

Unbalanced Load Compensation In Three Phase Power System

2016 International Conference on Electrical Engineering and Automation (EEA2016) was held in Hong Kong, China from June 24th–26th, 2016. EEA2016 has provided a platform for leading academic scientists, researchers, scholars and students around the world, to get together to compare notes, and share their results and findings, in areas of Electronics Engineering and Electrical Engineering, Materials and Mechanical Engineering, Control and Automation Modeling and Simulation, Testing and Imaging, Robotics, Actuating and Sensoring. The conference had received a total of 445 submissions. However, after peer review by the Technical Program Committee only 129 were selected to be included in this conference proceedings; based on their originality, ability to test ideas, and contribution to the understanding and advancement in Electronics and Electrical Engineering.

Electric power systems are headed for a true changing of the guard, due to the urgent need for achieving sustainable energy delivery. Fortunately, the development of new technologies is driving the transition of power systems toward a carbon-free paradigm while maintaining the current standards of quality, efficiency, and resilience. The introduction of HVDC and FACTS in the 20th century, taking advantage of dramatic improvements in power electronics and control, gave rise to unprecedented levels of flexibility and speed of response in comparison with traditional electromechanical devices. This flexibility is nowadays required more than ever in order to solve a puzzle with pieces that do not always fit perfectly. This Special Issue aims to address the role that FACTS and HVDC systems can play in helping electric power systems face the challenges of the near future.

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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.

The Power Systems Computation Conference provides a truly international forum for the exchange of knowledge and experience on developments of theory and new methods relating to the analysis, modelling and simulation of any aspect of power systems or its components. Practical applications of power systems computations are also very welcome. There is an emphasis on modelling and simulation for understanding a system of components, plants or actors, the interactions between them and their collective behaviour, and methods to inform decision making in power systems. Contributions might comment on the analytical techniques, modelling challenges and complex software engineering issues, or what the analyses say in respect of today's and the future's power systems challenges. Thus, papers from utility and manufacturing industry engineers are just as welcome as those from academic researchers.

All papers included in this proceedings had undergone the strict peer-review by the experts before they are accepted for publications. This proceeding covers the subjects of analog circuits and digital circuits, assembly and packaging, biomedical circuits, computer architecture, computer engineering, control engineering, electric power system and automation, energy and power systems, instrumentation engineering, signal processing and other related areas. We hope this proceeding will contribute in stimulating debate and research among scholars, researchers and academicians. CEEE 2014 is to provide a forum for researchers, academicians, engineers, and government officials from all over the world to be involved in the general areas of Electronics and Electrical Engineering to disseminate their latest research results and exchange views on the future research directions of these fields. This conference provides opportunities for the participants to exchange new ideas and application experiences face to face.

This volume brings together contributions dealing with renewable energies and power quality, presented over five years of the International Conference on Renewable Energy and Power Quality (ICREPQ). It contains a selection of the best papers and original contributions presenting state-of-the-art research in the field of renewable energy sources. Including some of the leading authorities in their areas of expertise, the contributors to the volume are drawn from across the globe, with about 300 authors from 60 different countries.

Active Power Line Conditioners: Design, Simulation and Implementation for Improving Power Quality presents a rigorous theoretical and practical approach to active power line conditioners, one of the subjects of most interest in the field of power quality. Its broad approach offers a journey that will allow power engineering professionals, researchers, and graduate students to learn more about the latest landmarks on the different APLC configurations for load active compensation. By introducing the issues and equipment needs that arise when correcting the lack of power quality in power grids, this book helps define power terms according to the IEEE Standard 1459. Detailed chapters discuss instantaneous reactive power theory and the theoretical framework that enabled the practical development of APLCs, in both its original and modified formulations, along with other proposals. Different APLCs configurations for load compensation are explored, including shunt APF, series APF, hybrid APF, and

shunt combined with series APF, also known as UPQC. The book includes simulation examples carefully developed and ready for download from the book's companion website, along with different case studies where real APLCs have been developed. Finally, the new paradigm brought by the emergence of distribution systems with dispersed generation, such as the use of small power units based on gas technology or renewable energy sources, is discussed in a chapter where mitigation technologies are addressed in a distributed environment. Combines the development of theories, control strategies, and the most widespread practical implementations of active power line conditioners, along with the most recent new approaches Details updated and practical content on periodic disturbances mitigation technologies with special emphasis on distributed generation systems Includes over 28 practical simulation examples in Matlab-Simulink which are available for download at the book's companion website, with 4 reproducible case studies from real APLCs

