

Technical Sessions

Monday, May 21: 13:30-15:35

Room A

Oral Session (Organized) 21A1 Wireless Power Transfer

Chair: Takehiro Imura (*The University of Tokyo*)

Yijie Wang (*Harbin Institute of Technology*)

21A1-1 Three-Phase Inductive Power Transfer System with 12 Coils for Radiation Noise Reduction

Invited Paper Keisuke Kusaka, Jun-ichi Itoh

13:30 Nagaoka University of Technology, Japan

21A1-2 Secondary-Side-Only Control for Smooth Voltage Stabilization in Wireless Power Transfer Systems with Constant Power Load

Invited Paper Giorgio Lovison, Takehiro Imura, Hiroshi Fujimoto, Yoichi Hori
The University of Tokyo, Japan

21A1-3 Constant Current Charging and the Maximum System Efficiency Tracking for Wireless Charging Systems Employing Dual-Side Control

Invited Paper Zhenjie Li, Xiaoliang Huang, Kai Song, Jinhai Jiang, Chunbo Zhu, Zhijiang Du
Harbin Institute of Technology, China

21A1-4 Electric Field Coupling Type High Power Wireless Power Transfer with Leakage Electric Field Structure

Invited Paper Mitsuru Masuda
14:45 FURUKAWA ELECTRIC CO., LTD., Japan

21A1-5 Transfer Power Analysis of Capacitively Isolated Outlet and Plug (CapIsOP) Using Series Resonance

Invited Paper Hirohito Funato, Koki Amano, Takuya Hatsumi, Junnosuke Haruna
15:10 Utsunomiya University, Japan

Room B

Oral Session 21B1 LLC Converters

Chair: Yoshiya Ohnuma (*Nagaoka Power Electronics Co., Ltd.*)

Haoyu Wang (*ShanghaiTech University*)

21B1-1 Wide Voltage Gain Range LLC DC/DC Topologies: State-of-the-Art

13:30 Qi Cao, Zhiqing Li, Haoyu Wang
Shanghai Tech University, China

21B1-2 Dual Half-Bridge LLC Resonant Converter with Hybrid-Secondary-Rectifier (HSR) for Wide-Output-Voltage Applications

13:55 Jae-Il Baek¹, Chong-Eun Kim², Keon-Woo Kim¹, Min-Su Lee¹, Gun-Woo Moon¹
1) KAIST, Korea, 2) SoluM, Korea

21B1-3 A Study on the Analysis and Control of No-Load Characteristics of LLC Resonant Converter for Plasma Process

14:20 Min-Jun Kwon, Woo-Cheol Lee
Hankyong National University, Korea

21B1-4 Mechanism of Current Imbalance in LLC Resonant Converter with Center Tapped Transformer

14:45 Mitsuru Sato, Shingo Nagaoka, Takeshi Uematsu, Toshiyuki Zaitzu
Omron Corporation, Japan

21B1-5 Performance Study of High-Power Half-Bridge Interleaved LLC Converter

15:10 Hung-I Hsieh¹, Hui-Lung Chiu², Guan-Chyun Hsieh²
1) National Chiayi University, Taiwan, 2) Chung Yuan Christian University, Taiwan

Oral Session (Organized) 21C1 Packaging Technologies for Power Devices

Chair: Tsuyoshi Funaki (*Osaka University*)

Jun Wang (*Virginia Tech*)

21C1-1 Multi-Chip SiC MOSFET Power Modules for Standard Manufacturing, Mounting and Cooling

Invited Paper Alberto Castellazzi¹, Asad Fayyaz¹, Emre Gurpinar², Abdallah Hussein¹, Jianfeng Li¹, Bassem Mouawad¹

13:30 1) *University of Nottingham, UK*, 2) *Oak Ridge National Laboratory, USA*

21C1-2 An Alternative Method to Accurately Determine the Thermal Resistance of SiC MOSFET Structures with Discrete Diodes

Invited Paper Andras Vass-Varnai¹, Young Joon Cho¹, Gabor Farkas², Marta Rencz^{2,3}

13:55 1) *Mentor Graphics, Korea*, 2) *Mentor Graphics, Hungary*, 3) *Budapest University of Technology and Economics, Hungary*

21C1-3 Heat-Resistant Packaging Technology for Wide Bandgap Power Devices and Thermal Reliability Testing

Invited Paper K. Suganuma, H. Zhang, S. Nagao, C. Chen, T. Sugahara, A. Shimoyama, A. Suetake

14:20 *Osaka University, Japan*

21C1-4 Verification of Identification Accuracy of Loss Calculated by Inverse Thermal Analysis

Invited Paper Yuki Ikari, Kazushige Nakao

14:45 *Fukui University of Technology, Japan*

21C1-5 Packaging Architectures for Silicon Carbide Power Electronic Modules

Invited Paper H. Alan. Mantooth, Simon S. Ang

15:10 *University of Arkansas, USA*

Oral Session (Organized) 21D1 High Speed Machines and Drives

Chair: Masahide Ooshima (*Tokyo University of Science, Suwa*)

Eric L. Severson (*University of Wisconsin*)

21D1-1 Development of a Homo-Polar Bearingless Motor with Concentrated Winding for High Speed Applications

Invited Paper Junichi Asama¹, Dai Suzuki¹, Takaaki Oiwa¹, Akira Chiba²

13:30 1) *Shizuoka University, Japan*, 2) *Tokyo Institute of Technology, Japan*

21D1-2 High-Speed Slotless Permanent Magnet Machines: Modelling and Design Frameworks

Invited Paper S. Jumayev¹, K.O. Boynov¹, E.A. Lomonova¹, J. Pyrhönen²

13:55 1) *Eindhoven University of Technology, The Netherlands*, 2) *Lappeenranta University of Technology, Finland*

21D1-3 Development and Performance of High-Speed SPM Synchronous Machine

Invited Paper Kota Kawanishi¹, Keisuke Matsuo¹, Takayuki Mizuno¹, Koji Yamada¹, Takashi Okitsu¹, Kouki Matsuse²

14:20 1) *Meidensha Corporation, Japan*, 2) *Meiji University Tokyo, Japan*

21D1-4 1.2kW 100,000rpm High Speed Motor for Aircraft

Invited Paper Takehiro Jikumaru, Gen Kuwata

14:45 *IHI Corporation, Japan*

21D1-5 Comparative Evaluation of Y-Inverter against Three-Phase Two-Stage Buck-Boost DC-AC Converter Systems

Invited Paper Michael Antivachis, Dominik Bortis, David Menzi, Johann W. Kolar

15:10 *ETH Zürich, Switzerland*

Oral Session (Organized) 21E1 System Management Technologies

Chair: Püschel Tilo (*Bachmann GmbH*)

Tadatoshi Babasaki (*NTT Facilities, Inc.*)

21E1-1 DC-Powered Office Buildings and Data Centres

Invited Paper **The First 380 VDC Micro Grid in a Commercial Building in Germany**

13:30 Tilo Püschel

Bachmann GmbH, Germany

- 21E1-2 Recent Trend in Power Electronics for ICT Systems**
Invited Paper Hiroshi Nakao^{1,2}, Yu Yonezawa¹, Yoshiyasu Nakashima¹
13:55 1) Fujitsu Laboratories LTD., Japan, 2) Nagasaki University, Japan
- 21E1-3 Green Base Station Using Robust Solar System and High Performance Lithium Ion Battery for Next Generation Wireless Network (5G) and against Mega Disaster**
Invited Paper M. Nakamura, K. Takeno
14:20 NTT DOCOMO, Inc., Japan
- 21E1-4 Optimization of Maintenance by Failure Prediction Considering Instantaneous and Cumulative Effects of External Environments**
Invited Paper Kaisei Kanetani¹, Masahiro Yamazaki¹, Tadatoshi Babasaki¹, Hideaki Kim², Tatsushi Matsubayashi²
14:45 1) NTT Facilities, Inc., Japan, 2) Nippon Telegraph and Telephone Corporation, Japan
- 21E1-5 Hybrid Converters with Reduced Inductor Loss for Integratable Power Conversion**
Invited Paper Gab-Su Seo^{1,2}, Hanh-Phuc Le¹
15:10 1) University of Colorado, USA, 2) National Renewable Energy Laboratory, USA

Room F

Oral Session (Organized) 21F1 Recent Motor Drive Technologies for Industrial Applications

Chair: Ikuya Sato (*Fuji Electric Co., Ltd.*)
 Faz Rahman (*The University of New South Wales*)

- 21F1-1 Energy Saving System Trend For Harbor Crane with Lithium Ion Battery**
Invited Paper Hidemasa Yoshihara
13:30 Yaskawa Siemens Automation and Drives Corp., Japan
- 21F1-2 Inverter Drive of Dynamometers for Automotive Evaluation System**
Invited Paper Shizunori Hamada, Toshimichi Takahashi, Nobutaka Kezuka, Masaju Kouketsu, Shingo Ishigaki
13:55 Meidensha Corporation, Japan
- 21F1-3 Experimental Investigation of Prototype All-SiC Converter for Ultra-High-Speed Elevator**
Invited Paper Kazuhisa Mori, Kaoru Katoh, Yohei Matsumoto, Tatsushi Yabuuchi, Naoto Ohnuma
14:20 Hitachi, Ltd., Japan
- 21F1-4 High-Voltage, Large-Capacity Converter Technologies and Their Applications**
Invited Paper Daisuke Yoshizawa¹, Paul Bixel², Masahiko Tsukakoshi¹
14:45 1) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan, 2) TMEIC Corporation, U.S.A
- 21F1-5 Higher Radial Suspension Force of Magnetic Bearing on Centrifugal Compressor for HVAC**
Invited Paper Yuji Nakazawa, Yusuke Irino, Atsushi Sakawaki, Kazunobu Ohyama
15:10 Daikin Industries, Ltd., Osaka, Japan

Room G

Oral Session 21G1 DC-DC Converters and Battery Management Systems

Chair: Masatoshi Uno (*Ibaraki University*)
 Florian Krismer (*ETH Zürich*)

