Advanced Power Electronic Converters and Power Quality Conditioning

Lam, Chi Seng; Yang, Yongheng; Zhong, Qing; Chen, Yandong; Lao, Keng Weng

Published in:
Journal of Electrical and Computer Engineering

DOI (link to publication from Publisher):
10.1155/2018/9701013

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Hindawi
Journal of Electrical and Computer Engineering
Volume 2018, Article ID 9701013, 2 pages
https://doi.org/10.1155/2018/9701013

Editorial

Advanced Power Electronic Converters and Power Quality Conditioning

Chi-Seng Lam,[1] **Yongheng Yang**,[2] **Qing Zhong**,[3] **Yandong Chen**,[4] **and Keng-Weng Lao**[5,6]

[1]*State Key Laboratory of Analog and Mixed-Signal VLSI, University of Macau, Macau*
[2]*Department of Energy Technology, Aalborg University, Aalborg, Denmark*
[3]*School of Electrical Power, South China University of Technology, Guangzhou, China*
[4]*College of Electrical and Information Engineering, Hunan University, Changsha, China*
[5]*Department of Electrical and Computer Engineering, Faculty of Science and Technology, University of Macau, Macau*
[6]*Department of Electrical and Computer Engineering, University of Texas at Austin, Austin, Texas, USA*

Correspondence should be addressed to Chi-Seng Lam; cslam@umac.mo

Received 9 October 2018; Accepted 9 October 2018; Published 19 November 2018

With the proliferation and increased use of power electronic devices (nonlinear loads) in adjustable speed drives (ASDs), arc furnaces, bulk rectifiers, power supplies, fluorescent lamps, elevators, escalators, large air conditioning systems, etc. and also rapid increase in renewable energy generation and railway electrification systems in grid or microgrids recently, the power quality (PQ) problems become more serious, especially for lower power factor, harmonic pollution, unbalanced current, neutral current, voltage sag, voltage swell, voltage fluctuation, and resonance problems, which strongly affect the performance, efficiency, and reliability of the grid or microgrids. Advanced PQ solutions, compensator topologies, detection methods, control algorithms, and PWM techniques are the key driven force to achieve the goal of power quality enhancement in power grid or microgrids.

The purpose of this special issue is to collect high-quality research articles as well as review papers on the recent theoretical, structure, control, and analysis advancement on PQ problems and their corresponding solutions in power grid, microgrids, and railway electrification system. This special issue has attracted the submission of many high-quality papers. After going through the peer-review process, six papers have been accepted and published.

In the paper entitled "Feedforward Harmonic Mitigation Strategy for Single-Phase Voltage Source Converter," Q. Zhong et al. present a harmonic analysis model of single-phase voltage source converters (SPVSCs) based on dynamic phasor (DP).With the model, the harmonics interaction between the ac side and the dc side can be analyzed, which reveals the generation mechanism of the harmonics in the SPVSC. Based on the mechanism, a feedforward harmonic mitigation strategy has been presented. The principle of the strategy is to add low-order harmonic signal to the PWM signals to reduce the harmonic current on the ac side. As the SPVSC has been widely used with the rapid development of distributed generations (DGs) in the grid or microgrid, this paper aims at mitigating the harmonic injection problem of the SPVSC.

In the paper entitled "A Novel Hybrid T-Type Three-Level Inverter Based on VPWM for PV Application," A. Tuluhong et al. compare different multilevel grid-connected inverter topologies for PV applications and propose a hybrid T-type inverter topology, which can reduce the harmonic content and the power loss of the converter and improve the conversion efficiency of the system. The space vector pulse width modulation (SVPWM) method is applied for the proposed topology. The results show that the proposed

structure is superior to the most widely used topology, i.e., the diode clamped and the T-type three-level circuits.

In the paper entitled "Analysis of Transient Voltage Stability in a Low Voltage Distribution Network Using SST for the Integration of Distributed Generations," S. Li et al. analyze the transient voltage stability issue of a low-voltage distribution network integrated with distributed generations (DGs) with and without using tertiary-structure solid-state transformers (SSTs). Although the SST control makes the load bus have better transient voltage stability, the DC bus voltage is easy to keep climbing continually when the short circuit occurs at the line side that is close to the SST input stage or the line disconnection occurs at any location of the line. If a battery energy storage station is installed, the transient voltage stability of DC bus and load bus will be improved effectively and guarantee the system safety.

In the paper entitled "A Double Update PWM Method to Improve Robustness for the Deadbeat Current Controller in Three-Phase Grid-Connected System," L. Yang et al. propose a double-update PWM method for the deadbeat current controller in three-phase grid-connected systems. It not only effectively decreases the grid current distortion and control delay but also improves the system stability and dynamic response speed due to reducing the characteristic root equation order of the closed-loop transfer function. The influence of the filter inductance deviation coefficient on the system performance is analyzed. Considering the system stability and dynamic response, the optimal range of the control parameters is acquired.

In the paper entitled "Shunt Active Power Filter Based on Proportional Integral and Multi Vector Resonant Controllers for Compensating Nonlinear Loads," S. Ye et al. propose a control algorithm based on PI and multi vector resonant (VR) controllers to control shunt active power filter (SAPF). Through detailed analysis on the frequency response characteristic of the current closed loop, the PI and VR controller can compensate the harmonic currents with zero steady-state error, negligible phase delay, and good dynamic performance. Under the synchronous reference frame, the proposed method is simple to compensate the harmonic, which reduces the computation and is better adapted to the frequency fluctuation.

In the paper entitled "Review and Selection Strategy for High-Accuracy Modeling of PWM Converters in DCM," Y.-J. Mao et al. review, study, and compare the two most general and popular small signal modelling methods: state-space averaging (SSA) and circuit averaging (CA) for various DC-DC converters operating in the discontinuous conduction mode (DCM). The authors also streamline the general model deriving processes, such that their corresponding DCM small-signal models can be easily determined. Finally, a selection strategy for a high-accuracy modelling method for different DC-DC converters operating in DCM is provided, and it is beneficial for designing a more accurate DCM closed-loop controller for DC-DC converters, thus achieving better stability and transient response.

We believe that the papers appearing in this special issue provide a good contribution and representation of significant research topics in the field of power electronics converters and also power quality conditioning.

Conflicts of Interest

The editors declare that there are no conflicts of interest regarding the publication of this special issue.

Acknowledgments

We would like to thank the authors for their contributions and the reviewers for their competent and timely work for this special issue.

Chi-Seng Lam
Yongheng Yang
Qing Zhong
Yandong Chen
Keng-Weng Lao