Low Power Converters

• Augmentation of Fractional-Order PI Controller with Nonlinear Error-Modulator for Enhancing Robustness of DC-DC Boost Converters ............................................................... Omer Saleem, Mohsin Rizwan, Ahmad Khizar, and Muazz Ahmad 835

• ZVT Series Capacitor Interleaved Buck Converter with High Step-Down Conversion Ratio .................................................................................................................. Zhangyong Chen, Yong Chen, Wei Jiang, and Tiesheng Yan 846

• Analysis, Design and Implementation of Flexible Interlaced Converter for Lithium Battery Active Balancing in Electric Vehicles ................................................................................ Shuailong Dai, Jiayu Wang, Teng Li, Zhifei Shan, and Yewen Wei 858

• Design-Oriented Stability of Outer Voltage Loop in Capacitor Current Controlled Buck Converters ..................................................... Xi Zhang, Zhongwei Zhang, Bocheng Bao, Han Bao, Zhimin Wu, Kaiwen Yao, and Jing Wu 869

• Double Boost Power-Decoupling Topology Suitable for Low-Voltage Photovoltaic Residential Applications Using Sliding-Mode Impedance-Shaping Controller .................................................. Mohamed Atef Tawfik, Ashraf Ahmed, and Joung-Hu Park 881

• High Quality DC-DC Boosting Converter Based on Cuk Converter and Advantages of Using It in Multilevel Structures ........................................................................................................................................ Sajad Rostami, Vahid Abbasi, and Tamas Kerekes 894

High Power Converters


• Optimal Selection of Arm Inductance and Switching Modulation for Three-Phase Modular Multilevel Converters in Terms of DC Voltage Utilization, Harmonics and Efficiency ........................................................................................... Ali Osman Arslan, Mehmet Kurtoglu, Fatih Ergolu, and Ahmet Mete Vural 922

• Current Sharing Method Based on Optimal Phase Shift Control for Interleaved Three-Phase Half Bridge LLC Converter with Floating Y-Connection ................................................................. Lin Shi, Bangyin Liu, and Shaxiu Duan 934

• SVPWM Strategies for Three-level T-type Neutral-point-clamped Indirect Matrix Converter .......................................................................................................................... Nguyen Dinh Tuyen, Le Minh Phuong, and Hong-Hee Lee 944

Adjustable Speed Drives

• Virtual Signal Injected MTPA Control for DTC Five-Phase IPMSM Drives ................................................................................................................................. Guohai Liu, Yuqi Yang, and Qian Chen 956

• Effects of Zero-Sequence Transformations and Min-Max Injection on Fault-Tolerant Symmetrical Six-Phase Drives with Single Isolated Neutral .............................................................. Wan Noraishah Wan Abdul Munim, Mahdi Tousizadeh, and Hang Seng Che 968

• Influence of Frequency on Electromagnetic Field of Super High-Speed Permanent Magnet Generator .......................................................................................................................... Hongbo Qiu, Yanqi Wei, Wei Wang, Bingxia Tang, Xifang Zhao, and Cunxiang Yang 980

• Fault-Tolerant Control for 5L-HNPC Inverter-Fed Induction Motor Drives with Finite Control Set Model Predictive Control Based on Hierarchical Optimization ........................................... Chunjie Li, Guifeng Wang, Fei Li, Hongmei Li, Zhonglong Xia, and Zhan Liu 989

(Contents Continued on Next Page)
Analysis, Modeling and Control

• Transient-Performance-Oriented Discrete-Time Design of Resonant Controller for Three-Phase Grid-Connected Converters
  .................................................................................................................................................. Zhanfeng Song, Yun Yu, Yaqi Wang, and Xiaohui Ma 1000

Renewable Energy

• Buck-Flyback (fly-buck) Stand-Alone Photovoltaic System for Charge Balancing with Differential Power Processor Circuit
  .................................................................................................................................................. Chun-Gu Lee, Jung-Hyun Park, and Joung-Hu Park 1011

• Control Strategy for Accurate Reactive Power Sharing in Islanded Microgrids
  .................................................................................................................................................. Xuan Hoa Thi Pham and Toi Thanh Le 1020

Power Quality and Utility Applications

• Multiple Decoupling Current Control Strategies for LCL Type Grid-Connected Converters Based on Complex Vectors under Low Switching Frequencies
  .......................................................... Haiyuan Liu, Yang Shi, Yinan Gao, Yingjie Wang, and Wenchao Wang 1034