- 21G1-1 Novel Switching Control Method for Full-Bridge DC-DC Converters for Improving Light-Load Efficiency Using Reverse Recovery Current**
13:30 Fumihiro Sato, Takae Shimada, Takayuki Ouchi
 Hitachi, Ltd., Japan
- 21G1-2 A 800V/14V Soft-Switched Converter with Low-Voltage Rating of Switch for xEV Applications**
13:55 Byeongwoo Kim, Kangsan Kim, Sewan Choi
 Seoul National University of Science and Technology, Korea
- 21G1-3 High Speed Control Method for Superposing High-Frequency-High-Sinusoidal-Current with DC Current to Analyze Battery AC Impedance**
14:20 Jin Xu, Toshihiko Kishimoto, Noboru Shimosato
 Myway Plus Corporation, Japan

- 21G1-4 EV BMS with Time-Shared Isolated Converters for Active Balancing and Auxiliary Bus Regulation**
14:45 Z. Gong¹, B.A.C. van de Ven^{1,2}, Y. Lu¹, Y. Luo¹, K. Gupta¹, C. da Silva¹, H.J. Bergveld², O. Trescases¹
1) University of Toronto, Canada, 2) Eindhoven University of Technology, The Netherlands

Room H

Oral Session 21H1 Power Electronics and Applied to Home Appliances

Chair: Tomokazu Mishima (Kobe University)

Min Chen (Zhejiang University)

- 21H1-1 A Driving Circuit with Partial Power Regulation for RGB LED Lamps**
13:30 You-Chun Huang¹, Yu-Jen Chen², Yong-Jyun Li³, Chin-Sien Moo¹
1) National Sun Yat-Sen University, Taiwan, 2) Industrial Technology Research Institute, Taiwan, 3) Gemtek Technology Co., Ltd, Taiwan
- 21H1-2 FPGA-Based Dynamic Duty Cycle and Frequency Controller for a Class-E² DC-DC Converter**
13:55 Sanghyeon Park, Juan Rivas-Davila
Stanford University, USA
- 21H1-3 Design Methodology of 3 kW Induction Heating System for Both Low Resistance and High Resistance Containers in a Single Burner.**
14:20 Si-hoon Jeong, Hwa-pyeong Park, Jee-hoon Jung
Ulsan National Institute of Science and Technology, Korea
- 21H1-4 Multi-Resonant Inverter Realizing Downsizing and Loss Reduction for All-Metallic IH Cooktop**
14:45 Takayuki Hirokawa, Makoto Imai, Atsushi Fujita
Panasonic Corporation, Japan

Room K

Oral Session (Organized) 21K1 Advanced Power Conversion Systems Using SiC-MOSFET Devices: Fundamental and Applied Research I

Chair: Hirofumi Akagi (Tokyo Institute of Technology)

- 21K1-1 Temperature Estimation of Aluminum Electrolytic Capacitor under Actual Circuit Operation**
Invited Paper Kazuki Urata, Toshihisa Shimizu
13:30 Tokyo Metropolitan University, Japan
- 21K1-2 Design and Evaluation of Current Distribution in Power Module**
Invited Paper Takaaki Ibuchi, Eisuke Masuda, Tsuyoshi Funaki
13:55 Osaka University, Japan
- 21K1-3 Development of Impedance-Source Inverter Using SiC-MOSFET**
Invited Paper Ryuji Iijima, Thilak Senanayake, Takanori Isobe, Hiroshi Tadano
14:20 University of Tsukuba, Japan
- 21K1-4 Control Methodology for Realization of 100kW HEECS Chopper with 99.5% Efficiency**
Invited Paper Yukinori Tsuruta, Atsuo Kawamura
14:45 Yokohama National University, Japan
- 21K1-5 Iron Loss Reduction in the Cores of Induction Heating Coils for Small-Foreign-Metal Particle Detector with a 400-kHz SiC-MOSFETs High-Frequency Inverter**
Invited Paper
15:10 Takuya Shijo, Yuki Uchino, Yujiro Noda, Hiroaki Yamada, Toshihiko Tanaka
Yamaguchi University, Japan

Room A

Oral Session 21A2 Wireless Power Transfer Systems I

Chair: Keisuke Kusaka (*Nagaoka University of Technology*)

Yi Tang (*Nanyang Technological University*)

- 21A2-1 **Frequency Tracking Burst-Mode PDM-Controlled Class-D Zero Voltage Soft-Switching Resonant Converter for Inductive Power Transfer Applications**
15:55
Yoichiro Tabata, Tomokazu Mishima, Tatsuya Kido
Kobe University, Japan
- 21A2-2 **Reduced-Order Dynamical Models of Tuned Wireless Power Transfer Systems**
16:20
Hongchang Li, Jingyang Fang, Yi Tang
Nanyang Technological University, Singapore
- 21A2-3 **Dynamic Modelling and Closed Loop Control of Transmitter Parallel and Receiver Series Compensated IPT Topology for EV Applications**
16:45
Suwendu Samanta, Akshay Kumar Rathore
Concordia University, Canada
- 21A2-4 **Development of Inductive Power Transfer System for Excavator under Large Load Fluctuation -Consideration of Relationship between Load Voltage and Resonance Parameter-**
17:10
Jun-ichi Itoh, Kent Inoue, Keisuke Kusaka
Nagaoka University of Technology, Japan
- 21A2-5 **Wireless Power Transfer System Using Three-Phase to Single-Phase Matrix Converter**
17:35
Yuji Hayashi, Hiromasa Motoyama, Takaharu Takeshita
Nagoya Institute of Technology, Japan

Room B

Oral Session 21B2 Dual Active Bridge Converters

Chair: Takeo Kanai (*Toshiba Mitsubishi-Electric Industrial Systems Corporation*)

Katherine A. Kim (*Ulsan National Institute of Science and Technology*)

- 21B2-1 **Design of a Reduced-Order Observer for Sensorless Control of Dual-Active-Bridge Converter**
15:55
Nguyen Duy Dinh^{1,2}, Goro Fujita¹
1) Shibaura Institute of Technology, Japan, 2) Hanoi University of Science and Technology, Vietnam
- 21B2-2 **Improved Load Transient Response of a Dual-Active-Bridge Converter**
16:20
Sheng-Zhi Zhou, Chuan Sun, Song Hu, Guo Chen, Xiaodong Li
Macau University of Science and Technology, China
- 21B2-3 **Modulation and Active Midpoint Control of a Three-Level Three-Phase Dual-Active Bridge DC-DC Converter under Non-Symmetrical Load**
16:45
Philipp Joebges, Anton Gorodnichev, Rik W. De Doncker
RWTH Aachen University, Germany
- 21B2-4 **A Novel Switching Algorithm to Improve Efficiency at Light Load Conditions for Three- Phase DAB Converter in LVDC Application**
17:10
Hyun-jun Choi, Si-hoon Jung, Jee-hoon Jung
Ulsan National Institute of Science and Technology, Korea
- 21B2-5 **Design of a High-Frequency Dual-Active Bridge Converter with GaN Devices for an Output Power of 3:7kW**
17:35
Philipp Schülting, Christian Winter, Rik W. De Doncker
Aachen University, Germany

Oral Session 21C2 Magnetic Components

Chair: Koichi Shigematsu (*CYBERNETSYSTEMS Co. Ltd.*)

Alan Mantooth (*University of Arkansas*)

- 21C2-1** **Exploration of the Design and Performance Space of a High Frequency 166 kW / 10 kV SiC Solid-State Air-Core Transformer**
15:55
Piotr Czyz, Thomas Guillod, Florian Krismer, Johann W. Kolar
ETH Zürich, Switzerland
- 21C2-2** **Novel Calculation Method of Iron Loss of Gapped Inductors Using Loss Map**
16:20
Yoshihiro Miwa, Toshihisa Shimizu
Tokyo Metropolitan University, Japan
- 21C2-3** **Verification of the Reduction of the Copper Loss by the Thin Coil Structure for Induction Cookers**
16:45
Morimasa Hataya, Koki Kamaeguchi, Eiji Hiraki, Kazuhiro Umetani, Takayuki Hirokawa, Makoto Imai, Hideki Sadakata
1) Okayama University, Japan, 2) Panasonic Corporation, Japan
- 21C2-4** **Condition Monitoring of Electrolytic Capacitor Based on ESR Estimation and Thermal Impedance Model Using Improved Power Loss Computation**
17:10
Sundararajan Prasanth¹, Mohamed Halick Mohamed Sathik¹, Firman Sasongko¹, Tan Chuan Seng¹, Peng Yaxin¹, Rejeki Simanjourang²
1) Nanyang Technological University, Singapore, 2) Rolls-Royce Singapore Pte. Ltd., Singapore
- 21C2-5** **Test Setup for Characterisation of Biased Magnetic Hysteresis Loops in Power Electronic Applications**
17:35
Min Luo¹, Drazen Dujic¹, Jost Allmelting²
1) École Polytechnique Fédérale de Lausanne, Switzerland, 2) Plexim GmbH, Switzerland

Oral Session 21D2 Modeling, Simulation, EMI and Reliability -Reliability-

Chair: Koji Orikawa (*Hokkaido University*)

Frede Blaabjerg (*Aalborg University*)

- 21D2-1** **A Fast Open-Circuit Fault Diagnosis Scheme for Modular Multilevel Converters with Model Predictive Control**
15:55
Dehong Zhou, Shunfeng Yang, Yi Tang
Nanyang Technological University, Singapore
- 21D2-2** **An Online Open-Circuit Fault Diagnosis and Fault Tolerant Scheme for Three-Phase AC-DC Converters with Model Predictive Control**
16:20
Dehong Zhou, Yi Tang
Nanyang Technological University, Singapore
- 21D2-3** **The Lifetime Assessment of a Micro-Inverter for PV Applications**
16:45
Tohihiro Shimao¹, Koji Kato¹, Youichi Ito¹, Akio Iwabuchi¹, Yongheng Yang², Frede Blaabjerg²
1) Sanken Electric Co., Ltd., Japan, 2) Aalborg University, Denmark
- 21D2-4** **Online Health Monitoring of Multiple MOSFETs in a Grid-Tied PV Inverter Using Spread Spectrum Time Domain Reflectometry (SSTDR)**
17:10
Sourov Roy, Faisal Khan
University of Missouri, USA
- 21D2-5** **An Improved Equivalent Model for a Long PV String under Partial Shading Conditions**
17:35
Xiaoyang Wang, Huiqing Wen, Xingshuo Li
Xian Jiaotong-Liverpool University, China