This book bridges the divide between the fields of power systems engineering and computer communication through the new field of power system information theory. Written by an expert with vast experience in the field, this book explores the smart grid from generation to consumption, both as it is planned today and how it will evolve tomorrow. The book focuses upon what differentiates the smart grid from the "traditional" power grid as it has been known for the last century. Furthermore, the author provides the reader with a fundamental understanding of both power systems and communication networking. It shows the complexity and operational requirements of the evolving power grid, the so-called "smart grid," to the communication networking engineer; and similarly, it shows the complexity and operational requirements for communications to the power systems engineer. The book is divided into three parts. Part One discusses the basic operation of the electric power grid, covering fundamental knowledge that is assumed in Parts Two and Three. Part Two introduces communications and networking, which are critical enablers for the smart grid. It also considers how communication and networking will evolve as technology develops. This lays the foundation for Part Three, which utilizes communication within the power grid. Part Three draws heavily upon both the embedded intelligence within the power grid and current research, anticipating how and where computational intelligence will be implemented within the smart grid. Each part is divided into chapters and each chapter has a set of questions useful for exercising the readers' understanding of the material in that chapter. Key Features: Bridges the gap between power systems and communications experts Addresses the smart grid from generation to consumption, both as it is planned today and how it will likely evolve tomorrow Explores the smart grid from the perspective of traditional power systems as well as from communications Discusses power systems, communications, and machine learning that all define the smart grid It introduces the new field of power system information theory This book includes original research papers related to renewable energy and power systems in which theoretical or practical issues of symmetry are considered. The book includes contributions on voltage stability analysis in DC networks, optimal dispatch of islanded microgrid systems, reactive power compensation, direct power compensation, optimal location and sizing of photovoltaic sources in DC networks, layout of parabolic trough solar collectors, topologic analysis of high-voltage transmission grids, geometric algebra and power systems, filter design for harmonic current compensation. The contributions included in this

book describe the state of the art in this field and shed light on the possibilities that the study of symmetry has in power grids and renewable energy systems.

Smart grid and microgrid technology are growing exponentially as they are adopted throughout the world. These new technologies have revolutionized the way electricity is produced, delivered, and consumed, and offer a plethora of benefits as well as the potential for further growth. It is critical to examine the current stage of smart grid and microgrid development as well as the direction they are headed as they continue to expand in order to ensure that cost-effective, reliable, and efficient systems are put in place. The Research Anthology on Smart Grid and Microgrid Development is an all-encompassing reference source of the latest innovations and trends within smart grid and microgrid development. Detailing benefits, challenges, and opportunities, it is a crucial resource to fully understand the current opportunities that smart grids and microgrids present around the world. Covering a wide range of topics such as traditional grids, future smart grids, electrical distribution systems, and microgrid integration, it is ideal for engineers, policymakers, systems developers, technologists, researchers, government officials, academicians, environmental groups, regulators, utilities specialists, industry professionals, and students.

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

The book is a collection of high-quality peer-reviewed research papers presented in the Proceedings of International Conference on Power Electronics and Renewable Energy Systems (ICPERES 2014) held at Rajalakshmi Engineering College, Chennai, India. These research papers provide the latest developments in the broad area of Power Electronics and Renewable Energy. The book discusses wide variety of industrial, engineering and scientific applications of the emerging techniques. It presents invited papers from the inventors/originators of new applications and advanced technologies.

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 thesis presents a control scheme for a single-stage three-phase Photovoltaic (PV) converter with negative sequence load current compensation. In this thesis a dual virtual impedance active damping technique for an LCL filter is proposed to address the issue of LCL filter resonance. Both inverter-side current and the capacitor current are used in the feedback loop. Using both signals provides higher DC rejection than using capacitor current alone. The proposed active damping scheme results in a faster transient response and higher damping ratio than can be obtained using inverter-side current alone. The feedback gains can be calculated to achieve a specified damping level. A method of determining the gains of the Proportional and Resonant current controller based on frequency response characteristics is presented. For a specified set of gain and phase margins, the controller gains can be calculated explicitly. Furthermore, a modification is proposed to prevent windup in the resonator. A numerically compensated Half-Cycle Discrete Fourier Transform (HCDFT) method is developed to calculate the negative sequence component of the load current. The numerical compensation allows the HCDFT to accurately estimate the fundamental component of the load current under off-nominal frequency conditions. The proposed HCDFT method is shown to have a quick settling time that is comparable to that obtained with conventional sequence compensation techniques as well as immunity to harmonics in the input signal. The effect of unbalance compensation on the PV power output depending on the irradiance and the operational region on the power-voltage curve is examined. Analysis of the DC link voltage ripple shows the region of operation on the P-V curve affects the amplitude of the DC link voltage ripple during negative sequence compensation. The proposed control scheme is validated by simulation in the Matlab/Simulink® environment. The proposed control scheme is tested in the presence of excessive current imbalance, unbalanced feeder impedances, and non-linear loads. The results have shown that the proposed control scheme can improve power quality in a hybrid PV-diesel microgrid by reducing both voltage and current imbalance while simultaneously converting real power from a PV array.

