent reference for facility electrical power engineers and maintenance technicians.

Power Quality in Power Systems and Electric Machines

This book covers instantaneous power theory as well as the importance of design of shunt, series, and combined shunt-series power active filters and hybrid passive-active power filters. It illustrates pioneering applications of the p-q theory to power conditioning, which highlights distinct differences from conventional theories. It explores p-q-r theory to give a new method of analyzing the different powers in a three-phase circuit and provides exercises at the end of many chapters that are unique to the second edition.

Advances in Electrical and Computer Technologies

This book discusses the major aspects of load flow, optimization, optimal load flow, and culminates in modern heuristic optimization techniques and evolutionary programming. In the deregulated environment, the economic provision of electrical power to consumers requires knowledge of establishing a certain power quality and load flow. Many case studies and practical examples are included to emphasize real-world applications. The problems at the end of each chapter can be solved by hand calculations without having to use computer software. The appendices are devoted to calculations of line and cable constants, and solutions to the problems are included throughout the book.

Power Quality Issues in Distributed Generation

With distributed generation interconnection power flow becomes 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 line protection, and fault calculation 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.

Power Quality This book is a collection of research papers and articles presented at the 3rd International Conference on Communications and Cyber-Physical Engineering (ICCCCE 2020), held on 1-2 February 2020 at CMR Engineering College, Hyderabad, Telangana, India. Discussing the latest developments in voice and data communication engineering, cyber-physical systems, network science, communication software, image and multimedia processing research and applications, as well as communication technologies and other related technologies, it includes contributions from both academia and industry. This book is a valuable resource for scientists, research scholars and PG students working to formulate their research ideas and find the future directions in these areas. Further, it may serve as a reference work to understand the latest engineering and technologies used by practicing engineers in the field of communication engineering.

Power System Harmonics

Power distribution and quality remain the key challenges facing the electrical utilities industry. Technology alone cannot provide a solution to power quality problems, and there exists a variety of procedures and programs that can be put in place to ensure reliable, high-quality electricity. With chapters carefully culled from the best-selling Electric Power Distribution Handbook, Distribution Reliability and Power Quality provides an economical, sharply focused reference for engineers and technicians working in this specialty area of power distribution. The book introduces the concept of reliability, outlining various methods of assessing and improving reliability along with the factors that affect it. It follows with a detailed look at voltage sags and momentary interruptions, various solutions to these issues, power quality monitoring, and other quality issues such as voltage unbalance and harmonics. Because faults are the cause of many interruptions and other power quality problems, the author devotes a detailed chapter to various aspects of faults. Focused on enhancing the delivery of high-quality power, this volume includes a new chapter on reliability and power quality improvement programs that provide a roadmap to better performance and ultimately to higher efficiency. Presenting a host of practical solutions for reliability and power quality specialists, Distribution Reliability and Power Quality gathers critical tools, techniques, and knowledge into a single source that is ideally suited for immediate implementation.

energy systems—in a completely updated, new edition The second edition of Renewable and Efficient Electric Power Systems provides a solid, quantitative, practical introduction to a wide range of renewable energy systems. For each topic, essential theoretical background is introduced, practical engineering considerations associated with designing and predicting system performance are provided, and methods for the efficient and reliable operation of these systems are presented. While the book focuses on the fastest growing, most promising wind and solar technologies, new material on tidal and wave power, small-scale hydroelectric power, geothermal and biomass systems is introduced. Both supply-side and demand-side technologies are blended in the final chapter, which introduces the energy grid. As these technologies are supported by renewable resources create the role of demand-side management in helping maintain grid balance and explored. Renewable energy systems have become mainstream technologies and are now, literally, big business. Throughout this edition, more depth has been provided on the financial analysis of large-scale conventional and renewable energy projects. While grid-connected systems dominate the off-grid systems, beginning have a significant impact on emerging economies, where electricity is a scarce commodity. Considerable attention is paid to the economics of all of these systems. This edition has been completely rewritten, updated, and reorganized. New material has been presented both in the form of new topics as well as in greater depth in some areas. The section on the fundamentals of electric power has been enhanced, making this edition a much better bridge to the more advanced courses in power that are returning to many electrical engineering programs. This includes an introduction to phasor notation, more emphasis on on-reactive power as well as real power, more on power converter and inverter electronics, and more material on generator technologies. Realizing that many students, as well as professionals, in this increasingly important field may have modest electrical engineering backgrounds, early chapters develop the skills and knowledge necessary to understand these important topics without the need for supplementary materials. With numerous completely worked examples throughout, the book has been designed to encourage self-instruction. The book includes worked examples for virtually every topic that lends itself to quantitative analysis. Each chapter ends with a problem set that provides additional practice. This is an essential resource for a mixed audience of engineering and other technology-focused individuals.