Oral Session 21E2 IM Drives

Chair: Ibrahim Mohd Alsofyani (*Ajou University*)
Toshihiko Noguchi (*Shizuoka University*)

- 21E2-1 **Optimized Flux-Weakening Control of Induction Motor for Torque Enhancement in Voltage Extension Region**
15:55 Zhen Dong, Yong Yu, Bo Wang, Qinghua Dong, Dianguo Xu
Harbin Institute of Technology, China
- 21E2-2 **Improved Performance of CFTC-Based Direct Torque Control of Induction Machines by Increasing Torque Loop Bandwidth**
16:20 Ibrahim Mohd Alsofyani, June-Hee Lee, Kyo-Beum Lee
Ajou University, Korea
- 21E2-3 **μ -Analysis Evaluation of A Novel Combined Current-and-Speed Control for Induction Motors via ILQ Design Method**
16:45 Shuto Omori¹, Hiroshi Takami¹, Masashi Nakamura²
1) Shibaura Institute of Technology, Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan
- 21E2-4 **Loss Minimization Control of Sensorless Scalar-Controlled Induction Motor Drives Considering Iron Loss**
17:10 Nguyen Anh Tan, Dong-Choon Lee
Yeungnam University, Korea
- 21E2-5 **Tuning of Induction Motor Drive with Torque Sensor**
17:35 Hajime Kubo, Yugo Tadano
Meidensha Corporation, Japan

Oral Session 21F2 Control and Design Technologies for Industrial Applications

Chair: Hiroki Takahashi (*Yaskawa Electric Corporation*)
Laxman Maharjan (*Fuji Electric Co., Ltd.*)

- 21F2-1 **Quasi-Two-Level Converter for Overvoltage Mitigation in Medium Voltage Drives**
15:55 F. Bertoldi¹, M. Pathmanathan¹, R. S. Kanchan¹, K. Spiliotis², J. Driesen²
1) ABB Corporate Research, Sweden, 2) ESAT-ELECTA, Belgium
- 21F2-2 **A Medium-Voltage Three-Phase AC-DC Converter Consisting of Cascaded Three-Level Boost-Type Rectifiers and an Open-End Winding Transformer**
16:20 Ryoji Tsuruta¹, Hiromitsu Suzuki², Ritaka Nakamura²
1) Mitsubishi Electric Corp., Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan
- 21F2-3 **A Fault Tolerant Control Strategy for the Delta-Connected Cascaded Converter**
16:45 Ping-heng Wu, Po-tai Cheng
National Tsing Hua University, Taiwan
- 21F2-4 **Cooling Performance Improvement of Heat Sink by Oscillating Heat Pipe Addition and Design for Environment of Oscillating Heat Pipe Refrigerant**
17:10 Kuan-Chung Tey, Kenichiro Suzuki
Meidensha Corporation, Japan
- 21F2-5 **Compact Large Capacity Gas Turbine Static Starter**
17:35 Hironori Kawaguchi, Shigeyuki Nakabayashi, Akinobu Ando, Hiroshi Ogino, Yasuaki Matsumoto, Ikuto Udagawa, Takahiro Ohta
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

Oral Session 21G2 Applications of Grid-tied Inverters I

Chair: Takushi Jimichi (*Mitsubishi Electric Corporation*)

Kyungbae Lim (*Chungbuk National University*)

- 21G2-1 Voltage Reference Modification Scheme for Resonance Suppression in LCL-Filtered Inverters with Discontinuous PWM Method**
15:55
Hyeon-Sik Kim, Seung-Ki Sul
Seoul National University, Korea
- 21G2-2 Parametric Robustness Analysis for Parallel Feedforward Compensation Based Active Damping of LCL Grid Connected Inverter**
16:20
Muhammad Talib Faiz¹, Muhammad Mansoor Khan¹, Xu Jianming², Muhammad Ali¹, Houjun Tang¹
1) *Shanghai Jiaotong University, China.*, 2) *Changzhou Power Supply Company, China*
- 21G2-3 Open-Loop-Based Island-Mode Voltage Control Method for Single-phase Grid-Tied Inverter with Minimized LC Filter**
16:45
Satoshi Nagai, Jun-ichi Itoh
Nagaoka University of Technology, Japan
- 21G2-4 Experimental Validation of Adaptive Current Injecting Method for Grid-Synchronization Improvement of Grid-Tied REGS During Short-Circuit Fault**
17:10
Shaokang Ma¹, Hua Geng¹, Geng Yang¹, Bo Liu²
1) *Tsinghua University, China*, 2) *Zongheng Electro-Mechanical Technology Development Co., China*
- 21G2-5 Adaptive Control of Grid-Voltage Feedforward for Grid-Connected Inverters based on Real-Time Identifications of Grid Impedance**
17:35
Roni Luhtala, Tuomas Mess, Tomi Roinila
Tampere University of Technology, Finland

Oral Session 21H2 Motion Control Applications

Chair: Tadanao Zanma (*Chiba University*)

Tomoyuki Shimono (*Yokohama National University*)

- 21H2-1 Model Based Tuning of Proportional Resonant Controllers for Voltage Source Inverters**
15:55
Stefan Almér, Thomas Besselmann, Mario Schweizer
ABB Corporate Research, Switzerland
- 21H2-2 An SoC-Based Platform for Integrated Multi-Axis Motion Control and Motor Drive**
16:20
Yongping Sun, Ming Yang, Yangyang Chen, Wangpin He, Dianguo Xu
Harbin Institute of Technology, China
- 21H2-3 Variable Switching Frequency Strategy for Enhanced Settling Performance of Position Control within Inverter Loss Limit**
16:45
Choongin Lee, Jung-Ik Ha
Seoul National University, Korea
- 21H2-4 Two-Wheel Cane for Walking Assistance**
17:10
Phi Van Lam, Yasutaka Fujimoto
Yokohama National University, Japan
- 21H2-5 Fall Prevention and Vibration Suppression of Wheelchair Using Rider Motion State**
17:35
Isseki Takahashi, Toshiyuki Murakami
Keio University, Japan

Oral Session (Organized) 21K2 DC Grids as Future Grid Solutions

Chair: Masahide Hojo (*Tokushima University*)

Kai Sun (*Tsinghua University*)

21K2-1 Stabilization Method for Residential DC System Based on Passivity Criterion

Invited Paper Hiroaki Kakigano

15:55 *Ritsumeikan University, Japan*

21K2-2 A Novel Control Approach to Multi-Terminal Power Flow Controller for Next-Generation DC Power Network

Invited Paper Kenji Natori, Yuta Nakao, Yukihiro Sato

16:20 *Chiba University, Japan*

21K2-3 DC Microgrid for Telecommunications Service and Related Application

Invited Paper Keiichi Hirose

16:45 *NTT Facilities, Inc., Japan*

21K2-4 MVDC Distribution Grids for Electric Vehicle Fast-Charging Infrastructure

Invited Paper Marco Stieneker, Benedict J. Mortimer, Arne Hinz, Adolf Müller-Hellmann, Rik W. De Doncker

17:10 *RWTH Aachen University, Germany*

Tuesday, May 22: 10:40-12:45

Oral Session 22A1 High Frequency Converters

Chair: Kazuaki Mino (*Murata Manufacturing Co., Ltd.*)

Prasanth Thummala (*Technical University of Denmark*)

22A1-1 Review of Resonant Gate Driver in Power Conversion

10:40 Bainan Sun, Zhe Zhang, Michael A. E. Andersen

Technical University of Denmark, Denmark

22A1-2 A Low Profile High Frequency LED Driving System Based on Aircore Planar Inductor

11:05 Yueshi Guan, Xihong Hu, Shu Zhang, Yijie Wang, Dianguo Xu, Wei Wang

Harbin Institute of Technology, China

22A1-3 Analysis and Compensation of Dead-Time Effect in SiC-Device-Based High-Switching-Frequency Inverters

11:30 Qingzeng Yan^{1,2}, Xibo Yuan¹, Xiaojie Wu², Yiwen Geng²

1) *University of Bristol, UK*, 2) *China University of Mining and Technology, China*

22A1-4 Control and Performance of New Asymmetrical Operation for Switched-Capacitor-Based Resonant Converters

11:55 Hadi Setiadi, Hideaki Fujita

Tokyo Institute of Technology, Japan

22A1-5 High-Frequency Resonant Converter with Synchronous Rectification for High Conversion Ratio and Variable Load Operation

12:20 Lei Gu, Kawin Surakitbovorn, Juan Rivas-Davila

Stanford University, USA

Oral Session (Organized) 22B1 Application-Oriented Control Methods for Power Converters

Chair: Yaow-Ming Chen (*National Taiwan University*)

Koji Kato (*Sanken Electric Co., Ltd.*)

22B1-1 Smart PV Inverters for Smart Grid Applications

Invited Paper Cheng-Jhen Yang¹, Terng-Wei Tsai¹, Yi-Chan Li¹, Cheng-Yu Tang², Yaow-Ming Chen¹, Yung-Ruei Chang³

10:40 1) *National Taiwan University, Taiwan*, 2) *Feng Chia University, Taiwan*, 3) *Atomic Energy Council, Taiwan*

22B1-2 High-Voltage Bi-Directional Half-Bridge Three-Level Series Resonant Converter with Frequency Modulation

Invited Paper **Control**

11:05 Sih-Yi Lee¹, Jynu-Jhe Jhang¹, Jing-Yuan Lin¹, Yao-Ching Hsieh², Haung-Jen Chiu¹

1) National Taiwan University of Science and Technology, Taiwan, 2) National Sun Yat-Sen University, Taiwan

22B1-3 A Control Strategy for Flying-Start of Shaft Sensorless Permanent Magnet Synchronous Machine Drive

Invited Paper Zih-Cing You, Sheng-Ming Yang

11:30 National Taipei University of Technology, Taiwan

22B1-4 Contactless EV Power Track System with Segment-Excited Inductively Coupled Structure

Invited Paper Jia-You Lee, Yu-Chi Wang, Chih-Yi Liao

11:55 National Cheng Kung University, Taiwan

Room C

Oral Session (Organized) 22C1 Motion Control I

Chair: Kenji Natori (Chiba University)

