

2019 IEEE Third International Conference on DC Microgrids (ICDCM 2019)

**Matsue, Japan
20-23 May 2019**



**IEEE Catalog Number: CFP19CDF-POD
ISBN: 978-1-7281-3492-5**

**Copyright © 2019 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP19CDF-POD
ISBN (Print-On-Demand):	978-1-7281-3492-5
ISBN (Online):	978-1-7281-3491-8

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

Oral Session

Session 1-A: Power Electronics for grids (1)

May 21, 11:00 - 12:30, Hall A

Session Chairs:

Johan Driesen (KU Leuven, Belgium)

Masahito Shoyama (Kyushu University, Japan)

- 11:00 **Modular Multilevel Photovoltaic Interfaced Converter with Low Voltage Energy Integration for DC Systems 1**
- 1-A-1 Mladen Gagic, *Delft University of Technology, Netherlands*
Kewei Huang, *Delft University of Technology, Netherlands*
Zian Qin, *Delft University of Technology, Netherlands*
Braham Ferreira, *Delft University of Technology, Netherlands*
- 11:18 **350 kVA Multi-Function Converters for DC-Microgrid Applications 7**
- 1-A-2 T.-F Wu, *National Tsing Hua University, Taiwan*
Y.-T Liu, *National Tsing Hua University, Taiwan*
Y.-H Huang, *National Tsing Hua University, Taiwan*
T. Sakavov, *National Tsing Hua University, Taiwan*
- 11:36 **Finite-State Predictive Power Control based Interlink Converter for AC-DC Micro-grid 13**
- 1-A-3 Sohit Sharma, *Visvesvaraya National Institute of Technology, India*
Mohan V. Aware, *Visvesvaraya National Institute of Technology, India*
Apekshit Bhowate *Visvesvaraya National Institute of Technology, India*
- 11:54 **A 13.2kV / 150kVA Solid State Transformer for a Bipolar LVDC Distribution System 18**
- 1-A-4 Hosung Kim, *KERI, Korea*
Juwon Baek, *KERI, Korea*
Myounggho Kim, *KERI, Korea*
Hyeokjin Yun, *KERI, Korea*
Dongkeun Jeong, *KERI, Korea*
Jintae Cho, *KERI, Korea*
- 12:12 **An Inverter Control Method for Remote Island Electric Power System Constituted by Renewable Energy Sources 22**
- 1-A-5 Yasuhiro Noro, *Kogakuin university, Japan*

**Session 1-B: Technology and demonstration of DC Microgrids
May 21, 11:00 - 12:30, Hall B**

Session Chairs:

Hirohisa Aki (University of Tsukuba, Japan)

Chris Marnay (Lawrence Berkeley National Lab, USA)

- 11:00
1-B-1 **Comparison of Battery Technologies for DC Microgrids with Integrated PV 28**
Soumya Bandyopadhyay, *Delft University of Technology, Netherlands*
Zian Qin, *Delft University of Technology, Netherlands*
Laura Ramirez-Elizondo, *Delft University of Technology, Netherlands*
Pavol Bauer, *Delft University of Technology, Netherlands*
- 11:18
1-B-2 **Storage Battery Capacity Reduction Effect on 400V-class DC Power Supplied Office with Consideration for Renewable Energy Ratio 37**
Kazufumi YUASA, *NTT FACILITIES, INC., Japan*
Miki UESHIMA, *NTT FACILITIES, INC., Japan*
Tadatoshi BABASAKI, *NTT FACILITIES, INC., Japan*
- 11:36
1-B-3 **Demonstration of a DC Microgrid with Central Operation Strategies on an Island 42**
Jintae Cho, *KEPCO Research Institute, Korea*
Hongjoo Kim, *KEPCO Research Institute, Korea*
Youngpyo Cho, *KEPCO Research Institute, Korea*
Hyunmin Kim, *KEPCO Research Institute, Korea*
Juyong Kim, *KEPCO Research Institute, Korea*
- 11:54
1-B-4 **DC Microgrid Experimental System at KIT Hakusan-roku Campus for Regional Areas 47**
Yoshio Izui, *Kanazawa Institute of Technology, Japan*
Daisuke Natsuume, *Kanazawa Institute of Technology, Japan*
Masashi Saito, *Kanazawa Institute of Technology, Japan*
Hirokazu Tabata, *Kanazawa Institute of Technology, Japan*
Masanori Fujimoto, *Kanazawa Institute of Technology, Japan*
- 12:12
1-B-5 **Medium voltage cable designs for 100km DC superconducting power transmission line using experimental data of Ishikari Project 54**
Sataro Yamaguchi, *Chubu University, Japan*
Takashi Iitsuka, *JGC Corporation, Japan*
Takeo Yamada, *JGC Corporation, Japan*
Akio Sato, *JFE Steel, Japan*
Toru Sawamura, *Sakura Internet, Japan*
Victor Sytnikov, *R&D Center, FGC UEC, Russia*

Session 2-A: Power Electronics for grids (2)

May 21, 14:40 - 16:10, Hall A

Session Chairs:

Aditya Shekhar (TU Delft/Dept. ESE, Netherlands)

Wu Tsai-Fu (National Tsing Hua University, Taiwan)

- 14:40
2-A-1 **Autonomous DC Microgrid Consisting of Triple Active Bridge Converters 58**
Yuichi Kado, *Kyoto Institute of Technology, Japan*
Shota Okutani, *Kyoto Institute of Technology, Japan*
Keigo Katagiri, *Kyoto Institute of Technology, Japan*
Pin-Yu Huang, *Kyoto Institute of Technology, Japan*
- 14:58
2-A-2 **Hardware in the loop verification of a fast backup protection scheme for embedded MVDC links within distribution networks 63**
Lewis Hunter, *University of Strathclyde, Scotland*
Qiteng Hong, *University of Strathclyde, Scotland*
Campbell Booth, *University of Strathclyde, Scotland*
Stephen Finney, *The University of Edinburgh, Scotland*
Adrià Junyent-Ferré, *Imperial College London, UK*
- 15:16
2-A-3 **Resonance suppression control for flying capacitor type bidirectional three-level chopper circuit 69**
Noriaki Nagao, *Osaka University, Japan*
Jia Liu, *Osaka University, Japan*
Yushi Miura, *Nagaoka University of Technology, Japan*
Toshifumi Ise, *Osaka University, Japan*
Naoki Morishima, *Toshiba Mitsubishi-Electric Industrial, Japan*
- 15:34
2-A-4 **Model Predictive Control for isolated DC/DC converters with fast dynamic stabilization in DC Microgrids 77**
Linglin Chen, *University of Nottingham, United Kingdom*
Luca Tarisciotti, *Universidad Andres Bello Santiago., Chile*
Alessandro Costabebber, *University of Nottingham, United Kingdom*
Pericle Zanchetta, *University of Nottingham, United Kingdom*
Patrick Wheeler, *University of Nottingham, United Kingdom*
Tomislav Dragičević, *Aalborg University, Denmark*
- 15:52
2-A-5 **Three-level DC-DC Converters versus Half-bridge Voltage Balancers for Bipolar DC Microgrids —An Efficiency Comparison 83**
Giel Van den Broeck, *KU Leuven, Belgium*
Simon Ravyts, *KU Leuven, Belgium*
Mauricio Dalla Vecchia, *KU Leuven, Belgium*
Leonie Hallems, *KU Leuven, Belgium*
Johan Driesen, *KU Leuven, Belgium*