Power Quality Problems and Mitigation Techniques In the present day deregulated power market electric power quality issues have become great concerns of utilities, end users and manufacturers. Worldwide researches are going on to address those issues. Electric Power Quality has evolved from the researches carried out by the authors. The focus of the book as found out from the point of view, different power quality issues, their sources and effects and different related standards, which are required for students, researchers and practising engineers and, on the other hand, measurement techniques for different power quality parameters, the content level is designed in such a way that the concepts of different power quality issues in modern power system are built up first, followed by some existing and new measurement methods. This content should attract the students, attractors engineers and practising engineers, the predominant features are Lucid but precise description of the subject, detailed new measurement techniques and Electric Power Quality is intended for graduate, postgraduate and researchers as well as for professionals in the related fields. At the end, a chapter has been added which deals with a concept of generation of harmonics in a power system and its components.

Power Quality Problems and Mitigation Methods: Case Study at DBBF The electric power delivery system that carries electricity from large central generators to customers could be severely damaged by a small number of well-informed attackers. The system is inherently vulnerable because transmission lines may span hundreds of miles, and many key facilities are unguarded. This vulnerability is exacerbated by the fact that the power grid, most of which was originally designed to meet the needs of individual vertically integrated utilities, is being used to move power between regions to support the needs of competitive markets for power generation. Primarily because of ambiguities introduced as a result of recent restricting the of the industry and cost pressures from consumers and regulators, investment to strengthen and upgrade the grid has lagged, with the result that many parts of the bulk high-voltage system are heavily stressed. Electric systems are not designed to withstand or quickly recover from damage inflicted simultaneously on multiple components. Such an attack could be carried out by knowledgeable attackers with little risk of detection or interdiction. Further well-planned and coordinated attacks by terrorists could leave the electric power system in a large region of the country at least partially disabled for a very long time. Although there are many examples of terrorist and military attacks on power systems elsewhere in the world, at the time of this internationals, the U.S. power grid has been one of the most well-protected systems, that should not be a basis for complacency. Because all parts of the economy, as well as human health and welfare, depend on electricity, the results could be devastating. Terrorism and the Electric Power Delivery System focuses on measures that could make the power delivery system less vulnerable to attacks, restore power faster after an attack, and make critical services less vulnerable while the delivery of conventional electric power has been disrupted.