Toshimasa Miyazaki (Nagaoka University of Technology)

22C1-1 Driving Test Evaluation of Sensorless Vehicle Detection Method for In-Motion Wireless Power Transfer

Invited Paper Katsuhiro Hata¹, Kensuke Hanajiri¹, Takehiro Imura¹, Hiroshi Fujimoto¹, Yoichi Hori¹, Motoki Sato²,

10:40 Daisuke Gunji³

1) The University of Tokyo, Japan, 2) Toyo Denki Seizo, Japan, 3) NSK Ltd., Japan

22C1-2 A System Design Method of High-Frequency Class-D Inverter for Wideband Current Control

Invited Paper Hiroki Kurumatani, Seiichiro Katsura

11:05 Keio University, Japan

22C1-3 Analysis of Interior Permanent Magnet Two Degrees of Freedom Motor Based on Cross-Coupled Structure

Invited Paper Yoshiyuki Hatta^{1,2}, Tomoyuki Shimono^{1,2}

11:30 1) Yokohama National University, Japan, 2) Kanagawa Institute of Industrial Science and Technology, Japan

22C1-4 Study Comparison between Firefly Algorithm and Particle Swarm Optimization for SLAM Problems

Invited Paper Mounia Janah, Yasutaka Fujimoto

11:55 Yokohama National University, Japan

22C1-5 Bandwidth Limitations in Force Control of a Series Elastic Actuator with Backlash and Quantization

Invited Paper Hanul Jung, Chan Lee, Sehoon Oh

12:20 DGIST, Korea

Room D

Oral Session 22D1 PM Machines

Chair: Kyohei Kiyota (University of Toyama)

Shoji Shimomura (Shibaura Institute of Technology)

22D1-1 Rotor Shape Optimization of Interior Permanent Magnet Synchronous Motors with Concentrated Windings by

10:40 **Considering End-Leakage Flux**

Katsumi Yamazaki, Hiroki Narushima

Chiba Institute of Technology, Japan

22D1-2 Loss Analysis of Permanent-Magnet Synchronous Machines Considering In-plane Eddy Current in Electrical Steel Sheets

11:05 Hideki Ohguchi¹, Satoshi Imamori¹, Katsumi Yamazaki², Haiyan Yui², Masao Shuto¹

1) Fuji Electric Co., Ltd., Japan, 2) Chiba Institute of Technology, Japan

22D1-3 Study on Influence of Difference in Structure of Concentrated Winding IPMSMs Obtained by Automatic Design

11:30 A. Ura, M. Sanada, S. Morimoto, Y. Inoue

Osaka Prefecture University, Japan

22D1-4 Carrier Harmonic Loss Reduction Technique on Dual Three-Phase Permanent-Magnet Synchronous Motors with Phase-Shift PWM

11:55 Yoshihiro Miyama^{1,2}, Haruyuki Kometani¹, Kan Akatsu²

1) Mitsubishi Electric Corporation, Japan, 2) Shibaura Institute of Technology, Japan

22D1-5 Flux Intensifying PM-Motor with Variable Leakage Magnetic Flux Technique

12:20 Masahiro Aoyama¹, Toshihiko Noguchi²

1) *Suzuki Motor Corporation, Japan*, 2) *Shizuoka University, Japan*

Room E

Oral Session (Organized) 22E1 Analysis and Control of Advanced Motor Drive Systems

Chair: Akio Toba (*Fuji Electric Co., Ltd.*)

Guisepe Guidi (*SINTEF Energy Research*)

22E1-1 Continuous Operation Control of PMSM in the Case of DC Power Supply Loss

Invited Paper Jongwon Heo, Keiichiro Kondo

10:40 *Chiba University, Japan*

22E1-2 Model Predictive Control for Multiphase Motor Drives – a Technology Status Review

Invited Paper A. Tenconi, S. Rubino, R. Bojoi

11:05 *Politecnico di Torino, Italy*

22E1-3 Influence of Fast Switching Semiconductors on the Winding Insulation System of Electrical Machines

Invited Paper Kay Hameyer, Andreas Ruf, Florian Pauli

11:30 *RWTH Aachen University, Germany*

22E1-4 Centralized Control of Modular Multi Rectifier for Motor Drive Applications under Unbalanced Grid

Invited Paper Yipeng Song, Pooya Davari, Frede Blaabjerg

11:55 *Aalborg University, Denmark*

22E1-5 Vector Control of Magnetically Modulated Motor for Power Splitting of HEV Application

Invited Paper Toshihiko Noguchi, Sawanth Krishna Machavolu, Masahiro Aoyama, Yuto Motohashi

12:20 *Shizuoka University, Japan*

Room F

Oral Session (Organized) 22F1 Grid-tied Converters with Virtual Inertia

Chair: Yushi Miura (*Osaka University*)

Rolando Burgos (*Virginia Tech, CPES*)

22F1-1 Impedance-Based Stability Evaluation of Virtual Synchronous Machine Implementations in Converter

Invited Paper **Controllers**

10:40 Eneko Unamuno¹, Atle Rygg², Mohammad Amin³, Marta Molinas², Jon Andoni Barrena¹

1) *Mondragon Unibertsitatea, Spain*, 2) *Norwegian University of Science and Technology, Norway*, 3) *Illinois Institute of Technology, USA*

22F1-2 Stable Power Supply Method for Household Appliances via Virtual Synchronous Generator in Single-Phase

Invited Paper **Three-Wire Microgrid**

11:05 Yuko Hirase¹, Hidehiko Nakagawa¹, Eiji Yoshimura¹, Shogo Katsura¹, Kensho Abe¹, Osamu Noro¹, Kazushige Sugimoto², Kenichi Sakimoto²

1) *Kawasaki Technology Co., Ltd., Japan*, 2) *Kawasaki Heavy Industries, Ltd., Japan*

22F1-3 A Novel Oscillation Damping Method of Virtual Synchronous Generator Control without PLL Using Pole Placement

Invited Paper Jia Liu, Yushi Miura, Toshifumi Ise

Osaka University, Japan

22F1-4 Operation of a Modular Multilevel Converter Controlled as a Virtual Synchronous Machine

Invited Paper Salvatore D'Arco¹, Giuseppe Guidi¹, Jon Are Suul^{1,2}

11:55 1) *Energy Research, Norway*, 2) *Norwegian University of Science and Technology, Norway*

22F1-5 Assessment of Virtual Synchronous Machine Based Control in Grid-Tied Power Converters

Invited Paper Chi Li, Igor Cvetkovic, Rolando Burgos, Dushan Boroyevich

12:20 *Virginia Tech, USA*

Oral Session (Organized) 22G1 Conversion Technologies for Renewable Energy and Energy Saving I

Chair: Nobumasa Matsui (*Nagasaki Institute of Applied Science*)
Liuchen Chang (*University of New Brunswick*)

- 22G1-1 Research on the Blockchain-Based Integrated Demand Response Resources Transaction Scheme**
Invited Paper Shengnan Zhao¹, Yang Li¹, Beibei Wang¹, Huiling Su²
10:40 1) Southeast University, China, 2) Jiangsu Electric Power Research Institute, China
- 22G1-2 Indirect Current Control for Seamless Transfer of Utility Interactive Inverter**
Invited Paper Kyungbae Lim, Injong Song, Jaeho Choi
11:05 Chungbuk National University, Korea
- 22G1-3 Study of AC Power Interchange and DC Power Interchange for Micro Grid Systems**
Invited Paper Kazuto Yukita, Daiki Owaki, Shunsuke Horie, Toshiro Matsumura, Yasuyuki Goto
11:30 Aichi Institute of Technology, Japan
- 22G1-4 Stability Enhancement Strategy for Islanding Microgrid with Multi-Type Inverters Based on Hybrid Impedance Modelling**
Invited Paper Meiqin Mao, Yong Ding, Yatao Shen, Liuchen Chang
11:55 Hefei University of Technology, China
- 22G1-5 DC Powered Data Center with 200 kW PV Panels**
Invited Paper Keiichi Hirose
12:20 NTT Facilities, Inc., Japan

Oral Session 22H1 DC-DC Converters for Information and Communication Systems

Chair: Jun Imaoka (*Nagoya University*)
Veerachary Mummadi (*Indian Institute Technology, Delhi*)

- 22H1-1 Influences of Deterioration in Capacitor and Inductor on Current Sensorless Static Model DC-DC Converter**
10:40 Fujio Kurokawa¹, Masashi Taguchi², Jizhe Wang², Hidenori Maruta², Nobumasa Matsui¹
1) Nagasaki Institute of Applied Science, Japan, 2) Nagasaki University, Japan
- 22H1-2 Capacitive Divider Based Passive Start-Up Methods for Flying Capacitor Step-Down DC-DC Converter Topologies**
11:05 Michael Halamicek, Tom Moiannou, Nenad Vukadinović, Aleksandar Prodić
University of Toronto, Canada
- 22H1-3 High Voltage Gain Interleaved Active-Clamp Forward (IACF) Converter Having Reduced Primary Conduction Loss**
11:30 Yeonho Jeong¹, Mu-Hyun Park¹, Gun-Woo Kim¹, Byoung-Hee Lee², Gun-Woo Moon¹
1) KAIST, Korea, 2) Han-Bat University, Korea
- 22H1-4 Control of Switching-Capacitor Based Buck-Boost Converter**
11:55 M. Veerachary, Vasudha Khubchandani
Indian Institute of Technology Delhi, India
- 22H1-5 Improvement of Upload Transient Responses for Ultra High Step-Down Converter**
12:20 Y. T. Yau¹, K. I. Hwu²
1) Asian Power Devices Inc., Taiwan, 2) National Taipei University of Technology, Taiwan

Oral Session (Organized) 22K1 Technology Trend of Near Future Home and Consumer Appliances

Chair: Hideki Omori (*Osaka Institute of Technology*)
Huang-Jen Chiu (*National Taiwan University of Science & Technology*)

- 22K1-1 Power Electronics and Control Technologies for Household Washer**
Invited Paper Toru Niki
10:40 Hitachi Appliances, Inc., Japan

- 22K1-2 Development of Room Air Conditioner with Twin-Propeller Fans**
Invited Paper Takamasa Uemura, Tomoya Fukui, Kenichi Sakoda
 11:05 Mitsubishi Electric Corporation Advanced Technology R&D Center, Japan
- 22K1-3 Electrolytic Capacitor-Less Single-Phase to Three-Phase Inverter with Harmonics Suppression Control for Air Conditioner**
Invited Paper
 11:30 Nobuo Hayashi, Takuro Ogawa, Tomoisa Taniguchi, Morimitsu Sekimoto
 Daikin Industries, Ltd., Japan
- 22K1-4 Latest Development of SiC Power Module-Based Single-Stage AC-AC Resonant Converter for High-Frequency Induction Heating Applications**
Invited Paper
 11:55 Tomokazu Mishima
 Kobe University, Japan
- 22K1-5 An Optimized Control Strategy to Improve the Current Zero-Crossing Distortion in Bidirectional AC/DC Converter Based on V2G Concept**
Invited Paper
 12:20 Lei Jing, Xiaoqing Wang, Bodong Li, Maohang Qiu, Bo Liu, Min Chen
 Zhejiang University, China

Tuesday, May 22: 13:00-14:20

Room P

Poster Session 22P1 DC-AC Converters I

Chair: Kazuto Takagi (Sanken Electric Co., Ltd.)