Session 2-B: DC Breaker and Arc Detection

May 21, 14:40 - 16:10, Hall B

Session Chairs:

Harry Stokman (Direct Current BV, Netherlands)

Ryoichi Hara (Hokkaido University, Japan)

14:40 **Performance Analysis of Hybrid DC Circuit Breaker based on Counter-Current Injection**
2-B-1 **Method for Low-Voltage DC Grids 90**

Ali Virdag, *Hager Group, Germany*

Nisar Ahmed Khan, *RWTH Aachen, Germany*

Torsten Hager, *Hager Group, Germany*

Rik. W. DeDoncker, *RWTH Aachen, Germany*

14:58 **A study on estimation of arc parameters for low voltage DC arc breaking process 96**
2-B-2

Akihiro Tsusaka, *Aichi Institute of Technology, Japan*

Kazuho Hasegawa, *Aichi Institute of Technology, Japan*

Toshiro Matsumura, *Aichi Institute of Technology, Japan*

Kazuto Yukita, *Aichi Institute of Technology, Japan*

Yasuyuki Goto, *Aichi Institute of Technology, Japan*

Atsushi Miyamoto, *Nitto Kogyo corporation, Japan*

Hiroyuki Ito, *Nitto Kogyo corporation, Japan*

Yasunobu Yokomizu, *Nagoya university Nagoya, Japan*

15:16 **Design of the Short Circuit Protection for the Power Flow Control Converter N/A**
2-B-3

Pavel Purgat, *Delft University of Technology, Netherlands*

Zian Qin, *Delft University of Technology, Netherlands*

Pavol Bauer, *Delft University of Technology, Netherlands*

15:34 **Verification of arc discharge phenomenon and connection reliability 102**
2-B-4

Koichi Kiryu, *Fujitsu Component Limited,*

Japan Tetsugaku Tanaka, Fujitsu Component Limited, Japan

Kyohei Seki, *Fujitsu Component Limited, Japan*

Kouki Satou, *Fujitsu Component Limited, Japan*

15:52 **Power Module for Low Voltage DC Hybrid Circuit Breaker 108**
2-B-5

Kenan Askan, *Eaton Industries Austria GmbH, Austria*

Michael Bartonek, *Eaton Industries Austria GmbH, Austria*

Katharina Weichselbaum, *Eaton Industries Austria GmbH, Austria*

Session 3-A: DC Applications (1)

May 21, 16:30 - 18:00, Hall A

Session Chairs:

Kenji Natori (Chiba University, Japan)

Stefan Lidström (COMSYS, Sweden)

- 16:30 **Hybrid magnetic EMI filter design for Low Voltage DC distribution (LVDC) network 116**
- 3-A-1 Wai Keung Mo, *University of Southern Denmark, Denmark*
Kasper M. Paasch, *University of Southern Denmark, Denmark*
Thomas Ebel, *University of Southern Denmark, Denmark*
- 16:48 **Comparison of Load Models for Estimating Electrical Efficiency in DC Microgrids 122**
- 3-A-2 A. Santos, *Colorado State University, USA*
J. Cale, *Colorado State University, USA*
A. Singh, *Colorado State University, USA*
D. Gerber, *Lawrence Berkeley National Laboratory, USA*
S. Frank, *National Renewable Energy Laboratory, USA*
G. Duggan, *Colorado State University, USA*
D. Zimmerle, *Colorado State University, USA*
R. Brown, *Lawrence Berkeley National Laboratory, USA*
- 17:06 **Novel Fault Tolerant DC-DC Converter Architecture for LED Lighting Systems Operating in DC Microgrids 130**
- 3-A-3 Fernando Bento, *Universidade da Beira Interior, Portugal*
Antonio J. Marques Cardoso, *Universidade da Beira Interior, Portugal*
- 17:24 **A Verification on a Zero-Current Detection Method of Interleaved Boost Chopper with High Frequency Operation 136**
- 3-A-4 Yuudai Ogawa, *Ritsumeikan University Kusatsu, Japan*
Ryo Ito, *Ritsumeikan University Kusatsu, Japan*
Hiroaki Kakigano, *Ritsumeikan University Kusatsu, Japan*
- 17:42 **Parametric Analysis of Centralized DC Microgrids for Rural Electrification 142**
- 3-A-5 Mashood Nasir, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences, Pakistan*
Saqib Iqbal, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences, Pakistan*
Hassan Abbas Khan, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences, Pakistan*

Session 3-B: DC applications for transportation

May 21, 2019 16:30 - 18:00, Hall B

Session Chairs:

Johan Driesen (KU Leuven, Belgium)

Takanori Isobe (University of Tsukuba, Japan)

- 16:30 **A review on protection systems in DC Railway “microgrids” 147**
3-B-1 Björn Fischer, *Applied Research Sécheron SA., Switzerland*
 Tarek Lamara, *Applied Research Sécheron SA., Switzerland*
 Christopher Nazeri, *DC breakers development Sécheron SA., Switzerland*
- 16:48 **Power Flow Calculation of Shipboard DC Microgrid Power System 151**
3-B-2 Dawei Yao, *Tsinghua University DC Research Center, China*
 Kangsheng Cui, *Tsinghua University DC Research Center, China*
 Haibo Li, *Tsinghua University DC Research Center, China*
 Chao Yang, *Tsinghua University DC Research Center, China*
 Bo Liu, *Shandong Taikai High Voltage Switchgear Co., Ltd DC Application Tech. Center, China*
- 17:06 **Real-Time HIL Setup for Testing and Evaluating EV integration for DC Microgrids 157**
3-B-3 Stephan Ledinger, *Austrian Institute of Technology, Australia*
 David Reihls, *Austrian Institute of Technology, Australia*
 Daniel Stahleder, *Austrian Institute of Technology, Australia*
 Catalin Gavriluta, *Austrian Institute of Technology, Australia*
 Felix Lehfuss, *Austrian Institute of Technology, Australia*
 Georg Lauss, *Austrian Institute of Technology, Australia*
- 17:24 **Cooperative Control of Multi-Input Modular DC/DC Converter for Electric Off-Highway Vehicles 163**
3-B-4 Qingyun Piao, *YANMAR CO., LTD., Japan*
 Masaaki Konoto, *YANMAR CO., LTD., Japan*
 Tasuku Kakisaka, *Nagoya University, Japan*
 Jun Imaoka, *Nagoya University, Japan*
 Masayoshi Yamamoto, *Nagoya University, Japan*
- 17:42 **Integrated Charging of EVs Using Existing LVDC Light Rail Infrastructure: A Case Study 169**
3-B-5 Kyle Smith, *University of Strathclyde, Glasgow, Scotland*
 Lewis Hunter, *University of Strathclyde, Glasgow, Scotland*
 Stuart Galloway, *University of Strathclyde, Glasgow, Scotland*
 Campbell Booth, *University of Strathclyde, Glasgow, Scotland*
 Colin Kerr, *Edinburgh Trams, Scotland*
 Michael Kellett, *Edinburgh City Council, Scotland*