Signal Processing of Power Quality Disturbances offers a comprehensive introduction to the issues of control of power systems during cascading outages and restoration process Power System Control Under Cascading Failures offers comprehensive coverage of three major topics related to prevention of cascading power outages in a power transmission grid: modelling, system separation and power system restoration. The book examines modelling and analysis of cascading failures for reliable and efficient simulation and better understanding of important mechanisms, root causes and propagation patterns of failures and power outages. Second, it covers controlled system separation to mitigate cascading failures addressing key questions such as where, when and how to separate. Third, this book explores optimal system restoration from cascading system separation. Throughout the book, essential theoretical background is introduced, practical engineering considerations are provided, and methods for the efficient and reliable operation of these systems are presented. While the book focuses on the fastest growing, most promising wind and solar technologies, new material on tidal and wave power, small-scale hydroelectric power, geothermal and biomass systems is introduced. Both supply-side and demand-side technologies are blended in the final chapter, which introduces the energy grid. As these technologies supported by renewable resources create the role of demand-side management in helping maintain grid balance and explored. Renewable energy systems have become mainstream technologies and are now, literally, big business. Throughout this edition, more depth has been provided on the financial analysis of large-scale conventional and renewable energy projects. While grid-connected systems dominate the off-grid systems, beginning have a significant impact on emerging economies, where electricity is a scarce commodity. Considerable attention is paid to the economics of all of these systems. This edition has been completely rewritten, updated, and reorganized. New material has been presented both in the form of new topics as well as in greater depth in some areas. The section on the fundamentals of electric power has been enhanced, making this edition a much better bridge to the more advanced courses in power that are returning to many electrical engineering programs. This includes an introduction to phasor notation, more emphasis on on-reactive power as well as real power, more on power converter and inverter electronics, and more material on generator technologies. Realizing that many students, as well as professionals, in this increasingly important field may have modest electrical engineering backgrounds, early chapters develop the skills and knowledge necessary to understand these important topics without the need for supplementary materials. With numerous completely worked examples throughout, the book has been designed to encourage self-instruction. The book includes worked examples for virtually every topic that lends itself to quantitative analysis. Each chapter ends with a problem set that provides additional practice. This is an essential resource for a mixed audience of engineering and other technology-focused individuals.

Electric Power Quality Due to the complexity of power systems combined with other factors such as increasing sustainability of equipment, power quality (PQ) is apt to waver. With electricity in growing demand, low PQ is on the rise and becoming notoriously difficult to remedy. It is an issue that confronts professionals on a daily basis, but few
have the required knowledge to diagnose and solve these problems. Handbook of Power Quality examines of the full panorama of PQ disturbances, with background theory and guidelines on measurement procedures and problem solving. It presents the perspectives of both supplier and electricity users, with contributions from experts in all aspects of PQ supplying a vital basis for scientific and practical information on the following: frequency variations; the characteristics of voltage, including dips, fluctuations and flicker; the continuity and reliability of electricity supply, its structure, appliances and equipment; the relationship of PQ with power systems, distributed generation, and the electricity market; the monitoring and cost of poor PQ; rational use of energy. An accompanying website hosts all the worked problems, providing practice for readers and a vast array of solutions to the questions asked in the book. The website also includes extensive appendices listing the current standards, mathematical formulas, and principles of electrical circuits that are critical for the optimization of solutions. This comprehensive handbook explains PQ methodology with a hands-on approach that makes it essential for all practising power systems engineers and researchers. It simultaneously acts as a reference for electrical engineers and technical managers who meet with power quality issues and would like to further their knowledge in this area.

Microgrid Architectures, Control and Protection Methods This book includes the original, peer-reviewed research from the 2nd International Conference on Emerging Trends in Electrical, Communication and Information Technologies (ICECIT 2015), held in December, 2015 at Chinivas Ramanjanji Institute of Technology, Ananthapuramu, Andhra Pradesh, India. It covers the latest research trends or developments in areas of Electrical Engineering, Electronic and Communication Engineering, and Computer Science and Information.

Power Quality Issues

Computing Algorithms with Applications in Engineering The utilization of renewable energy sources such as wind energy, or solar energy, among others, is currently of greater interest. Nevertheless, since their availability is arbitrary and unstable this can lead to frequency variation, to grid instability and to a total or partial loss of load power flow not supplying the appropriate sources to be directly connected to the main utility grid. Additionally, the presence of a static converter as output interface of the generating plants introduces voltage and current harmonics into the electrical system that negatively affect system power quality. By integrating distributed power generation systems close to the loads in the electric grid, we can eliminate the need to transfer energy over long distances through the electric grid. In this book, the reader will be introduced to different power generation and distribution systems with an analysis of some types of existing disturbances and a study of different industrial applications such as battery charges.