Georgios Konstantinou (University of New South Wales)

- 22P1-1 Per-Phase Control Strategy of the Three-Phase Four-Wire Inverter**
 Yi-Chan Li¹, Terng-Wei Tsai¹, Cheng-Jhen Yang¹, Yaow-Ming Chen¹, Yung-Ruei Chang²
 1) National Taiwan University, Taiwan, 2) Institute of Nuclear Energy Research, Atomic Energy Council, Taiwan
- 22P1-2 Opportunities for Performance Improvement of Single-Phase Power Converters through Enhanced Automatic-Power-Decoupling Control**
 Huawei Yuan¹, Sinan Li¹, Wenlong Qi¹, Siew-Chong Tan¹, S. Y. (Ron)Hui^{1,2}
 1) The University of Hong Kong, China, 2) Imperial College London, UK
- 22P1-3 Zero Voltage Switching Scheme for Flyback Converter to Ensure Compatibility with Active Power Decoupling Capability**
 Hiroki Watanabe, Jun-ichi Itoh
 Nagaoka University of Technology, Japan
- 22P1-4 Model Predictive Fault Tolerant Control of Bidirectional AC/DC Converter with Voltage Balance of Split Capacitor**
 Nan Jin, Chongyan Zhao, Leilei Guo
 Zhengzhou University of Light Industry, China

Poster Session 22P2 DC-AC Converters II

Chair: Kazuto Takagi (Sanken Electric Co., Ltd.)

Georgios Konstantinou (University of New South Wales)

- 22P2-1 PWM Strategy for Parallel Operation of Three Phase Converters Tied to Grid**
 Hyun-Sam Jung, Seung-Ki Sul
 Seoul National University, Korea
- 22P2-2 Practical Issues and Implementation Circuits of the Digital-Analog Hybrid Full Feed-Forward Method with Unipolar and Bipolar Modulations**
 Xin Zhang¹, Henry S. H. Chung², ZhiXun Ma¹
 1) Nanyang Technological University, Singapore, 2) City University of Hong Kong, Hong Kong
- 22P2-3 An AC-DC Power Converter for Electrolytic Capacitor-less LED Driver with High Luminous Efficacy**
 Kwon-Sik Park, Byuong-Jun Seo, Kyoung-Suk Kang, Eui-Cheol Nho
 Pukyong National University, Korea

Poster Session 22P3 DC-DC Converters I

Chair: Nobuyuki Kurita (*Gunma University*)
Duy-Dinh Nguyen (*Shibaura Institute of Technology*)

- 22P3-1 **An Improved Cascaded Dual-Buck Inverter**
Usman Ali Khan¹, Honnyong Cha¹, Ashraf Ali Khan², Heung-Geun Kim³, Wilson Eberle¹, Liwei Wang²
1) *Kyungpook National University, Korea*, 2) *The University of British Columbia, Canada*
- 22P3-2 **A Single-Switch Integrated-Stage LED Driver Based on Cuk and Class-E Converter**
Shu Zhang, Yijie Wang, Xiaosheng Liu, Yan Zhou, Dianguo Xu
Harbin Institute of Technology, China

Poster Session 22P4 Grid-tied Converters I

Chair: Hiroaki Matsumori (*Nagoya Institute of Technology*)
Hongchang Li (*Nanyang Technological University*)

- 22P4-1 **A Fault-Tolerant Parallel Inverter Applied to Micro-Grid**
Yan Li, Xiangyue Shi, Jinjie Peng, Zhifeng Qiu, Wei Xiong
Central South University, China
- 22P4-2 **Stability Analysis of Grid-Connected Converters with Add-on Voltage Support Functionality Using Repetitive Control**
Y. Zhang, M. G. L. Roes, M. A. M. Hendrix, J. L. Duarte
Eindhoven University of Technology, The Netherlands
- 22P4-3 **Adaptive Series Stabilizer Module for the Grid Connected Inverter under Variable Grid Conditions**
Xin Zhang
Nanyang Technological University, Singapore
- 22P4-4 **An Improved Droop Control Based Smooth Transfer Control Strategy**
Xin Meng, Jinjun Liu, Zeng Liu, Ronghui An
Xi'an Jiaotong University, China
- 22P4-5 **Frequency Response Analysis of Load Effect on Dynamics of Grid-Forming Inverter**
Matias Berg, Tuomas Messo, Teuvo Suntio
Tampere University of Technology, Finland

Poster Session 22P5 Isolated DC-DC Converters I

Chair: Prasanth Thummala (*Technical University of Denmark*)
Guan-Chyun Hsieh (*Chung Yuan Christian University*)

- 22P5-1 **A New Control Method for Triple-Active Bridge Converter with Feed Forward Control**
Takanobu Ohno, Nobukazu Hoshi
Tokyo University of Science, Japan
- 22P5-2 **Analysis of PFM Operation Model for Capacitor Charger Resonant Topology with Energy Dosage**
Pengyu Jia, Yiqin Yuan, Shengwen Fan, Zhenyu Shan
North China University of Technology, China
- 22P5-3 **An Active-Clamped Current-Fed Half-bridge DC-DC Converter With Three Switches**
Truong-Duy Duong¹, Minh-Khai Nguyen², Young-Cheol Lim¹, Joon-Ho Choi¹
1) *Chonnam National University, Korea*, 2) *Chosun University, Korea*

Poster Session 22P6 Isolated DC-DC Converters II

Chair: Prasanth Thummala (*Technical University of Denmark*)
Guan-Chyun Hsieh (*Chung Yuan Christian University*)

- 22P6-1 **A High Gain Quasi Single Stage LLC Resonant DC/DC Converter with Coupled Inductor and Partial Active Clamp**
Chongcan Huo, Xiaogao Xie, Shuai Jiang, Hanjing Dong
Hangzhou Dianzi University, China
- 22P6-2 **Suppression of Ripple Current in High Step-Up DC-DC Converter Utilizing Cockcroft-Walton Circuit with Inductor**
Takumi Yasuda, Masataka Minami, Shin-ichi Motegi, Masakazu Michihira
Kobe City College of Technology, Japan

- 22P6-3 An Optimal Design Method Considering Transformer Parasitic Capacitance of LLC Resonant Converters**
Naizeng Wang, Xu Yang, Mofan Tian, Haiyang Jia, Guangzhao Xu, Zhenwei Li
Xi'an Jiaotong University, China

Poster Session 22P7 Multi-level Converters and MMC I

Chair: Somboon Sangwongwanich (*Chulalongkorn University*)

Eui-Cheol Nho (*Pukyong National University*)

- 22P7-1 Comparison of Harmonic Linearization and Harmonic State Space Methods for Impedance Modeling of Modular Multilevel Converter**
Jing Lyu¹, Xin Zhang², Jingjing Huang², Jianwen Zhang¹, Xu Cai¹
1) *Shanghai Jiao Tong University, China*, 2) *Nanyang Technological University, Singapore*
- 22P7-2 An Improved Phase-Shifted PWM for a Five-level Hybrid-Clamped Converter**
Kui Wang¹, Nianzhou Liu², Zedong Zheng¹, Yongdong Li¹
1) *Tsinghua University, China*, 2) *Wuhan Institute of Marine Electric Propulsion, China*
- 22P7-3 Integrated Control Methods for Asymmetrical Cascaded H-bridge Rectifier**
Wenjing Dai, Jie Chen, Xin Chen, Chunying Gong
Nanjing University of Aeronautics and Astronautics, China
- 22P7-4 Transient Voltage Stress Modeling for Submodules of Modular Multilevel Converters under Grid Voltage Sags**
Zhijian Yin, Yongheng Yang, Huai Wang
Aalborg University, Denmark
- 22P7-5 SVPWM Strategy Based on Multilevel 3LNPC-CR**
Xiaoqiong He^{1,2}, Pengcheng Han¹, Xiaolan Lin¹, Yi Wang¹, Xu Peng¹
1) *Southwest Jiaotong University, China*, 2) *National Rail Transit Electrification and Automation Engineering Technique Research Center, China*

Poster Session 22P8 Multi-level Converters and MMC II

Chair: Somboon Sangwongwanich (*Chulalongkorn University*)

Eui-Cheol Nho (*Pukyong National University*)

- 22P8-1 The Multiple Degree of Freedom Based Neutral Point Potential Control of Three Level Neutral Point Clamped Converters**
Bo Guan, Shinji Doki
Nagoya University, Japan
- 22P8-2 A Modified Phase-Shifted PWM Technique for the Grid-Connected Hybrid Cascaded Converter**
Yu-chen Su, Po-tai Cheng
National Tsing Hua University, Taiwan
- 22P8-3 Novel T-type Dual-Buck Inverter with Minimum Number of Inductors**
Tien-The Nguyen¹, Honnyong Cha¹, Bang Le-Huy Nguyen¹, Heung-Geun Kim²
1) *Kyungpook National University, Korea*, 2) *Kyungpook National University, Korea*
- 22P8-4 Control of Direct AC/AC Modular Multilevel Converter in Railway Power Supply System**
Shuguang Song, Jinjun Liu, Shaodi Ouyang, Xingxing Chen, Baojin Liu
Xi'an Jiaotong University, China