Organized Session 4-A: Recent trends in DC power supply for electric railway and stations

May 22, 11:00 - 12:30, Hall A

Session Chair: Hitoshi Hayashiya (East Japan Railway Company Tokyo, Japan)

- 11:00 **Overview of particularities of DC traction power supply system for electric railway** N/A
Hitoshi Hayashiya, *East Japan Railway Company, Tokyo, Japan*
- 4-A-1 **Analysis of Stray Current in DC Traction Power Supply System** N/A
- 11:18 Jinkun Tang, *Southwest Jiaotong University, China*
4-A-2 Jiawei Zhao, *Southwest Jiaotong University, China*
Guoyang Sang, *Southwest Jiaotong University, China*
Jinfei Xiong, *Southwest Jiaotong University, China*
Wei Lin, *Southwest Jiaotong University, China*
Fulin Zhou, *Southwest Jiaotong University, China*
Yong Wang, *CRRC Qingdao Sifang Co.,Ltd, China*
- 11:36 **Energy Saving Effect of DC Distribution System according to Station Type** N/A
4-A-3 Youhei Sonoda, *West Japan Railway Co. Technology Development dept., Japan*
Nobumichi Tsutsui, *West Japan Railway Co. Technology Development dept., Japan*
Jun Nakano, *West Japan Railway Co. Technology Development dept., Japan*
Keiji Kawahara, *West Japan Railway Co. Technology Development dept., Japan*
Kenichi Fukuno, *Mitsubishi Electric Corporation, Japan*
Hayato Takeuchi, *Mitsubishi Electric Corporation, Japan*
- 11:54 **Development of a High-Speed Circuit Breaker for DC Railway Substations** 176
4-A-4 Hiroshi Sasaki, *Mitsubishi Electric Corporation, Japan*
Nobumoto Toya, *Mitsubishi Electric Corporation, Japan*
Tomohiro Nakata, *Mitsubishi Electric Corporation, Japan*
Yuta Sagara, *Mitsubishi Electric Corporation, Japan*
Shinji Toba, *Mitsubishi Electric Corporation, Japan*
Sho Tanaka, *Mitsubishi Electric Corporation, Japan*
Yasuhiro Kamino, *Mitsubishi Electric Corporation, Japan*
Yuichi Yamaji, *Mitsubishi Electric Corporation, Japan*
- 12:12 **Simplification of Electric Substation System by Utilizing Energy Storage System** 180
4-A-5 Kota Minaminosono, *Environment Eng R&D Center of JR EAST Group East Japan Railway Company Saitama, Japan*
Makoto Hashimoto, *Environment Engineering Research Laboratory, R&D Center of JR EAST Group East Japan Railway Company Saitama, Japan*
Hitoshi Hayashiya, *Electrical & signal network system department, East Japan Railway Company Tokyo, Japan*
Dai Yasukochi, *Railway Systems Business Unit Hitachi, Ltd. Tokyo, Japan*

Session 4-B: Control, Simulation, Emulation and Analysis of Microgrids

May 22, 11:00 - 12:30, Hall B

Session Chairs:

Kazuaki Mino (Murata Manufacturing Co., Ltd., Japan)

Tomislav Dragicevic (Aalborg University, Denmark)

- 11:00 **Distributed Piecewise Droop Control of DC Microgrid with Improved Load Sharing and Voltage Compensation 185**
- 4-B-1 Sucheng Liu, *Anhui University of Technology, China*
Jiazhu Zheng, *Anhui University of Technology, China*
Zhongpeng Li, *Anhui Wanwei Group Co., Ltd Hefei, China*
Run Li, *Anhui University of Technology, China*
Wei Fang, *Anhui University of Technology, China*
Xiaodong Liu, *Anhui University of Technology, China*
- 11:18 **State of Charge Based Characteristic Diagram Control for Energy Storage Systems within Industrial DC Microgrids 191**
- 4-B-2 Alexander Maññel, *Bosch Rexroth AG, Lohr am Main, Germany*
Elias Knöchelmann, *Institute of Mechatronic Systems, Hannover, Germany*
Tobias Ortmaier, *Institute of Mechatronic Systems, Hannover, Germany*
Svenja Tappe, *Institute of Mechatronic Systems, Hannover, Germany*
- 11:36 **Voltage Dip Mitigation Techniques for Medium-Voltage DC Networks 197**
- 4-B-3 Thomas Hoehn, *CERN, Switzerland*
Francisco Blaquez, *CERN, Switzerland*
Karsten Kahle, *CERN, Switzerland*
Jean-Paul Burnet, *CERN, Switzerland*
Herwig Renner, *Graz University of Technology, Austria*
- 11:54 **Steady-State Power Flow Analysis of DC Distribution Systems 204**
- 4-B-4 Dario Chaifouroosh, *Delft University of Technology, Netherlands*
Nils H. van der Blij, *Delft University of Technology, Netherlands*
Laura Ramirez-Elizondo, *Delft University of Technology, Netherlands*
Pavol Bauer, *Delft University of Technology, Netherlands*
- 12:12 **Planar transformer design of LLC DC-DC converters with electromagnetics simulation 210**
- 4-B-5 Kumpei Yoshikawa, *Shindengen Electric Manufacturing Co., Ltd., Japan*
Tetsuya Oshikata, *Shindengen Electric Manufacturing Co., Ltd., Japan*

Session 5-A: Protection and Safety

May 23, 11:00 - 12:30, Hall A

Session Chairs:

Hiroaki Kakigano (Ritsumeikan University, Japan)

Holger Borchering (Ostwestfalen-Lippe University of Applied Sciences, Germany)

- 11:00 **Active and Passive Fault Ride-Through for MVDC Bipolar Short Circuit in Photovoltaic MVDC Collection and Integration System 216**
5-A-1 Jinggang Yang, *State Grid Jiangsu Electric Power Co., LTD., China*
 Xiaolong Xiao, *State Grid Jiangsu Electric Power Co., LTD., China*
 Yongyong Jia, *State Grid Jiangsu Electric Power Co., LTD., China*
 Shang Gao, *Southeast University, China*
 Jianhua Wang, *Southeast University, China*
 Zaijun Wu, *Southeast University, China*
- 11:18 **System Identification Methods for Refined Fault Detection in LVDC-Microgrids 226**
5-A-2 Christian Strobl, *E-T-A Elektrotechnische Apparate GmbH, Germany*
 Maximilian Schäfer, *Multimedia Communications and Signal Processing Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany*
 Rudolf Rabenstein, *Multimedia Communications and Signal Processing Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany*
- 11:36 **Enhanced Protection Selectivity in LVDC networks using a Superconducting Resistance 234**
5-A-3 Patrick McGuckin, *Abdullah Emhemed and Graeme Burt Institute for Energy and Environment University of Strathclyde, U.K.*
 Dong Wang, *Abdullah Emhemed and Graeme Burt Institute for Energy and Environment University of Strathclyde, U.K.*
- 11:54 **A Comprehensive Approach for Safety in DC-Microgrids 239**
5-A-4 Julian Kaiser, *Fraunhofer IISB, Germany*
 Christian Strobl, *E-T-A Elektrotechnische Apparate GmbH, Germany*
 Helmut Mann, *ABL SURSUM Bayerische Elektrozubehör GmbH & Co. KG., Germany*
 Helmut Muhm, *Bender GmbH & Co. KG, Germany*
 Marc Klimpel, *PHOENIX CONTACT GmbH & Co. KG, Germany*
 Franz Schork, *Dehn + Söhne GmbH & Co. KG., Germany*
 Martin März, *Fraunhofer IISB, Germany*
- 12:12 **Arc-Free Bidirectional Hybrid DC Switch using Tungsten or Tungsten-clad Copper Contacts 246**
5-A-5 Shoya Kubo, *Tokyo Institute of Technology, Japan*
 Shunsuke Sato, *Tokyo Institute of Technology, Japan*
 Yinming Huang, *Tokyo Institute of Technology, Japan*
 Koichi Yasuoka, *Tokyo Institute of Technology, Japan*