ICCCE 2020Bow Ties in Process Safety and Environmental Management: Current Trends and Future Perspectives aims to combine the process safety aspects and the potential dangers to the ecology including the source of the contamination, and especially, the unbalanced utilization of toxic chemicals in process industries. It also covers a broad spectrum of industrial process safety, environmental pollution factors, dangers to land, water, air and living species, remediation technologies (traditional and futuristic approaches), pollutant degradation through numerical methods, and toxicology and toxicodynamics of toxic chemicals and their theoretical aspects. The book also contains mandated safety data sheets already available and suggestions for the improvement of industrial specifications. Discusses detailed aspects of process safety and environmental impact from a theoretical and practical perspective Covers detailed procedures of environmental modeling concepts Explores forensic investigation sequences during the incident Proposes futuristic approaches towards risk assessment and management Includes real-time case studies with complexities and solutions This book is written for researchers, graduate students, and professionals involved in Chemical Engineering, Environmental Engineering, and Process Safety Engineering.

Renewable and Efficient Electric Power Systems Identify and Solve Key Electric-Power-Quality Problems and Ensure Reliable Power Delivery to All Customers Power Quality in Electrical Systems equips you with the latest engineering techniques for providing power quality to all customers, and includes vital information on manufacturing, data processing, and healthcare facilities. Based on an IEEE Professional Education course, the book is a practice-oriented engineering tutorial for solving key electric-power-quality problems. This skills-building resource is designed to improve job performance by taking you step-by-step through voltage distortion/harmonic current sources, corrections, power quality measurements, and their theories. The book also includes mandated safety data sheets already available and suggestions for the improvement of industrial specifications. Discusses detailed aspects of process safety and environmental impact from a theoretical and practical perspective Covers detailed procedures of environmental modeling concepts Explores forensic investigation sequences during the incident Proposes futuristic approaches towards risk assessment and management Includes real-time case studies with complexities and solutions This book is written for researchers, graduate students, and professionals involved in Chemical Engineering, Environmental Engineering, and Process Safety Engineering.

Handbook of Research on New Solutions and Technologies in Electrical Distribution Networks The second edition of this must-have reference covers power quality issues in four parts, including new discussions related to renewable energy systems. The first part of the book provides background on causes, effect, and remedial solutions for power quality and harmonics. Once the basics are established, the authors move on to harmonic modeling of power systems, including components and apparatus (electric machines). The final part of the book is devoted to power quality mitigation approaches and devices, and the fourth part extends the analysis to power quality solutions for renewable energy systems. Throughout the book worked examples and exercises provide practical applications, and tables, charts, and graphs offer useful data for the modeling and analysis of power quality issues. Provides a theoretical and practical insight into power quality problems of electric machines and systems 134 practical applications (example) problems with solutions 125 problems at the end of chapters dealing with practical applications 924 references, mostly journal articles and conference papers, as well as national and international standards and guidelines

Geomagnetic Disturbances Impacts on Power Systems Power Quality in Modern Power Systems presents an overview of power quality problems in electrical power systems, for identifying pitfalls and applying the fundamental concepts for tackling and maintaining the electrical power quality standards in power systems. It covers the recent trends and emerging topics of power quality in large scale renewable energy integration, electric vehicle charging stations, voltage control in active distribution network and solutions to integrate large scale renewable energy into
the electric grid with several case studies and real-time examples for power quality assessments and mitigations measures. This book will be a practical guide for graduate and post graduate students of electrical engineering, engineering professionals, researchers and consultants working in the area of power quality. Explains the power quality characteristics, diagnostic techniques, measurement and simulation of electric power systems. Various case studies and examples on power quality problems and their solutions. The book covers the fundamentals of power quality, including harmonic detection and analysis, protection and mitigation techniques, and advanced control strategies. The book also includes case studies and examples on power quality issues in various industries, such as industrial, commercial, and residential. The book provides a comprehensive overview of the power quality phenomena, including voltage sags, interruptions, and overvoltages, and discusses the methodologies and tools for their analysis, monitoring, and mitigation. The book also covers the impact of power quality issues on power system reliability, economics, and environmental sustainability. The book is suitable for power system engineers, researchers, and professionals in the field of power quality. It also provides useful guidelines for policymakers and regulatory agencies to improve power quality and ensure reliable and sustainable power system operation.
Integration of Renewable Energy Sources with Smart Grid This book deals with several selected aspects of electric power quality issues typically faced during grid integration processes of contemporary renewable energy sources. In subsequent chapters of this book the reader will be familiarized with the issues related to voltage and current harmonics and inter-harmonics generation and elimination, harmonic emission of switch-mode rectifiers, reactive power flow control in power system with non-linear loads, modeling and simulation of power quality issues in power grid, advanced algorithms used for estimating harmonic components, and new methods of measurement and analysis of real time accessible power quality related data.