Poster Session 22P9 Other Converters

Chair: Hideaki Fujita (*Tokyo Institute of Technology*)

Xin Zhang (*Nanyang Technological University*)

- 22P9-1 Research on Low Input Current Ripple Two-Stage Converter for Low Frequency Pulsed Power Applications**
Yu Gu, Donglai Zhang, Xiaorui Zhu
Harbin Institute of Technology, China
- 22P9-2 Wireless Power Transfer: Critical Review of Related Standards**
Mohamad Abou Houran, Xu Yang, Wenjie Chen, Mehdi Samizadeh
Xi'an Jiaotong University, China

- 22P9-3 Comparative Study of Single-Phase Fundamental Component Frequency Estimation Schemes under Time-varying Harmonic Distortion Operation**
E. B. Kapisch^{1,2}, J. L. Duarte¹, C. A. Duque²
1) Eindhoven University of Technology, The Netherlands, 2) Federal University of Juiz de Fora, Brazil
- 22P9-4 A Comprehensive Dead-Time Compensation Method for a Three-Phase Dual-Active Bridge Converter with Hybrid Modulation Schemes**
Jingxin Hu, Zhiqing Yang, Rik W. De Doncker
RWTH Aachen University, Germany

Poster Session 22P10 Passive Components

Chair: Juergen Biela (*ETH Zürich*)

Satoshi Matsumoto (*Kyushu Institute of Technology*)

- 22P10-1 Evaluation of a High-Frequency Reactor with a New Wire Guide for a Toroidal Core**
Hideki Ayano, Akira Fujimura, Yoshihiro Matsui
National Institute of Technology, Tokyo College, Japan
- 22P10-2 Core Loss Evaluation in Powder Cores: A Comparative Comparison between Electrical and Calorimetric Methods**
Yuki Ishikura¹, Jun Imaoka², Mostafa Noah¹, Masayoshi Yamamoto¹
1) Nagoya University, Japan, 2) Kyushu University, Japan
- 22P10-4 Modeling, Magnetic Design, and Simulation Methods Considering DC Superimposition Characteristic of Powder Cores Used in Power Converters**
Jun Imaoka¹, Kenkichi Okamoto¹, Masahito Shoyama¹, Yuki Ishikura², Mostafa Noah², Masayoshi Yamamoto²
1) Kyushu University, Japan, 2) Nagoya University, Japan
- 22P10-5 Modelling and Design of a Medium Frequency Transformer for High Power DC-DC Converters**
Miloš Stojadinović, Jürgen Biela
ETH Zürich, Switzerland
- 22P10-6 Evaluation of Inductor Losses on Z-source Inverter Considering AC and DC Components**
Ryuji Iijima, Naoki Kamoshida, Rene Alexander Barrera Cardenas, Takanori Isobe, Hiroshi Tadano
University of Tsukuba, Japan
- 22P10-7 An Integrating Structure of Output Filter for Grid Connected Inverter Based on FMLF Technique**
Jie Ma, Yenan Chen, PingPing Chen, Wenxing Zhong, Dehong Xu
Zhejiang University, China

Poster Session 22P11 Wide Band Gap Devices I

Chair: Konstantin Kostov (*The Mads Clausen Institute, SDU Electrical Engineering*)

Hiroshi Tadano (*University of Tsukuba*)

- 22P11-1 New Screening Method for Improving Transient Current Sharing of Paralleled SiC MOSFETs**
Junji Ke, Zhibin Zhao, Peng Sun, Huazhen Huang, James Abuogo, Xiang Cui
North China Electric Power University, China
- 22P11-2 PSpice Modeling and Application for SiC Power MOSFET to Evaluate the Power Loss in Full-Bridge Converter**
Juan Wei¹, Fei Lin¹, Zhongping Yang¹, Xianjin Huang¹, Chanjuan Xiao², Hao Zhang², Wencai Liang²
1) Beijing Jiaotong University, China, 2) CRRC Qingdao Sifang Co., Ltd, China
- 22P11-3 All-SiC Module Packaging Technology**
Kento Shirata, Norihiro Nashida, Hideyo Nakamura, Yoshitaka Nishimura
Fuji Electric Co., Ltd., Japan

Poster Session 22P12 Packaging and Circuit Integration I

Chair: Yongheng Yang (*Aalborg University*)

Keiji Wada (*Tokyo Metropolitan University*)

- 22P12-1 A New Smallest 1200V Intelligent Power Module for Three Phase Motor Drives**
Minsub Lee, Miran Baek, Junbae Lee, Daewoong Chung
Infineon Power Semitech, Korea

- 22P12-2 Design and Enhancement of ESD Reliability in Circular UHV 300-V nLDMOS Power Components**
Shen-Li Chen¹, Yi-Hao Chao¹, Chih-Ying Yen¹, Jen-Hao Lo², Chun-Ting Kuo², Yu-Lin Lin¹, Yi-Hao Chiu¹,
Pei-Lin Wu¹, Yu-Lin Jhou¹
1) National United University, Taiwan, 2) Peking University, China
- 22P12-3 A Technology Analysis of Voltage Sharing in Series Connected Power Devices**
Z Davletzhanova, O Alatisse, R Bonyadi, J Ortiz-Gonzalez, T Dai, M Jennings, L Ran, P Mawby
University of Warwick, UK
- 22P12-4 Failure Mechanism Analysis and Physics-of-Failure Lifetime Prediction Method for Press-Pack Thyristor of Converter Valve**
Ning Liang¹, Zhigang Zhang², Yating Gou², Cuicui Liu², Zebin Yang², Jiangnan Chen², Fang Zhuo², Feng Wang²
1) M&T Center of EHV Power Transmission Company, China, 2) Xi'an Jiaotong University, China
- 22P12-5 Surge Voltage Absorption by a Silicon Carbide Avalanche-Diode with P-N Structure**
K. Koseki, Y. Tanaka
National Institute of Advanced Industrial Science and Technology (AIST), Japan

Poster Session 22P13 Modeling, Simulation, EMI, and Reliability

Chair: Noriyuki Kimura (*Osaka Institute of Technology*)
Xiongfei Wang (*Aalborg University*)

- 22P13-1 Calculation of Thyristor Reliability Parameter of UHVDC Converter Valve in HEMP Environment**
Zhigang Zhang¹, Yating Gou¹, Cuicui Liu¹, Zebin Yang¹, Xiaotong Du¹, Jiangnan Chen¹, Fang Zhuo¹, Feng Wang¹,
Yuanliang Lan², Caiwang Sheng²
1) Xi'an Jiaotong University, China, 2) Global Energy Interconnection Research Institute Co. Ltd, China
- 22P13-2 Generalized Stackelberg Game-theoretic Approach for Jointed Energy and Reserve Coordination of Electric Vehicles**
Tianyang Zhao¹, Xuwei Pan², Lei Li², Fei Zhao², Can Wang²
1) Nanyang Technology University, Singapore, 2) Harbin Institute of Technology, China
- 22P13-3 Impedance Influence Analysis of Phase-Locked Loops on Three-Phase Grid-Connected Inverters**
Yuncheng Wang, Xin Chen, Yang Zhang, Jie Chen, Chunying Gong
Nanjing University of Aeronautics and Astronautics, China

Poster Session 22P14 Motor Control and Drives I

Chair: Xi Xiao (*Tsinghua University*)
Masaru Hasegawa (*Chubu University*)

- 22P14-1 Pulse-Injection-Based Sensorless Control Method with Improved Dynamic Current Response for PMSM**
Hechao Wang, Kaiyuan Lu, Dong Wang, Frede Blaabjerg
Aalborg University, Denmark
- 22P14-2 Influence of Parameter Variations on Operating Characteristics of MTPF Control for DTC-Based PMSM Drive System**
Keisuke Fujii, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada
Osaka Prefecture University, Japan
- 22P14-3 A Quiet Position Sensorless Control for an IPMSM Based on Extended EMF and Voltage Injection Synchronized with PWM Carrier**
Yuki Ishii, Hiroki Yamashita, Hisao Kubota
Meiji University, Japan
- 22P14-4 Study of Torque Ripple Reduction and Torque boost by Modified Trapezoidal Modulation**
Satoshi Joryo, Kazuto Tatsumi, Toshimitsu Morizane, Katsunori Taniguchi, Noriyuki Kimura, Hideki Omori
Osaka Institute of Technology, Japan
- 22P14-5 Fault Diagnosis Method of Current Sensor for Permanent Magnet Synchronous Motor Drives**
Guoqiang Zhang¹, Guoxin Wang¹, Gaolin Wang¹, Junya Huo^{1,2}, Lianghong Zhu², Dianguo Xu¹
1) Harbin Institute of Technology, China, 2) GD Midea Air-Conditioning Equipment Co., Ltd., China
- 22P14-6 Sensorless Speed Control of Diesel-Generator Systems Based on Multiple SOGI-FLLs**
Ngoc Dat Dao¹, Dong-Choon Lee¹, Dae-Sik Lim²
1) Yeungnam University, Korea, 2) Bokuk Electric Industrial Company, Korea

- 22P14-7 Robustness of Simplified Speed-Sensorless Vector Control for Induction Motor**
Naoki Akao, Mineo Tsuji, Shin-ichi Hamasaki
Nagasaki University, Japan
- 22P14-8 Maximum Torque Control Reference Frame Based on a Torque Map for IPMSMs with Large Inductance Variation**
Kazuki Ohta¹, Takumi Ohnuma¹, Shinji Doki²
1) National Inst. of Tech., Japan, 2) Nagoya University, Japan

Poster Session 22P15 Motor Control and Drives II

Chair: Dong-Choon Lee (*Yeungnam University*)
Syuhei Shinmyo (*Keio University*)