Session 5-B: Controls Strategy of DC Microgrids

May 23, 2019 11:00 - 12:30, Hall B

Session Chairs:

Gaku Kamitani (Murata Manufacturing Co., Ltd., Japan)

Vagelis Vossos (Lawrence Berkeley National Lab, USA)

- 11:00 **DC-Link Voltage Control Strategy for MTDC Grids based on Virtual Synchronous Machines 250**
5-B-1 Javier Roldán-Pérez, *IMDEA Energy Institute, Spain*
 Alberto Rodríguez-Cabero, *IMDEA Energy Institute, Spain*
 Milan Prodanovic, *IMDEA Energy Institute, Spain*
- 11:18 **Multi-Hop Network Based Coordination of Converters in DC Microgrids 256**
5-B-2 Herbert L. Ginn III, *University of South Carolina, U.S.A.*
 Castulo Aaron De La O, *University of South Carolina, U.S.A.*
 Andrea Benigni, *University of South Carolina, U.S.A.*
- 11:36 **Cooperative Decentralized Tertiary Based Control of DC Microgrid with Renewable Distributed Generation 262**
5-B-3 Hossam Aboelsoud Eid Elhassaneen, *Yokohama National University, Japan*
 Takao Tsuji, *Yokohama National University, Japan*
- 11:54 **Decentralized Cost-Optimized Fuzzy Control of DC Microgrids 268**
5-B-4 Elias Knochelmann, *Gottfried Wilhelm Leibniz Universität at Hannover, Institute of Mechatronic Systems, Germany*
 Alexander Männel, *Bosch Rexroth AG, Germany*
 Svenja Tappe, *Gottfried Wilhelm Leibniz Universität at Hannover, Institute of Mechatronic Systems, Germany*
 Tobias Ortmaier, *Gottfried Wilhelm Leibniz Universität at Hannover, Institute of Mechatronic Systems, Germany*
- 12:12 **Dual-EKF Method for State and Parameter Estimation in Nonlinear DC MG N/A**
5-B-5 Navid Vafamand, *Shiraz University, Iran*
 Mohammad Hassan Khooban, *Aarhus University, Denmark*
 Tomislav Dragičević, *Aalborg University, Denmark*

Session 6-A: DC Microgrids in Buildings

May 23, 14:40 - 16:10, Hall A

Session Chairs:

Tilo PÜSCHEL (Bachmann GmbH, Germany)

King Jet Tseng (Singapore Institute of Technology, Singapore)

- 14:40 **Modular DC/AC Microgrid 275**
6-A-1 John J. Shea, *Schneider-Electric, USA*
 Jonathan Hastings, *Schneider-Electric, USA*
 Van Wagner, *Schneider-Electric, USA*
 Mike Liptak, *Schneider-Electric, USA*
- 14:58 **Best Practices for Integrating Direct Current in Zero-Net Energy Buildings
in North America 282**
6-A-2 Vagelis Vossos, *Lawrence Berkeley National Lab Berkeley, CA, USA*
 Daniel Gerber, *Lawrence Berkeley National Lab Berkeley, CA, USA*
 Eric Mannarino, *ARU, San Francisco, CA, USA*
 Richard Brown, *Lawrence Berkeley National Lab Berkeley, CA, USA*
 Ruby Heard, *ALINGA Energy Consulting Melbourne, Australia*
- 15:16 **Earth Fault Analysis and Safety Recommendations for BIPV Module-
Level Converters in Low-voltage DC Microgrids 289**
6-A-3 S. Ravyts, *KU Leuven, Belgium*
 M. Dalla Vecchia, *KU Leuven, Belgium*
 G. Van den Broeck, *KU Leuven, Belgium*
 L. Hallems, *KU Leuven, Belgium*
 K. Stul, *KU Leuven, Belgium*
 J. Driesen, *KU Leuven, Belgium*
- 15:34 **An Efficiency-Focused Design of Direct-DC Loads in Buildings 297**
6-A-4 Daniel L. Gerber, *Bldg Tech Urban Systems (BTUS)Lawrence Berkeley Labs,
USA*
 Richard Liou, *Elec Eng Comp Sci (EECS)University of California Berkeley, USA*
 Richard Brown, *Bldg Tech Urban Systems (BTUS)Lawrence Berkeley Labs,
USA*
- 15:52 **Supercapacitor Assisted LED lighting (SCALED) for DC-micro grids 305**
6-A-5 Dilini Jayannada, *University of Waikato, New Zealand*
 Nihal Kularatna, *University of Waikato, New Zealand*
 D. Alistair Steyn-Ross, *University of Waikato, New Zealand*

Session 6-B: DC Applications (2)

May 23, 14:40 - 16:10, Hall B

Session Chairs:

Yuko Hirase (Toyo University, Japan)

Josep Maria Guerrero (Aalborg University, Denmark)

- 14:40 **Lifetime Calculation for Capacitors in Industrial Micro DC grids 311**
6-B-1 Simon Puls, *Lenze SE, Germany*
 Johann Austermann, *Ostwestfalen-Lippe UAS, Germany*
 Holger Borcharding, *Ostwestfalen-Lippe UAS, Germany*
- 14:58 **Bidirectional Converter with Balancing Capacitor using Multi-stage
FET Driving Technique 317**
6-B-2 Yiki Ishikura, *Murata Manufacturing Co., Ltd., Japan*
 Jun Imaoka, *Nagoya University, Japan*
 Mostafa Noah, *Nagoya University, Japan*
 Masayoshi Yamamoto, *Nagoya University, Japan*
- 15:16 **Implementation of a Remote Control and Monitoring Network for a DC
Microgrid N/A**
6-B-3 Maziar Mobarrez, *ABB Corporate Research Center, USA*
 N. Ghanbari, *ECE Department, North Carolina State University, USA*
 R. V. Agashe, *ECE Department, North Carolina State University, USA*
 S. Bhattacharya, *ECE Department, North Carolina State University, USA*
- 15:34 **Graphical User Interface of EV Battery Charging Reservation System for
Small-Scale Office Building Concerning Net-Zero Energy 323**
6-B-4 Pradita Octoviandiningrum Hadi, *Shibaura Institute of Technology, Japan*
 Keisuke Tagami, *Tanaka, DAI-DAN Co., Ltd., Japan*
 Yasunobu Tanaka, *DAI-DAN Co., Ltd., Japan*
 Goro Fujita, *Shibaura Institute of Technology, Japan*
- 15:52 **Power electronics for a LVDC-microgrid with local PV production and
electrolytic converter 328**
6-B-5 Philippe Morey, *HEIG-VD, HES-SO Yverdon Yverdon-les-Bains, Switzerland*
 Jean-François Affolter, *HEIG-VD, HES-SO Yverdon Yverdon-les-Bains,
Switzerland*
 Line Barras, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*
 Aurélien Carrupt, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*
 Didier Blatter, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*
 René Rebord, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*
 Thomas Sterren, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*
 Philippe Barrade, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*
 Christoph Ellert, *HEVS, HES-SO Valais-Wallis Sion, Switzerland*