7th IEEE India International Conference on Power Electronics Geomagnetic Disturbances Impacts on Power Systems: Analysis & Mitigation This full book provides a full risk assessment and full risk assessment of power systems confronted geomagnetic disturbances (GMDs) and specifies mitigation opportunities for various stakeholders. “This book deals comprehensively with the threat of solar storms on the world’s power systems. It provides a context to GMDs with respect to other natural hazards, and describes methods to evaluate a particular grid’s risk factors in a straightforward fashion. This is extremely useful to grid power operators, as they are not experts in the field of space weather, but they must be able to deal with its effects. This is the critical message of this extremely valuable book.” - William A. Radasky, Ph.D., P.E., IEEE Life Fellow, Metatech Corporation, California USA Aimed at risk engineers, policy-makers, technical experts and non-specialists such as power system operators, this book seeks to provide an insight into the GMD as a natural hazard and to perform the risk assessment of its potential impacts on the power systems as critical infrastructures. The reader gets familiar with how the Sun can endanger ground-based technological systems and the physics of solar activity manifestation on the Earth as Geomagnetically Induced Currents (GICs). The reaction of power systems to GMDs and mitigation strategies aiming at reducing and controlling the risks are then addressed. The GMD mitigation strategies, the power systems critical factors analysis, the high-risk zones identification and an estimation of economic loss, which is a valuable input for the (re)insurance sector, are also brought to the full risk assessment of the real-world power systems. This book provides a full risk assessment of power systems confronted with space weather risks. Key features: • Brings together interdisciplinary perspectives on the topic in one, cohesive book • Practical guideline on mitigation actions for diverse users and even non-specialists • Dealing comprehensively with the threat of geomagnetic disturbance on the world’s power systems • Introducing unique methods to evaluate a particular system risk factors in a straightforward fashion Authors Olga Sokolova, Ph.D., is a risk analyst and electrical engineer with expertise in the domain of critical infrastructure risk assessment to natural catastrophes. Nikolay Korovkin, Ph.D., is a full professor and head of Theoretic Electrical Engineering Department at Peter the Great Saint-Petersburg Polytechnic University (SPbPU). Masashi Hayakawa, Ph.D., is an emeritus professor of the University of Electro-Communications, and also CEO of Hayakawa Institute of Seismo Electromagnetics, Co.Ltd.

Power Electronics and Power Quality This book presents intuitive explanations of the principles of microgrids, including their structure and operation and their applications. It also discusses the latest research on microgrid control and protection technologies and the essential microgrid protection as well as enhanced communication systems. The book provides solutions to microgrid operation and planning issues using various methodologies including planning and modelling; AC and DC hybrid microgrids; energy storage systems in microgrids; and optimal microgrid operational planning. Written by specialists, it is filled in innovative solutions and research related to microgrid operation, making it a valuable resource for those interested in developing updated approaches in electric power design, analysis and operational strategies. Thanks to its in-depth explanations and clear, three-part structure, it is useful for electrical engineering students, researchers and technicians.