- 22P15-1 PMSM Model Discretization in Consideration of Park Transformation for Current Control System**
Masamichi Inoue, Shinji Doki
Nagoya University, Japan
- 22P15-2 Pseudo-Random High-Frequency Sinusoidal Voltage Injection Based Sensorless Control for IPMSM Drives**
Guoqiang Zhang¹, Huiying Wang¹, Gaolin Wang¹, Junya Huo^{1,2}, Lianghong Zhu², Dianguo Xu¹
1) Harbin Institute of Technology, China, 2) GD Midea Air-Conditioning Equipment Co., Ltd., China
- 22P15-3 AT-NPC 3-Level Inverter-Fed Induction Motor Vector Control with Neutral Point Voltage Control**
K. Sudo¹, M. Tsuji¹, S. Hamasaki¹, T. Fukuoka¹, H. Ichinose²
1) Nagasaki University, Japan, 2) Mitsubishi Electric Engineering Co., Ltd, Japan
- 22P15-4 Investigation of Various Position Estimation Accuracy Issues in Pulse-Injection-Based Sensorless Drives**
Hechao Wang, Kaiyuan Lu, Dong Wang, Frede Blaabjerg
Aalborg University, Denmark
- 22P15-5 Position Sensorless Control of Switched Reluctance Motor Using Estimated PWM Phase Voltage**
Y. Nakazawa¹, K. Ohyama², H. Fujii³, H. Uehara³, Y. Hyakutake³
1) National Institute of Technology, Akita College, Japan, 2) Fukuoka Institute of Technology, Japan, 3) Meiwa Manufacturing Co., Ltd, Japan
- 22P15-6 Experimental Confirmation of Thrust and Attractive Force Control of Linear Induction Motor by Two Different Frequency Components**
Kenta Sannomiya, Toshimitsu Morizane, Noriyuki Kimura, Hideki Omori
Osaka Institute of Technology, Japan
- 22P15-7 GA Based Optimized Trajectories of Rotating Speed and d - q Axis Currents for an IPMSM**
Shuta Kumagai, Kaoru Inoue, Toshiji Kato
Doshisha University, Japan
- 22P15-8 2-Degree-of-Freedom Deadbeat Control with Disturbance Compensation for PMSM Drive System Using FPGA**
Arata Takahashi, Shotaro Takakura, Tomoki Yokoyama
Tokyo Denki University, Japan

Poster Session 22P16 Motor Control and Drives III

Chair: Gaolin Wang (*Harbin Institute of Technology*)
Takumi Ohnuma (*National Institute of Technology, Numazu College*)

- 22P16-1 Extended EMF-Based Simple IPMSM Sensorless Vector Control Using Compensated Current Controller**
Takatoshi Inoue, Yasumasa Hamabe, Mineo Tsuji, Shin-ichi Hamasaki
Nagasaki University, Japan
- 22P16-2 Full-Band Output Impedance Model of Virtual Synchronous Generator in dq Framework**
Li Wenbing¹, Wang Jianhua¹, Song Jingyu², Luo Fangfang¹, Gao Shang¹, Wu Zaijun¹
1) Southeast University, China, 2) China State Shipbuilding Co., Ltd., China
- 22P16-3 An MTPA Control Method of a PMSM and a SynRM Based on a DTC in the Stator Flux Linkage Synchronous Frame**
Gimpei Itoh, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada
Osaka Prefecture University, Japan
- 22P16-4 EEMFs Excited by Signal Injection for Position Sensorless Control of PMSMs and Their Performance Comparison by Using Imaginary Electromotive Force**
Takumi Nimura¹, Shota Kondo¹, Shinji Doki¹, Mutuwo Tomita²
1) Nagoya University, Japan, 2) National Institute of Technology, Gifu College, Japan

- 22P16-5 Harmonic Current Cancellation Method for PMSM Drive System Using Resonant Controllers**
Dongsheng Li¹, Yoshitaka Iwaji¹, Yasuo Notohara¹, Ken Kishita²
1) Hitachi, Ltd., Japan, 2) Hitachi-Johnson Controls Air Conditioning, Inc., Japan
- 22P16-6 Estimation Error Analysis of Stator Flux Observer for DTC-Based PMSM Drives**
Atsushi Shinohara, Kichiro Yamamoto
Kagoshima University, Japan
- 22P16-7 Application of Fictitious Reference Iterative Tuning to Controller Design for Various Machines**
Hidehiro Ikeda¹, Kazuya Goto¹, Feili Zhang¹, Kazuya Kayashima¹, Tsuyoshi Hanamoto²
1) Nishi-Nippon Institute of Technology, Japan, 2) Kyushu Institute of Technology, Japan
- 22P16-8 High Efficiency Control for Permanent Magnet Motor Drive System with Fuel Cells Connected in Series with Electric Double-Layer Capacitors**
Kichiro Yamamoto, Fumiya Ohdera, Atsushi Shinohara
Kagoshima University, Japan
- 22P16-9 Comparative Study of Speed Ripple Reduction by Various Control Methods in PMSM Drive Systems with Pulsating Load**
Yuma Komaru, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada
Osaka Prefecture University, Japan
- 22P16-10 Estimation of the Parameters of the Servo Drive System Using Particle Swarm Optimization Algorithm**
Helin Zhu¹, Jae Hyuk Choi¹, Sang Uk Park¹, Jusuk Lee², Hyong Gun Lee³, Hyung Soo Mok
1) Konkuk University, Korea, 2) Gyeonggi College of Science and Technology, Korea, 3) LC-TEK Co. Ltd., Korea

Poster Session 22P17 Battery Energy Storage and Renewable Energy Systems

Chair: Yue Ma (*Murata Manufacturing Co., Ltd.*)
Keiichi Hirose (*NTT Facilities, Inc.*)

- 22P17-1 A Programmable Battery Test System with Energy Recycling Feature Based on Sinusoidal Loading Technique**
Chang-Hua Lin¹, Guan-Jung Chen¹, Hwa-Dong Liu¹, Kun-Feng Chen²
1) National Taiwan University of Science & Technology, Taiwan, 2) Chung-Shan Institute of Science and Technology, Taiwan
- 22P17-2 Development of Large-Capacity Converter for Battery Energy Storage Systems**
Hiroyoshi Komatsu, Tatsuji Katayama, Noriko Kawakami
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan
- 22P17-3 Analysis and Comparison of dc/dc Topologies in Partial Power Processing Configuration for Energy Storage Systems**
Maria C. Mira, Zhe Zhang, Michael A. E. Andersen
Technical University of Denmark, Denmark
- 22P17-4 Two-Stage Protection for Multi-Channel Power Electronic Converters Fed Large Asynchronous Hydro-Generating Unit**
R.R.Semwal, Anto Joseph, Thanga Raj Chelliah
Indian Institute of Technology, India
- 22P17-5 Current Sharing Control for Series-Parallel Changeover Using Battery and Electric Double-Layer Capacitor Bank**
Taisei Nishino, Keisaku Isozaki, Naoki Kogai, Kyungmin Sung
National Institute of Technology, Ibaraki College, Japan
- 22P17-6 Control Method of Energy Storage System to Improve Output Power of PCS**
Mikiya Ishibashi¹, Hitoshi Haga¹, Kenji Arimatsu², Koji Kato³
1) Nagaoka University of Technology, Japan, 2) Tohoku Electric Power Co., Inc, Japan, 3) Sanken Electric Co., Ltd., Japan
- 22P17-7 A Control Strategy of MMC Battery Energy Storage System Based on Arm Current Control**
Liu Danqing, Wang Guangzhu, Ou Zhujian, Liu Jiaying
Shandong University, China
- 22P17-8 Equivalent Resistance Control for Maximum Power Transfer Method of Piezoelectric Element in Vibration Power Generation**
Kenya Takamura¹, Hiroaki Yamada¹, Toshihiko Tanaka¹, Tomoharu Yada², Hajime Fujiwara²
1) Yamaguchi University, Japan, 2) New Japan Radio Company, Limited., Japan

- 22P17-9 DC Bus Voltage Stabilization for Cascaded Power Converter by Integrating an Extra Port into Load Side PSFB**
Jiang You, Weiyan Fan, Mengyan Liao
Harbin Engineering University, China

Poster Session 22P18 PV Systems I

Chair: Eiji Hiraki (*Okayama University*)
Kazuaki Mino (*Murata Manufacturing Co., Ltd.*)

- 22P18-1 Common Mode Current Reduction of Three-Phase Cascaded Multilevel Transformerless Inverter for PV System**
Wenjie Wang¹, Ke Chen¹, Lijun Hang¹, Anping Tong², Yiliang Gan³
1) Hangzhou Dianzi University, China, 2) Shanghai Jiao Tong University, China, 3) General Office of People's Government of Shuangliu District, China
- 22P18-2 Current Sharing/Voltage Sharing Control Strategy for Cascaded DC/DC Converter in Photovoltaic DC Collection System**
Bo Chen, Yi Wang, Yanjun Tian, Shilei Wei
North China Electric Power University, China
- 22P18-3 PCC Voltage Compensation of PV Inverter with Active Power Decoupling Circuit**
Duck-Hwan Hwang, Jung-Yong Lee, Younghoon Cho
Konkuk University, Korea
- 22P18-4 A Novel Partial Shading Detection Algorithm Utilizing Power Level Monitoring of Photovoltaic Panels**
Thusitha Randima Wellawatta, Sung-Jin Choi
University of Ulsan, Korea
- 22P18-5 Boost Integrated Three-Phase Solar Inverter Using Current Unfolding and Active Damping Methods**
Ha Pham N.¹, Tomoyuki Mannen², Keiji Wada²
1) University of Technology Sydney, Australia, 2) Tokyo Metropolitan University, Japan
- 22P18-6 Linear Active Disturbance Rejection Control for Isolated Three-Port Converter**
Jiang You, Mengyan Liao, Weiyan Fan
Harbin Engineering University, China

Poster Session 22P19 Power Electronics Applied to Transmission, Smart Grid, DC Grid and Distribution Systems I

Chair: Toshimitsu Morizane (*Osaka Institute of Technology*)
Torbjörn Thiringer (*Chalmers University of Technology*)