Session 7-A: Stability and Performance Analysis, Management

May 23, 16:30 - 18:00, Hall A

Session Chairs:

Yushi Miura (Nagaoka University of Technology, Japan)

Javier Roldán, (IMDEA Energy Institute, Madrid, Spain)

- 16:30 **Short Timescale Energy Management for DC Microgrids 333**
7-A-1 Fei Gao, *University of Oxford, United Kingdom*
 Leong Kit Gan, *Faraday Grid, United Kingdom*
 David A. Howey, *University of Oxford, United Kingdom*
 Daniel J. Rogers, *University of Oxford, United Kingdom*
- 16:48 **Stability Control Strategy for DC Micro-grid Considering Constant
Power Load 338**
7-A-2 Wenqiang Xie, *North China Electric Power University, China*
 Minxiao Han, *North China Electric Power University, China*
 Wenli Yan, *North China Electric Power University, China*
 Chao Wang, *North China Electric Power University, China*
- 17:06 **DC Bus System for Servo Drives and its Stability Analysis 344**
7-A-3 Takeshi Kiribuchi, *OMRON Corporation, Japan*
 Toshiyuki Zaitso, *OMRON Corporation, Japan*
 Masashi Doi, *OMRON Corporation, Japan*
 Keisuke Kusaka, *Nagaoka University of Technology, Japan*
 Junichi Itoh, *Nagaoka University of Technology, Japan*
- 17:24 **Stability of DC Distribution Systems: Analytical and Experimental
Results 349**
7-A-4 Nils H. van der Blij, *Delft University of Technology, Netherlands*
 Laura M. Ramirez-Elizondo, *Delft University of Technology, Netherlands*
 Matthijs T. J. Spaan, *Delft University of Technology, Netherlands*
 Wuhua Li, *Zhejiang University, China*
 Pavol Bauer, *Delft University of Technology, Netherlands*
- 17:42 **Smoothing Effect and Energy Capacity in Photovoltaic Power
Smoothing Control Using Spline Function 355**
7-A-5 Akiko Takahashi, *Okayama University, Japan*
 Tatsuya Kajitani, *Okayama University, Japan*
 Shigeyuki Funabiki, *Okayama University, Japan*

Session 7-B: DC Applications (3)

May 23, 16:30 - 18:00, Hall B

Session Chairs:

Antonio Marques Cardoso (Universidades da Beira Interior in Portugal, Portugal)

Toshihisa FUNABASHI (University of the Ryukyus, Japan)

- 16:30 **Common Mode Conductive Noise Cancellation for Multiphase Converter Using Auxiliary Winding 359**
- 7-B-1 Mamoru Sasaki, *Nagoya University, Japan*
Jun Imaoka, *Nagoya University, Japan*
Masayoshi Yamamoto, *Nagoya University, Japan*
Akira Nakano, *Alps Alpine Co., Ltd, Japan*
Koji Fuse, *Alps Alpine Co., Ltd, Japan*
- 16:48 **Supercapacitor-based switching matrix to improve energy conversion efficiency of PV solar systems 364**
- 7-B-2 R.S. Ukwatta, *The Open University of Sri Lanka, Sri Lanka*
Thilini Wickramasinghe, *University of Lyon 1, France*
A.G.M. Lokuliyana, *The Open University of Sri Lanka, Sri Lanka*
- 17:06 **Weakly Meshing the Radial Distribution Networks with Power Electronic Based Flexible DC Interlinks 369**
- 7-B-3 Aditya Shekhar, *Delft University of Technology, Netherlands*
Thiago Batista Soeiro, *Delft University of Technology, Netherlands*
Laura Ramirez-Elizondo, *Delft University of Technology, Netherlands*
Pavol Bauer, *Delft University of Technology, Netherlands*
- 17:24 **Impedance Measurement Method for Solar Cell Evaluation using a Power Converter 377**
- 7-B-4 Takeshi Yokoi, *Ritsumeikan University, Japan*
Koji Takechi, *Ritsumeikan University, Japan*
Hiroaki Kakigano, *Ritsumeikan University, Japan*
- 17:42 **An Improved Simple EMI Modeling Method for Conducted Common Mode Noise Prediction in DC- DC Buck Converter 383**
- 7-B-5 Baihua Zhang, *Kyushu University, Japan*
Shuaitao Zhang, *Kyushu University, Japan*
Henan Li, *Kyushu University, Japan*
Masahito Shoyama, *Kyushu University, Japan*
Eiji Takegami, *TDK-Lambda Corporation, Japan*

Poster session

Poster Session (1)

May 21, 2019 13:15 - 14:35, Poster Area

Session Chair: Yushi Miura (Nagaoka University of Technology, Japan)

- P1-1 **A Study on Allocation Method of Supply-demand Balancing Capability considering VPP deployment 389**
Miki Someha, *Nagoya Institute of Technology, Japan*
Mutsumi Aoki, *Nagoya Institute of Technology, Japan*
Suresh Chand, *Nagoya Institute of Technology, Japan*
- P1-2 **An Experimental Analysis of Frequency Characteristics in LLC Resonant Converter with Cockcroft-Walton Circuit 394**
Masataka Minami, *Kobe City College of Technology, Japan*
Hikaru Ouchi, *Kobe City College of Technology, Japan*
Takumi Yasuda, *Kobe City College of Technology, Japan*
- P1-3 **Simulation Research on the Operation Characteristics of a DC Microgrid 396**
Xiaohui Wang, *Beijing University of Civil Engineering and Architecture, China*
Yiming Zheng, *Beijing University of Civil Engineering and Architecture, China*
Zhongshan Lu, *M&E Design Department China Water Resources Beifang Investigation, Design and Research Co. Ltd, China*
- P1-4 **Capacitive earthing charge-based method for locating faults within a DC microgrid 400**
Ahmad Makkieh, *University of Strathclyde, UK*
Rafael Pena-Alzola, *University of Strathclyde, UK*
Abdullah Emhemed, *University of Strathclyde, UK*
Graeme Burt, *University of Strathclyde, UK*
Adria Junyent-Ferre, *Imperial College London, UK*
- P1-5 **Fuel cell and Electrolyzer System for Supply and Demand Balancing in DC 406**
Kentarho Shimomachi, *National Institute of Technology, Hakodate College, Japan* Yuji
Mishima, *National Institute of Technology, Hakodate College, Japan*
Ryoichi Hara, *Hokkaido University, Japan*
Hiroyuki Kita, *Hokkaido University, Japan*
- P1-6 **Research on the Control Method based on Virtual Synchronous Machine Technology of AC/DC Distribution Device 410**
Limin Lu, *State Grid Changzhou Power Supply Company, China*
Xufeng Li, *School of Electrical Engineering Southeast University, China*
Lexiang Cheng, *Lexiang Cheng, China*
Wenbing Li, *School of Electrical Engineering Southeast University, China*
Zhipeng Lv, *China Electric Power Research Institute, China*
Jianhua Wang, *School of Electrical Engineering Southeast University, China*