Professor Emanuel uses clear presentation to compare and facilitate understanding of two seminal standards, The IEEE Std. 1459 and The DIN 40110-2:2002-11. Through critical analysis of the most important and recent theories and review of basic concepts, a highly accessible guide to the essence of the standards is presented. Key features: Explains the physical mechanism of energy

flow under different conditions: single- and three-phase, sinusoidal and nonsinusoidal, balanced and unbalanced systems Starts at an elementary level and becomes more complex, with six core chapters and six appendices to clarify the mathematical aspects Discusses and recommends power definitions that played a significant historical role in paving the road for the two standards Provides a number of original unsolved problems at the end of each chapter Introduces a new nonactive power; the Randomness power. Power Definitions and the Physical Mechanism of Power Flow is useful for electrical engineers and consultants involved in energy and power quality. It is also helpful to engineers dealing with energy flow quantification, design and manufacturing of metering instrumentation; consultants working with regulations related to renewable energy courses and the smart grid; and electric utility planning and operation engineers dealing with energy bill structure. The text is also relevant to university researchers, professors, and advanced students in power systems, power quality and energy related courses.

This textbook explores reactive power control and voltage stability and explains how they relate to different forms of power generation and transmission. Bringing together international experts in this field, it includes chapters on electric power analysis, design and operational strategies. The book explains fundamental concepts before moving on to report on the latest theoretical findings in reactive power control, including case studies and advice on practical implementation students can use to design their own research projects. Featuring numerous worked-out examples, problems and solutions, as well as over 400 illustrations, Reactive Power Control in AC Power Systems offers an essential textbook for postgraduate students in electrical power engineering. It offers practical advice on implementing the methods discussed in the book using MATLAB and DlgSILENT, and the relevant program files are available at extras.springer.com.

Unmanned aerial vehicles (UAVs) are being increasingly used in different applications in both military and civilian domains. These applications include surveillance, reconnaissance, remote sensing, target acquisition, border patrol, infrastructure monitoring, aerial imaging, industrial inspection, and emergency medical aid. Vehicles that can be considered autonomous must be able to make decisions and react to events without direct intervention by humans. Although some UAVs are able to perform increasingly complex autonomous manoeuvres, most UAVs are not fully autonomous; instead, they are mostly operated remotely by humans. To make UAVs fully autonomous, many technological and algorithmic developments are still required. For instance, UAVs will need to improve their sensing of obstacles and subsequent avoidance. This becomes particularly important as autonomous UAVs start to operate in civilian airspaces that are occupied by other aircraft. The aim of this volume is to bring together the work of leading researchers and practitioners in the field of unmanned aerial vehicles with a common interest in their autonomy. The contributions that are part of this volume present key challenges associated with the autonomous control of unmanned aerial vehicles, and propose solution methodologies to address such challenges, analyse the proposed methodologies, and evaluate their performance.

This book describes parallel power electronic filters for 3-phase 4-wire systems, focusing on the control, design and system operation. It presents the basics of power-electronics techniques applied in power systems as well as the advanced techniques in

controlling, implementing and designing parallel power electronics converters. The power-quality compensation has been achieved using active filters and hybrid filters, and circuit models, control principles and operational practice problems have been verified by principle study, simulation and experimental results. The state-of-the-art research findings were mainly developed by a team at the University of Macau. Offering background information and related novel techniques, this book is a valuable resource for electrical engineers and researchers wanting to work on energy saving using power-quality compensators or renewable energy power electronics systems.

Power electronics technology is still an emerging technology, and it has found its way into many applications, from renewable energy generation (i.e., wind power and solar power) to electrical vehicles (EVs), biomedical devices, and small appliances, such as laptop chargers. In the near future, electrical energy will be provided and handled by power electronics and consumed through power electronics; this not only will intensify the role of power electronics technology in power conversion processes, but also implies that power systems are undergoing a paradigm shift, from centralized distribution to distributed generation. Today, more than 1000 GW of renewable energy generation sources (photovoltaic (PV) and wind) have been installed, all of which are handled by power electronics technology. The main aim of this book is to highlight and address recent breakthroughs in the range of emerging applications in power electronics and in harmonic and electromagnetic interference (EMI) issues at device and system levels as discussed in ?robust and reliable power electronics technologies, including fault prognosis and diagnosis technique stability of grid-connected converters and ?smart control of power electronics in devices, microgrids, and at system levels.

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Distributed Energy Resources in Microgrids: Integration, Challenges and Optimization unifies classically unconnected aspects of microgrids by considering them alongside economic analysis and stability testing. In addition, the book presents well-founded mathematical analyses on how to technically and economically optimize microgrids via distributed energy resource integration. Researchers and engineers in the power and energy sector will find this information useful for combined scientific and economical approaches to microgrid integration. Specific sections cover microgrid performance, including key technical elements, such as control design, stability analysis, power quality, reliability and resiliency in microgrid operation. Addresses the challenges related to the integration of renewable energy resources Includes examples of control algorithms adopted during integration Presents detailed methods of optimization to enhance successful integration

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 necessities is 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.