Instantaneous Power Theory and Applications to Power Conditioning Power Quality Issues: Current Harmonics provide solutions for the mitigation of power quality problems related to harmonics. Focusing on active power filters (APFs) due to their excellent harmonic and reactive power compensation in two-wire (single phase), three-wire (three-phase without neutral), and four-wire (three-phase with neutral) AC power networks with nonlinear loads, the text: Introduces the APF technology, describing various APF configurations and offering guidelines for the selection of APFs for specific application considerations Compares shunt active filter (SHAF) control strategies for extracting three-phase refining active current, evaluating their performance under a number of source voltage conditions using a proportional-integral (PI) controller Presents PI controller-based SHAF instantaneous active and reactive power (p-q) and instantaneous active and reactive current (Id-Iq) control strategies, supplying detailed MATLAB®/Simulink simulation results Proposes SHAF control strategies using type 1 and type 2 fuzzy logic controllers (FLCs) with different fuzzy membership functions (MFs), analyzing their harmonic mitigation and DC link voltage regulation Verifies the proposed type 2 FLC-based SHAF control strategies with trapezoidal, triangular, and Gaussian fuzzy MFs using RT-LAB, a real-time digital simulation software from OPAL-RT Technologies Power Quality Issues: Current Harmonics is a useful resource for those tackling electrical power quality challenges. The compensation techniques described in this book alleviate harmonic issues that can distort voltage waveforms, fry a building’s wiring, trigger nuisance tripping, overheat transformer units, and cause random end-user equipment failure.

Electrical Power Systems Quality This handbook serves as a guide to deploying battery energy storage technologies, smart distributed energy resources. Battery energy storage technologies are fast becoming a critical component of modern electric power systems, and the increasing integration of renewable energy resources with their inverter-based interfaces into distribution systems have brought different power quality problems in these systems. There is no doubt that the transition from traditional centralization systems to future decentralized smart grid and microgrid systems are making much attention to power quality knowledge to realize better system reliability and performance to be ready for the big change in the coming years of accommodating thousands of decentralized generation units. This book aims to present harmonic modeling, analysis, and mitigation techniques for modern power systems. It is a tool for the practicing engineers of electrical power systems that are concerned with the power system harmonics. Likewise, it is a key resource for academics and researchers who have some background in electrical power systems.
Load Flow Optimization and Optimal Power Flow This book starts with an overview of renewable energy technologies, smart grid technologies, energy storage systems, and covers the details of renewable energy integration with smart grid and the corresponding controls. This book provides better views on power scenario in developing countries. The requirement of the integration of smart grid along with the energy storage systems are deeply discussed to acknowledge the importance of sustainable development of smart city. The methodologies are made quite possible with the high-efficient power converter topologies and intelligent control schemes. These control schemes are capable to provide better control with the help of machine intelligence techniques and artificial intelligence. The book also advances power converter topologies and corresponding control schemes for renewable energy integration with smart grid. The design and analysis of power converters that are used for grid integration of solar PV along with simulation and experimental results are illustrated. The protection aspects of the microgrid with power electronic configurations for wind energy systems are elucidated.

Handbook of Power Quality The electrical power industry is one of the fastest growing industries in the world. Nowadays, electricity consumers are very much concerned of the quality of the supply they receive, due to increased use of sophisticated equipment in their day-to-day activities. Nature of electrical power is such that it can neither be conveniently stored in quantity nor be subjected to quality assurance checks before it is used. As such, study on Power Quality issues in power systems has become one of the most important areas in Electrical Engineering. Among many power quality problems that prevail in power systems, Harmonic distortion continues to cause more and more problems in electrical installations due to proliferation of high power semi conductor devices and power electronics in industrial processes, and microelectronics processors in a wide range of equipment's. The book focuses on the investigation of all the major steady state electrical phenomena that disturb the power quality of a conventional power system. The book is useful to professionals studying in electrical power systems.

Power Quality in Power Systems and Electrical Machines Power quality (PQ) is receiving more and more attention from consumers, distribution system operators, transmission system operators, and other entities related to electrical power systems. As PQ implications for business, productivity, and profitability have a direct impact on economic losses, the research and development monitoring technologies and power electronics solutions that ensure the PQ of the power systems are matters of utmost importance. This book is a collection of high quality papers published in the “Power Electronics and Power Quality” Special Issue of the Journal Energies. It reflects on the latest investigations and the new trends in this field.