- P1-7 **Distributed High Step-Down Ratio DC Transformer for Interconnection of MVDC and LVDC Grids 415**
Shang Gao, *School of Electrical Engineering Southeast University, China* Jinggang Yang, *State Grid Jiangsu Electric Power Co., LTD. Research Institute, China*
Xin Zhan, *State Grid Yangzhou Power Supply Company, China*
Xiaolong Xiao, *State Grid Jiangsu Electric Power Co., LTD. Research Institute, China*
Jianhua Wang, *School of Electrical Engineering Southeast University, China* Zaijun Wu, *School of Electrical Engineering Southeast University, China*
- P1-8 **A Multivariable Hysteresis-Based DC Bus Signaling Control for DC Microgrid With Enhanced Reliability 420**
Sucheng Liu, *Anhui University of Technology, China*
Run Li, *Anhui University of Technology, China*
Kun Huang, *Anhui University of Technology, China*
Xiang Li, *Anhui University of Technology, China*
Wei Fang, *Anhui University of Technology, China*
Xiaodong Liu, *Anhui University of Technology, China*
- P1-9 **Research on electric arc and practice in building LVDC distribution system 426**
Xiangdong Liu, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Wei Zhang, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Jianhai Yan, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*
Wenbo Chen, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*
Xiaodong Yuan, *Jiangsu Electric Power Science Research Institute, China* Xueyi Zou, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*
- P1-10 **Research and Practice of Relay Protection in LVDC Distribution Network 430**
Zhong Li, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Jianhai Yan, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Xueyi Zou, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*
Yuming Zhao, *Shenzhen Power Supply Co., Ltd, China*
Xuewen Yu, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Xiangdong Liu, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*

- P1-11 **Modeling of a Building Scale Liquid Energy Storage and Expansion System with ASPEN HYSYS 434**
 Ryan M. Willis, *Graduate School of Engineering and Applied Sciences Naval Postgraduate School, USA*
 Anthony G. Pollman, *Graduate School of Engineering and Applied Sciences Naval Postgraduate School, USA*
 Anthony J. Gannon, *Graduate School of Engineering and Applied Sciences Naval Postgraduate School, USA*
 Alejandro Hernandez, *Graduate School of Engineering and Applied Sciences Naval Postgraduate School, USA*
- P1-12 **Fault Identification and Interruption Methods in Low Voltage DC Grids – A Review 439**
 L. Hallemans, *KU Leuven, Belgium*
 G. Van den Broeck, *KU Leuven, Belgium*
 S. Ravyts, *KU Leuven, Belgium*
 M. M. Alam, *VITO, Belgium*
 M. Dalla Vecchia, *KU Leuven, Belgium*
 P. Van Tichelen, *VITO, Belgium*
 J. Driesen, *KU Leuven, Belgium*
- P1-13 **A Study on Risk of Switching Stop Failure in Non-Isolated Step-Down DC-DC Converter 447**
 Yuichi Noge, *Tokyo University of Agriculture and Technology, Japan*
 Ming-cong Deng, *Tokyo University of Agriculture and Technology, Japan* Toshihiro Amei, *Research and Development Center, SMK corporation, Japan* Rie Abe, *Research and Development Center, SMK corporation, Japan* Haruhiko Kondo, *Research and Development Center, SMK corporation, Japan*
- P1-14 **Bidirectional Isolated Ripple Cancel Dual Active Bridge DC-DC Converter 451**
 Pin-Yu Huang, *Kyoto Institute of Technology, Japan*
 Takahiro Ohta, *Kyoto Institute of Technology, Japan*
 Makoto Fujii, *Kyoto Institute of Technology, Japan*
 Yuichi Kado, *Kyoto Institute of Technology, Japan*
- P1-15 **Polar Coordinate Decoupling Power Flow Control for Triple Active Bridge Converter 456**
 Shota Okutani, *Kyoto Institute of Technology, Japan*
 Akira Nishi, *Kyoto Institute of Technology, Japan*
 Pin-Yu Huang, *Kyoto Institute of Technology, Japan*
 Yuichi Kado, *Kyoto Institute of Technology, Japan*
- P1-16 **Comprehensive Cost Comparison and Analysis of Building-Scale Solar DC and AC Microgrid N/A**
 N. Ghanbarii, *North Carolina State University, USA*
 M. Mobarrez, *North Carolina State University, USA*
 M. Madadi, *North Carolina State University, USA*
 S. Bhattacharya, *North Carolina State University, USA*

- P1-17 **Voltage Control of High-voltage Distribution System Using Distributed Electric Vehicles 461**
Akiko Takahashi, *Okayama University, Japan*
Motohiro Shirakawa, *Okayama University, Japan*
Shigeyuki Funabiki, *Okayama University, Japan*
- P1-18 **An Experimental Study on Extinguishing Property of DC Arc Ignited with Disconnection of Activated PV Array 467**
Toshiya Yokoi, *Aichi Institute of Technology, Japan*
Akihiro Tsusaka, *Aichi Institute of Technology, Japan*
Kazuho Hasegawa, *Aichi Institute of Technology, Japan*
Toshiro Matsumura, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Yasuyuki Goto, *Aichi Institute of Technology, Japan*
Atsushi Miyamoto, *Nitto Kogyo Corporation*
Hiroyuki Ito, *Nitto Kogyo Corporation*
- P1-19 **Voltage Stabilization Control Method of DC Microgrid by Eigenvalue Analysis 472**
Naoya Ikeda, *Graduate School of Science Engineering Yokohama National University, Japan*
Hossam Aboelsoud Eid Elhassaneen, *Graduate School of Science Engineering Yokohama National University, Japan*
Takao Tsuji, *Faculty of Engineering Yokohama National University, Japan*
- P1-20 **Influence of voltage rise suppression control with constant output power at the introduction of large photovoltaic device to the end of distribution system 476**
Masumi Tsukamoto, *Aichi Institute of Technology, Japan*
Toshiro Matsumura, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Yasuyuki Goto, *Aichi Institute of Technology, Japan*
Yasunobu Yokomizu, *Nagoya University*
Kento Tatewaki, *Nagoya University*
Daisuke Iioka, *Tohoku University, Japan*
Hiroataka Shimizu, *Polytechnic University, Japan*
Hideki Iwatsuki, *Chubu Electric Power Co., Inc., Japan*
Hirokazu Uenishi, *Chubu Electric Power Co., Inc., Japan*
Hiroyuki Ishikawa, *Chubu Electric Power Co., Inc., Japan*
Yuuki Kanazawa, *Chubu Electric Power Co., Inc., Japan*
- P1-21 **Hybrid AC/DC Microgrid for Residential Applications 481**
Ameer Hamza, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences Lahore, Pakistan*
Hamza Bin Tahir, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences Lahore, Pakistan*
Kiran Siraj, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences Lahore, Pakistan*
Mashood Nasir, *Syed Babar Ali School of Science and Engineering Lahore University of Management Sciences Lahore, Pakistan*