Inhaltsangabe:Abstract: The object of this thesis is to design software and hardware to obtain the device parameters of a compensator. This compensator should restore the balance and the power factor of a three-phase three-wire system by using reactive elements only. The derived parameters should be accessible remotely and displayed on a PC. L. S. Czarnecki recently presented a highly respected approach to derive the device parameters of the compensating susceptances. He defined the admittances Y_e and A which represent the conditions in a three-phase system. He also suggested a way to derive these susceptances by measuring two line-to-line voltages and two line currents. The load balancing technique used in this project was based on Czarnecki's approach. The first phase of the project concentrated on understanding and proving the theory behind the project by means of computer simulation. The second phase of the project involved writing software for the DSP and building an interface to successfully task the requirements set by the theory. The aspect of being able to transfer the data to a PC via a modem-to-modem connection was taken into account too. In the final stage it is shown that the implemented system is able to derive the necessary parameters in order to balance the currents and restore the power factor as supplied from mains. It was found that even though the supply from the University of Cape Town does not meet the requirements of the theory in terms of harmonic distortion, it is possible to achieve sufficient load balancing and power factor correction. It was not possible to establish a reliable connection from one modem to the other because of the limitations of the telephone exchange system used at the University of Cape Town. The parts that are necessary for communication, however, were implemented and tested successfully. Therefore it was solely a reliable transmission of data that was unsuccessful and this was due to factors beyond the control or influence of the author. Inhaltsverzeichnis:Table of Contents: ERKLÄRUNGII AcknowledgementsIII Terms of ReferenceIV SynopsisV Table of ContentsVI List of FiguresX List of TablesXIII GlossaryXIV 1Introduction1 1.1The Need for Load Compensation1 1.2The Thesis as a Part of a Project2 1.3Objectives of the Thesis2 2Theory for Balancing a Three-Phase Three-Wire System3 2.1Fictitious Impedance3 2.2Sufficient Condition for Balancing a Three-Phase Load5 2.2.1Compensator to [...]

The book aims to equalize the theoretical involvement with industrial practicality and build a bridge between academia and industry by reducing the mathematical difficulties. It provides an overview of distributed control and distributed optimization theory, followed by specific details on industrial applications to smart grid systems, with a special focus on micro grid systems. Each of the chapters is written and organized with an introductory section tailored to provide the essential background of the theories required. The text includes industrial applications to realistic renewable energy systems problems and illustrates the application of proposed toolsets to control and optimization of smart grid systems.

Control Engineering and Information Systems contains the papers presented at the 2014 International Conference on Control Engineering and Information Systems (ICCEIS 2014, Yueyang, Hunan, China, 20-22 June 2014). All major aspects of the theory and applications of control engineering and information systems are addressed, including: – Intelligent systems – Teaching cases

– Pattern recognition – Industry application – Machine learning – Systems science and systems engineering – Data mining – Optimization – Business process management – Evolution of public sector ICT – IS economics – IS security and privacy – Personal data markets – Wireless ad hoc and sensor networks – Database and system security – Application of spatial information system – Other related areas

Control Engineering and Information Systems provides a valuable source of information for scholars, researchers and academics in control engineering and information systems.

This contains selected and peer-reviewed papers from the 4th Annual International Conference on Material Science and Environmental Engineering (MSEE), December 16-18 2016, in Chengdu, China. Interactions of building materials, biomaterials, energy materials and nanomaterials with surrounding environment are discussed. With abundant case studies, it is of interests to material scientists and environmental engineers.

Almost all experts are in agreement - although we will see an improvement in metering and control of the power flow, Power Quality will suffer. This book will give an overview of how power quality might impact our lives today and tomorrow, introduce new ways to monitor power quality and inform us about interesting possibilities to mitigate power quality problems.

This book presents the proceedings of the International Conference on Intelligent, Interactive Systems and Applications (IISA2018), held in Hong Kong, China on June 29–30, 2018. It consists of contributions from diverse areas of intelligent interactive systems (IIS), such as: autonomous systems; pattern recognition and vision systems; e-enabled systems; mobile computing and intelligent networking; Internet & cloud computing; intelligent systems and applications. The book covers the latest ideas and innovations from both the industrial and academic worlds, and shares the best practices in the fields of computer science, communication engineering and latest applications of IOT and its use in industry. It also discusses key research outputs, providing readers with a wealth of new ideas and food for thought.

The conference will consist of various topics relating to power systems, robotics, mechatronics and pattern recognition

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, effects, standards, and measurements of 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 theoretical and practical insight into power quality problems of electric machines and systems 134 practical application (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

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