• Fast Extraction of Symmetrical Components from Distorted Three-Phase Signals Based on Asynchronous-Rotational Reference Frame
  .................................................................................................................................................. Tianqu Hao, Feng Gao, and Tao Xu 1045

Devices and Components

• Influence of Device Parameters Spread on Current Distribution of Paralleled Silicon Carbide MOSFETs
  ................................................................................................................................. Junji Ke, Zhibin Zhao, Peng Sun, Huazhen Huang, James Abuogo, and Xiang Cui 1054
Journal of Power Electronics (JPE)

Editor-in-Chief
Jung-Ik Ha
Seoul National University, Korea
E-mail: jungikhai@snu.ac.kr

Kyo-Beum Lee
Ajou University, Korea
E-mail: kyle@ajou.ac.kr

Publication Editors
Sanjib Kumar Panda
National University of Singapore
E-mail: sjchoi@usln.ac.kr

Editor Board
Ralph Kennel
Technical University of Munich

Pat Wheeler
University of Nottingham

John Shen
University of Nottingham

Brahma Colak
Nisantasi University

Dehong Xu
Zhejiang University

Frederic Blaabjerg
Technical University of Denmark

Fang Z. Peng
Michigan State University

Ihsim C. Low
National University of Singapore

Hao Ma
Zhejiang University

E-mail: sjchoi@usln.ac.kr

Hong Kong<br>North Carolina State University<br>Brahma Colak<br>Univ. of Tokyo<br>Dong-Seok Hyeon<br>Yonnam University<br>Atsuo Kawanura<br>Kyushu University<br>Marian P. Kalmierkowski<br>Warsaw University of Tech.<br>Dukju Ahn<br>Incheon National University<br>Seok-Ju Ahn<br>Chungnam National University<br>Sanjay Gupta<br>Hanyang University<br>Taek-In Kim<br>Yonnam University<br>Inghun Cho<br>Yonnam University<br>Kyungpook National University<br>Yunsung Kim<br>Hanyang University<br>Hyung-Chan Kong<br>Yonnam University<br>Sang-Hoon Hong<br>Chungnam National University<br>Yoon-Kyu Kim<br>Yonnam University<br>Seung-Ki Park<br>Yonnam University<br>Jeongwon Shin<br>Chunum University<br>Woo-Sung Lee<br>Chungnam National University<br>Fuxin Liu<br>Nanjing Univ. of Aeron. and Astron.<br>Hao Ma<br>Zhejiang University<br>Saad Mekhilef<br>University of Malaya<br>Jinyeong Moon<br>Seoul National University<br режима 2019, Южная Корея<br>规划活动<br>管理活动<br>科研活动<br>技术活动

About the journal: The official title of the journal is Journal of Power Electronics (pISSN 1598-2092; eISSN 2093-4718), and the ISO abbreviation of the journal title is 'J. Power Electron.' The first issue of JPE was in April 2001. JPE is published bimonthly, appearing on the 20th day of January, March, May, July, September, November each year. Hard copies of JPE are distributed to 51 associations related with the field of power electronics.

Aims and Scope: Its scope includes all topics in the field of Power Electronics. Included are techniques for high power converters, power quality and utility applications, renewable energy, low power converters, control in power electronics, motor drives, electric machines, analysis, simulation and control, power devices and components, sensors, integration and packaging, education, and other applications.

Full Text Availability: Full text is freely available at the following URL – http://www.jpeles.org. Search articles by year, category, title, author, abstract, and keyword.

Index/Abstracted in: Science Citation Index Expanded (SCI E), Journal Citation Reports/Science Edition, Korea Citation Index, Scopus

Contact Information
The Korean Institute of Power Electronics
Rm. 41103, The Korean Science & Technology Bldg. (New Bld.), 22, Teheran-ro 7gil, Gangnam-gu, Seoul 60130, Republic of Korea
Tel: +82-2-544-0184, 0185; Fax: +82-2-544-0186; E-mail: editor@kipe.or.kr; Website: http://www.jpeles.org

© 2019. The Korean Institute of Power Electronics. All rights reserved. Responsibility for the contents rests upon the authors and not upon the KIPE.
Your text here.
# Table of Contents