- P1-22 **Experimental study on interruption time in two inductance for 100 V class DC breaking arc 486**
Takuma Higashitani, *Aichi Institute of Technology, Japan*
Akihiro Tsusaka, *Aichi Institute of Technology, Japan*
Kazuho Hasegawa, *Aichi Institute of Technology, Japan*
Toshiya Yokoi, *Aichi Institute of Technology, Japan*
Toshiro Matsumura, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Yasuyuki Goto, *Aichi Institute of Technology, Japan*
Atsushi Miyamoto, *Nitto Kogyo Corporation, Japan*
Hiroyuki Ito, *Nitto Kogyo Corporation, Japan*
Yasunobu Yokomizu, *Nagoya University*
- P1-23 **The Algorithm to Detect and Differentiate Line-Line and Shading Fault in PV System 490**
Jirada Gosumbonggot, *Shibaura Institute of Technology, Japan*
Goro Fujita, *Shibaura Institute of Technology, Japan*
- P1-24 **Performance Evaluation of GaN-MPPT by Transient Characteristics 496**
Yusuke Kobayashi, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Masayuki Minowa, *Aichi Institute of Technology, Japan*
Toshiro Matsumura, *Aichi Institute of Technology, Japan*
Katsunori Mizuno, *Aichi Institute of Technology, Japan*
Takanori Matsuyama, *Aichi Institute of Technology, Japan*
- P1-25 **Study of a microgrid using a private power generator during a utility grid failure 500**
Kazuhiro Minemura, *Aichi Institute of Technology, Japan*
Daiki Owaki, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Yasuyuki Goto, *Aichi Institute of Technology, Japan*
Takuya Ota, *SANYO DENKI Co., LTD., Japan*
Hiroaki Miyoshi, *SANYO DENKI Co., LTD., Japan*
WANG Beibei, *Southeast University, China*
Li Yang, *Southeast University, China*
Keiichi Hirose, *NTT Facilities, INC., Japan*
- P1-26 **Risk of Arc Extension by Multiple Capacitive Discharges in a Fuse for Microgrid 506**
Tomokazu SAKURABA, *Mersen Japan K.K., Japan*
Song Chen, *Mersen Shanghai, China*
Laurent MILLIERE, *Mersen France SB SAS, France, France*
- P1-27 **Terminal Capacitor Compensation Based Stability Design for DC Microgrid 510**
Fulong Li, *Aston University, UK*
Zhengyu Lin, *Aston University, UK*
Alian Chen, *Shandong University, China*
Jiande Wu, *Zhejiang University, China*

Poster Session (2)

May 23, 2019 13:15 - 14:35, Poster Area

Session Chair: Takao Tsuji (Yokohama National University, Japan)

- P2-1 **DC Power Control Using Simple Inverters Constructed by Concise Circuit Configuration 515**
Keiju Matsui, *Minna-denryoku, Inc. Setagaya Monozukuri Gakko, Japan*
Eiji Oishi, *Minna-denryoku, Inc. Setagaya Monozukuri Gakko, Japan*
Mikio Yasubayashi, *Chubu University, Japan*
Yuuichi Hirate, *Chubu University, Japan*
Steve Adikari, *Chubu University, Japan*
Masaru Hasegawa, *Chubu University, Japan*
- P2-2 **Power Packet Dispatching System and Router for Bi-directional Dispatching 520**
Ryo Takahashi, *Aichi University of Technology, Japan*
Naomitsu Yoshida, *Kyoto University, Japan*
Takashi Hikihara, *Kyoto University, Japan*
- P2-3 **The Efficiency Estimation Method for Harvesting Energy Charged into Capacitor 523**
Takashi Yoshikawa, *Kindai University Technical College, Japan*
- P2-4 **Verification of dc Capacitor Control of Modular Multilevel Converters for dc Transmission Systems 528**
Muneki Funami, *Ritsumeikan University, Japan*
Takahiro Hashimoto, *Ritsumeikan University, Japan*
Hiroaki Kakigano, *Ritsumeikan University, Japan*
- P2-5 **Unique Self-Tuning Method for Stability of Grid-Connected Inverter 534**
Yuhki Kamatani, *OMRON Corporation, Japan*
Takeo Nishikawa, *OMRON Corporation, Japan*
Takeshi Uematsu, *OMRON Corporation, Japan*
Toshiyuki Zaito, *OMRON Corporation, Japan*
- P2-6 **Supercapacitor Assisted Data Center Power Architecture for 380 V DC-microgrid 540**
Thilanga Ariyaratna, *University of Waikato, New Zealand*
Nihal Kularatna, *University of Waikato, New Zealand*
D. Alistair Steyn-Ross, *University of Waikato, New Zealand*
- P2-7 **Monte Carlo Model for Grid to Grid Connection of Islanded Microgrids 546**
Jonathan Bowes, *University of Strathclyde, United Kingdom*
Scott Strachan, *University of Strathclyde, United Kingdom*
Campbell Booth, *University of Strathclyde, United Kingdom*

- P2-8 **Grid Flexibility Dispatch by Integrated Control of Distributed Energy Resources 553**
Hirohisa Aki, *University of Tsukuba, Japan*
Takayuki Kumamoto, *University of Tsukuba, Japan*
Masayoshi Ishida, *University of Tsukuba, Japan*
- P2-9 **Demonstration application of LVDC distribution system in building 558**
Bao Zhang, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Jianhai Yan, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd., China*
Hao Tong, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*
Yutong Li, *Shenzhen Power Supply Co., Ltd, China*
Jinhao Wang, *State Grid Electric Power Research Institute of Shanxi Electric Power Company, China*
Jiajie Liu, *Nanjing Golden Cooperate DC Power Distribution Technology Co., Ltd, China*
- P2-10 **AC vs. DC Boost Converters: A Detailed Conduction Loss Comparison 563**
Daniel L Gerber, *Building Technology and Urban Systems Lawrence Berkeley Labs, USA*
Fariborz Musavi, *Engineering and Computer Science Washington State University, USA*
- P2-11 **A New Protection Scheme Using an AC/DC Converter for a L VDC Distribution System 569**
Jintae Cho, *Smart Power Distribution Laboratory KEPRI, Korea*
Youngpyo Cho, *Smart Power Distribution Laboratory KEPRI, Korea*
Hongjoo Kim, *Smart Power Distribution Laboratory KEPRI, Korea*
Hyunmin Kim, *Smart Power Distribution Laboratory KEPRI, Korea*
Juyong Kim, *Smart Power Distribution Laboratory KEPRI, Korea*
Hosung Kim, *Power Conversion Research Center KERI, Korea*
- P2-12 **DC Nano Grids for LED Lighting for 24x7 Facilities –Industries, Healthcare N/A**
Vineet Krishna Rohatgi, *Industries, Hospitals., India*
Rajeev Krishna Rohatgi, *Industries, Hospitals., India*
- P2-13 **DC Voltage Stabilization in DC/AC Hybrid Microgrid by Cooperative Control of Multiple Energy Storages 573**
Guohong Wu, *Tohoku Gakuin University, Japan*
Seiya Ishida, *Tohoku Gakuin University, Japan*
Hang Yin, *Tohoku Gakuin University, Japan*
- P2-14 **A History of Power Supply in an Off-grid Power System 578**
Toshihisa FUNABASHI, *University of the Ryukyus, Japan*
Kazuto YUKIT A, *Aichi Institute of Technology, Japan*