Distribution Reliability and Power Quality The book comprises select proceedings of the first International Conference on Advances in Electrical and Computer Technologies 2019 (ICAECT 2019). The papers presented in this book are peer reviewed and cover wide range of topics in Electrical and Computer Engineering fields. This book contains the papers presenting the latest developments in the areas of Electrical, Electronics, Communication systems and Computer Science such as smart grids, soft computing techniques in power systems, smart energy management systems, power electronics, feedback control systems, biomedical engineering, geo informatics systems, grid computing, data mining, image and signal processing, video processing, computer vision, pattern recognition, cloud computing, intelligent systems, artificial intelligence, neural network and fuzzy logic, broad band communication, mobile and optical communication, network security, VLSI, embedded systems, optical networks and wireless communication. This book will be of great use to the researchers and students in the areas of Electrical and Electronics Engineering, Communication systems and Computer Science.

Power Quality Enhancement Using Custom Power Devices Excessive utilization of power electronic devices and the increasing integration of renewable energy resources with their inverter-based interfaces into distribution systems have brought different power quality problems in these systems. There is no doubt that the transition from traditional centralized power systems to future decentralized smart grid necessitates paying much attention to power quality knowledge to realize better system reliability and performance to be ready for the big change in the coming years of accommodating thousands of decentralized generation units. This book aims to present harmonic modeling, analysis, and mitigation techniques for modern power systems. It is a tool for the practicing engineers of electrical power systems that are concerned with the power system harmonics. Likewise, it is a key resource for academics and researchers who have some background in electrical power systems.

Power System Harmonics - Analysis, Effects and Mitigation Solutions for Power Quality Improvement Bridging the gap between power quality and signal processing This innovative new text brings together two leading experts, one from signal processing and the other from power quality. Combining their fields of expertise, they set forth and investigate various types of power quality disturbances, how measurements of these disturbances are processed and interpreted, and, finally, the use and interpretation of power quality standards documents. As a practical aid to readers, the authors make a clear distinction between two types of power quality disturbances: Variations: disturbances that are continuously present Events: disturbances that occur occasionally. A complete analysis and full set of tools are provided for each type of disturbance. Detailed examination of the origin of the disturbance Signal processing measurement techniques, including advanced techniques and those techniques set forth in standardsdocuments Interpretation and analysis of measurement data Methods for further processing the features extracted from the signal processing into site and system indices The depth of coverage is outstanding: the authors present and analyze material that is not covered in the standards nor found in the scientific literature. This text is for two groups of researchers in power engineering: one seeking to perform power system disturbance analyses and diagnostics. It is also highly recommended for any engineer or utility professional involved in power quality monitoring.

Power Quality As the electrical industry continues to develop, one sector that still faces a range of concerns is the electrical distribution system. Excessive industrialization and inadequate billing are just a few issues that have plagued this electrical sector as it advances into the smart grid environment. Research is necessary to explore the possible solutions in fixing these problems and developing the distribution sector into an active and smart system. The Handbook of Research on New Solutions and Technologies in Electrical Distribution Networks is a collection of innovative research on the methods and applications of solving major issues within the electrical distribution system. Some issues covered within the publication include distribution losses, improper monitoring of system, renewable energy integration with micro-grid and distributed energy sources, and smart home energy management system modelling. This book is ideally designed for power engineers, electrical engineers, energy professionals, developers, technologists, policymakers, researchers, academicians, industry professionals, and students seeking current research on improving this key sector of the electrical industry.
Bow Ties in Process Safety and Environmental Management Power Quality Enhancement Using Custom Power Devices considers the structure, control and performance of series compensating DVR, the shunt DSTATCOM and the shunt with series UPQC for power quality improvement in electricity distribution. Also addressed are other power electronic devices for improving power quality in Solid State Transfer Switches and Fault Current Limiters. Applications for these technologies as they relate to compensating busses supplied by a weak line and for distributed generation connections in rural networks, are included. In depth treatment of inverters to achieve voltage support, voltage balancing, harmonic suppression and transient suppression in realistic network environments are also covered. New material on the potential for shunt and series compensation which emphasizes the importance of control design has been introduced.

Power System Control Under Cascading Failures 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.

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