**Journal of Power Electronics Vol. 19, No. 4 July 2019**

## Low Power Converters

Augmentation of Fractional-Order PI Controller with Nonlinear Error-Modulator for Enhancing Robustness of DC-DC Boost Converters .................................................. Omer Saleem, Mohsin Rizwan, Ahmad Khizar, and Muaaz Ahmad 835

ZVT Series Capacitor Interleaved Buck Converter with High Step-Down Conversion Ratio ........................................ Zhangyong Chen, Yong Chen, Wei Jiang, and Tiesheng Yan 846

Analysis, Design and Implementation of Flexible Interlaced Converter for Lithium Battery Active Balancing in Electric Vehicles ....................................................... Shuailong Dai, Jiayu Wang, Teng Li, Zhifei Shan, and Yewen Wei 858

Design-Oriented Stability of Outer Voltage Loop in Capacitor Current Controlled Buck Converters ................................ Xi Zhang, Zhongwei Zhang, Bocheng Bao, Han Bao, Zhimin Wu, Kaiwen Yao, and Jing Wu 869


High Quality DC-DC Boosting Converter Based on Cuk Converter and Advantages of Using It in Multilevel Structures ........................................................... Sajad Rostami, Vahid Abbasi, and Tamas Kerekes 894

## High Power Converters


Optimal Selection of Arm Inductance and Switching Modulation for Three-Phase Modular Multilevel Converters in Terms of DC Voltage Utilization, Harmonics and Efficiency .......................................................... Ali Osman Arslan, Mehmet Kurtoğlu, Fatih Eroğlu, and Ahmet Mete Vural 922

Current Sharing Method Based on Optimal Phase Shift Control for Interleaved Three-Phase Half Bridge LLC Converter with Floating Y-Connection ................................... Lin Shi, Bangyin Liu, and Shanxu Duan 934

SVPWM Strategies for Three-level T-type Neutral-point-clamped Indirect Matrix Converter ........................................ Nguyen Dinh Tuyen, Le Minh Phuong, and Hong-Hee Lee 944

## Adjustable Speed Drives

Virtual Signal Injected MTPA Control for DTC Five-Phase IPMSM Drives ................................................................. Guohai Liu, Yuqi Yang, and Qian Chen 956

Effects of Zero-Sequence Transformations and Min-Max Injection on Fault-Tolerant Symmetrical Six-Phase Drives with Single Isolated Neutral .............................. Wan Noraisah Wan Abdul Munim, Mahdi Tousizadeh, and Hang Seng Che 968

Influence of Frequency on Electromagnetic Field of Super High-Speed Permanent Magnet Generator ...................................................... Hongbo Qiu, Yanqi Wei, Wei Wang, Bingxia Tang, Xifang Zhao, and Cunxiang Yang 980

Fault-Tolerant Control for 5L-HNPC Inverter-Fed Induction Motor Drives with Finite Control Set Model Predictive Control Based on Hierarchical Optimization ........................................ Chunjie Li, Guifeng Wang, Fei Li, Hongmei Li, Zhenglong Xia, and Zhan Liu 989
**Analysis, Modeling and Control**

Transient-Performance-Oriented Discrete-Time Design of Resonant Controller for Three-Phase Grid-Connected Converters .................................................. Zhanfeng Song, Yun Yu, Yaqi Wang, and Xiaohui Ma 1000

**Renewable Energy**


Control Strategy for Accurate Reactive Power Sharing in Islanded Microgrids .................................................................................................................... Xuan Hoa Thi Pham and Toi Thanh Le 1020

**Power Quality and Utility Applications**

Multiple Decoupling Current Control Strategies for LCL Type Grid-Connected Converters Based on Complex Vectors under Low Switching Frequencies .......................................................................................... Haiyuan Liu, Yang Shi, Yinan Guo, Yingjie Wang, and Wenchao Wang 1034

Fast Extraction of Symmetrical Components from Distorted Three-Phase Signals Based on Asynchronous-Rotational Reference Frame .......................................................................................................... Tianqu Hao, Feng Gao, and Tao Xu 1045

**Devices and Components**

Influence of Device Parameters Spread on Current Distribution of Paralleled Silicon Carbide MOSFETs ................................................................................................................................. Junji Ke, Zhibin Zhao, Peng Sun, Huazhen Huang, James Abuogo, and Xiang Cui 1054