- P2-15 **DC Microgrid ESS Substation for AC Distribution Grid Support 584**
Yeuntae Yoo, *Korea University, Korea*
Seungmin Jung, *Hanbat National University, Korea*
Minhan Yoon, *Tongmyong University., Korea*
Sungchul Hwang, *Korea University, Korea*
Jaehyeong Lee, *Korea University, Korea*
Gilsoo Jang, *Korea University, Korea*
- P2-16 **MVDC ring-cable approach for new DC distribution and restructured AC grids 589**
Gerhard Jambrich, *Austrian Institute of Technology, Austria*
Johannes Stöckl, *Austrian Institute of Technology, Austria*
Markus Makoschitz, *Austrian Institute of Technology, Austria*
- P2-17 **Improving Efficiency, Reliability and Life-time Cost of Data Centers Using DC Technology 594**
Abdullah AL-Harbi, *Saudi Aramco, Saudi Arabia*
Farooq Al-Jwesm, *Saudi Aramco, Saudi Arabia*
Yasser Al-Howeish, *Saudi Aramco, Saudi Arabia*
- P2-18 **Decentralized Control-Scheme for DC-Interconnected Solar Home Systems for Rural Electrification 599**
Nishant Narayan, *Delft University of Technology, Netherlands*
Laurens Mackay, *DC Opportunities R&D, Netherlands*
Bryan Oscareno Malik, *Delft University of Technology, Netherlands* Jelena Popovic-Gerber, *Klimop Energy, Netherlands*
Zian Qin, *Delft University of Technology, Netherlands*
Pavol Bauer, *Delft University of Technology, Netherlands*
Miroslav Zeman, *Delft University of Technology, Netherlands*
- P2-19 **Improvement of temperature rise of Low voltage fuse 605**
Shunsuke Hasegawa, *Technical Development dept. Daito Communication Apparatus Co.,Ltd., Japan*
Ying Ren Yun, *Pinggao Intelligent Electric Co., Ltd., China*
Chao He, *Pinggao Group Smart Electric Co., Ltd, China*
Hiroshi Suzuki, *Daito Create Co., Ltd, Japan*
Masami Takada, *Daito Create Co., Ltd, Japan*
Noriaki Otsubo, *Daito Create Co., Ltd, Japan*
- P2-20 **Development of Sodium Sulfur Battery 608**
Naoki Hirai, *NGK Insulators, LTD., Japan*

- P2-21 **PV-grid performance under dynamic weather conditions 612**
Kasper M. Paasch, *University of Southern Denmark, Denmark*
Cristina Cornaro, *University of Rome "Tor Vergata", Italy*
Marco Pierro, *University of Rome "Tor Vergata", Italy*
- P2-22 **A soft-starting method for Dual Active Bridge Converters 617**
Duy-Dinh NGUYEN, *Aichi Institute of Technology, Japan*
Kazuto YUKITA, *Aichi Institute of Technology, Japan*
- P2-23 **Passive Components Size Reduction in Solid-State Transformers for EV Fast Charging System 623**
Haoyu Zhang, *University of Tsukuba, Japan*
Rene Barrera-Cardenas, *SINTEF Energy Research, Norway*
Ryuji Iijima, *University of Tsukuba, Japan*
Takanori Isobe, *University of Tsukuba, Japan*
Hiroshi Tadano, *University of Tsukuba, Japan*
- P2-24 **Study on the Surveying Wiring Path in Solar Power Generation System 630**
Yuji Iwane, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Toshiro Matsumura, *Aichi Institute of Technology, Japan*
Yasuyuki Goto, *Aichi Institute of Technology, Japan*
Kazuhiko Taniguchi, *Kinden Corporation, Japan*
Hiroshi Morita, *Kinden Corporation, Japan*
Naoya Kubo, *Kinden Corporation, Japan*
- P2-25 **Method of Determining Operation Voltage of Dispersed Photovoltaic Generator 634**
Koki Kato, *Aichi Institute of Technology, Japan*
Yuji Iwane, *Aichi Institute of Technology, Japan*
Shunsuke Horie, *Aichi Institute of Technology, Japan*
Tadahiro Goda, *Aichi Institute of Technology, Japan*
Kazuto Yukita, *Aichi Institute of Technology, Japan*
Toshiro Matsumura, *Aichi Institute of Technology, Japan*
Yasuyuki Goto, *Aichi Institute of Technology, Japan*
Issarachai Ngamroo, *King Mongkut's Institute of Technology, Thailand*

P2-26 **The Technical Case Study of Low Voltage DC Micro Grid System for Net Zero Energy Building N/A**

Yutong Li, *Shenzhen Institute of building research, China*

Wendi Liao, *Shenzhen Institute of building research, China*

Bin Hao, *Shenzhen Institute of building research, China*

Zhong Li, *Nanjing Golden Cooperate DC Power Distribution Technology, China*

Yibin Tong, *School of Electrical Engineering, China*

CHEN Wenbo, *Nanjing Golden Cooperate DC Power Distribution Technology, China*

P2-27 **Demonstration project MVDC Distribution System N/A**

Ryosuke Ochi, *Power Distribution Systems Centre, Mitsubishi Electric Corporation, Japan*

.Kosuke Shinji, *Power Distribution Systems Centre, Mitsubishi Electric Corporation, Japan*

P2-28 **Voltage-Frequency Control in PV Introduction System 638**

Gouken Fukuyama, *Aichi Institute of Technology, Japan*

Tadahiro Goda, *Aichi Institute of Technology, Japan*

Yuji Iwane, *Aichi Institute of Technology, Japan*

Koki Kato, *Aichi Institute of Technology, Japan*

Katsunori Mizuno, *Aichi Institute of Technology, Japan*

Kazuto Yukita, *Aichi Institute of Technology, Japan*

Toshiro Matsumura, *Aichi Institute of Technology, Japan*

Yasuyuki Goto, *Aichi Institute of Technology, Japan*

P2-29 **A Local Voting Protocol Based Cooperative DC Community Microgrids 642**

Subham Sahoo, *National University of Singapore, Singapore*

Jimmy Chih-Hsien Peng, *National University of Singapore, Singapore* Sukumar Mishra, *Indian Institute of Technology Delhi, India*

Tomislav Dragičević, *Aalborg University, Denmark*