- 22P19-1 Stability Constrained Gain Optimization of Droop Controlled Converters in DC Nanogrids**
Soumya Bandyopadhyay, Laura Ramirez-Elizondo, Pavol Bauer
Delft University of Technology, The Netherlands
- 22P19-2 SiC Based SSPC for High Voltage Space Applications**
D. Marroquí, A. Garrigós, José M. Blanes, R. Gutiérrez
Miguel Hernández University of Elche, Spain
- 22P19-3 An Improved Voltage-Type Grid-Connected Control Strategy for Compensating Unbalanced Voltage**
Liu Hongpeng, Zhou Jiajie, Wang Wei
Harbin Institute of Technology, China
- 22P19-4 Dual Two-Stage Isolated Bidirectional DC-DC Converter for DC Grid Storage**
Gabriel Tibola, Jorge L. Duarte
Eindhoven University of Technology, The Netherlands
- 22P19-5 Modular Multilevel Converter with Capacitor Voltage Self-Balancing Using Reduced Number of Voltage Sensors**
Taiyuan Yin¹, Yue Wang¹, Xiaolei Wang², Shiyuan Yin¹, Shumin Sun³, Guanglei Li³
1) Xi'an Jiaotong University, China, 2) Zhongyuan University of Technology, China, 3) State Grid Shandong Electric Power Research Institute, China
- 22P19-6 Plug and Outlet in Household DC Low Voltage Micro-grid Power Distribution**
Worapong Pairindra¹, Surin Khomfoi²
1) Valaya Alongkorn Rajabhat University, Thailand, 2) King Mongkut's Institute of Technology, Thailand
- 22P19-7 Performance Programming Technique for Multi-Stage Dc Power Distribution Systems**
Syam Kumar Pidaparthy, Hansang Kim, Yeonjung Kim, Byungcho Choi
Kyungpook National University, Korea

- 22P19-8 Coordination Control for Paralleled Inverters Based on VSG for PV/Battery Microgrid**
Meiqin Mao, Cheng Qian, Liuchen Chang, Yan Du
Hefei University of Technology, China
- 22P19-9 Adaptive Voltage Control Scheme for DAB Based Modular Cascaded SST in PV Application**
Tao Liu^{1,2}, Yang Xuan¹, Xu Yang¹, Peng Xu¹, Yang Li¹, Lang Huang^{1,2}, Xiang Hao²
1) Xian Jiaotong University, China, 2) TBEA Xinjiang Sunoasis Co., LTD, China
- 22P19-10 Six-Step MMC-Based High Power DC-DC Converter**
Stefan Milovanović, Dražen Dujčić
École Polytechnique Fédérale de Lausanne – EPFL, Switzerland
- 22P19-11 Combined DC Power Flow Controller for DC Grid**
Xu Zhong¹, Miao Zhu¹, Yongning Chi², Xizhou Du³, Siqi Liu¹, Xu Cai¹
1) Shanghai Jiao Tong University, China, 2) China Electric Power Research Institute, China, 3) State Grid Shanghai Municipal Electric Power Company, China
- 22P19-12 An Approach for the Emulation of DC Grid Admittances: Implementation on a Buck Converter**
Enrique Rodriguez-Diaz¹, Francisco D. Freijedo², Drazen Dujic², Juan C. Vasquez¹, Josep M. Guerrero¹
1) Aalborg University, Denmark, 2) Ecole Polytechnique Federale de Lausanne, Switzerland
- 22P19-13 A Compound Controller for Power Flow and Short-Circuit Fault in DC Grid**
Han Ye, Wu Chen, Pengpeng Pan, Xiaokun He
Southeast University, China
- 22P19-14 Design Procedure and Control of a Hybrid Circuit Breaker with Adaptable Pulse Current Injection**
Andreas Jehle, Jürgen Biela
ETH Zürich, Switzerland
- 22P19-15 A Pragmatic SOH and SOC Co-Estimator for Lithium-Ion Batteries in Smart Grid Applications**
Kaiyuan Li¹, King Jet Tseng², Feng Wei², Boon-Hee Soong¹
1) Nanyang Technological University, Singapore, 2) Singapore Institute of Technology, Singapore
- 22P19-16 Modeling and Stability Analysis of Parallel Droop- Controlled and Current-Controlled Inverters**
Shike Wang, Zeng Liu, Jinjun Liu, Ronghui An
Xi'an Jiaotong University, China

Poster Session 22P20 Power Supply Technologies for Information and Communication Systems

Chair: Yunwei Li (*University of Alberta*)
Hiroo Sekiya (*Chiba University*)

- 22P20-1 Direct Wireless Battery Charging System**
Woo-Seok Lee, Jin-Hak Kim, Shin-Young Cho, Il-Oun Lee
Myongji University, Korea
- 22P20-2 An Improved PWM Scheme to Achieve Zero-Voltage Switching for All Devices in Three-Phase Isolated Matrix Rectifier**
Xuerui Lin¹, Yunwei (Ryan) Li¹, Jahangir Afsharian², Dewei (David) Xu²
1) University of Alberta, Canada, 2) Ryerson University, Canada
- 22P20-3 Fixed-Frequency HF Gate Driver by a Push-Pull Self-Excitation LC Oscillator Having a Capacitance Transistor**
Naoyuki Ishibashi¹, Takuya Mizushima¹, Masahiko Hirokawa², Akihiko Katsuki¹
1) Nagasaki University, Japan, 2) TDK Corporation, Japan

Poster Session 22P21 Industrial Applications I

Chair: Masahiko Tsukakoshi (*Toshiba Mitsubishi-Electric Industrial Systems Corporation*)
Ikuya Sato (*Fuji Electric Co., Ltd.*)

- 22P21-1 A Flexible Reduced Capacitor Voltages Strategy for Variable-Speed Drives with Modular Multilevel Converter**
Fangzhou Zhao, Guochun Xiao, Daoshu Yang, Zhiqian Wu, Xin Meng
Xi'an Jiaotong University, China
- 22P21-2 A Leakage Flux Cancellation Technique for Series- Parallel Combined Resonant Circuits with Asymmetric Rotary Transformers Used for Ultrasonic Spindle Drive**
Jun Imaoka, Masahito Shoyama
Kyushu University, Japan

- 22P21-3 A Novel Structural Health Monitoring System with Wireless Power and Bi-Directional Data Transfer**
Yujin Jang, Keon-Woo Kim, Moo-Hyun Park, Nayoung Lee, Gun-Woo Moon
KAIST, Korea
- 22P21-4 Control Strategy for Starter Generator in UAV with Micro Jet Engine**
Jun-ichi Itoh¹, Kazuki Kawamura¹, Hiroyuki Koshikizawa², Kazuyuki Abe²
1) Nagaoka University of Technology, Japan, 2) YSEC Co., Ltd, Japan

Poster Session 22P22 Power Converters and Systems I

Chair: Toshihiko Tanaka (*Yamaguchi University*)

Jee-Hoon Jung (*Ulsan National Institute of Science and Technology*)

- 22P22-1 Study on the Influence of Voltage Variations for Non-Intrusive Load Identifications**
Yu-Hsiu Lin¹, Shun-Kang Hung², Men-Shen Tsai³
1) Providence University, Taiwan, 2) Avnet, Inc., Taiwan, 3) National Taipei University of Technology, Taiwan
- 22P22-2 Basic Experiment of a Maglev System for a Flexible Steel Plate with Curvature: Fundamental Consideration on Levitation Stability under Disturbance**
Makoto Tada, Kazuki Ogawa, Takayoshi Narita, Hideaki Kato, Hiroyuki Moriyama
Tokai University, Japan
- 22P22-3 Performance of Hybrid Magnetic Levitation Control System for Thin Steel Plate by EMs and PMs: Experimental Evaluation of Applying Optimal Gap and Arrangement of PMs**
Yasuaki Ito, Yoshiho Oda, Kengo Okuno, Toshiki Suzuki, Masahiro Kida, Takayoshi Narita, Hideaki Kato, Hiroyuki Moriyama
Tokai University, Japan
- 22P22-4 A Practical Lithium-Ion Battery Model Based on the Butler-Volmer Equation**
Kaiyuan Li¹, King Jet Tseng², Feng Wei², Boon-Hee Soong¹
1) Nanyang Technological University, Singapore, 2) Singapore Institute of Technology, Singapore
- 22P22-5 Bonding Technology Using Cold-Rolled Ag Sheet in Die-Attachment Applications**
Seungjun Noh, Chanyang Choe, Chuantong Chen, Hao Zhang, Katsuaki Sukanuma
Osaka University, Japan

Tuesday, May 22: 14:30-16:35

Room A

Oral Session 22A2 High Frequency Power Conversion

Chair: Hiroaki Yamada (*Yamaguchi University*)

Johannes Teigelkötter (*University of Applied Sciences Aschaffenburg*)

- 22A2-1 High-Frequency Self-Driven Synchronous Rectifier Controller for WPT Systems**
14:30 Akihiro Konishi, Kazuhiro Umetani, Eiji Hiraki
Okayama University, Japan
- 22A2-2 Automatic Resonance Frequency Tuning Method for Repeater in Resonant Inductive Coupling Wireless Power Transfer Systems**
14:55 Masataka Ishihara, Kazuhiro Umetani, Eiji Hiraki
Okayama University, Japan
- 22A2-3 Inductive Power Transfer for T5 Fluorescent Lamp Lighting System**
15:20 Chung-Chuan Hou, Tang-Jung Chen, Ching-Chen Chen, Chen-Wei Chang, Po-Wei Wang
Chung Hua University, Taiwan
- 22A2-4 An Implement 1.5 MHz of Induction Heating for Aluminum Based on Vacuum Tube Oscillator Circuit**
15:45 A. Bilsalam, P. Chanmontree, S. Supanyapong, V. Chunkag
King Mongkut's University of Technology North Bangkok, Thailand
- 22A2-5 Single-Inductor Multiple-Outputs Dimmable LED Driver with Buck Converter**
16:10 Ta-Wei Huang, Tsorng-Juu Liang, Wei-Jing Tseng, Jun-Xian Huang
National Cheng Kung University, Taiwan

Room B

Oral Session 22B2 Multi-level Inverters I

Chair: Kenichiro Sano (*Tokyo Institute of Technology*)

Xibo Yuan (*The University of Bristol*)

- 22B2-1 A Soft-Switched Three-Level T-Type Inverter with Auxiliary Commutated Poles**
14:30 Apollo Charalambous, Xibo Yuan
University of Bristol, UK
- 22B2-2 Carrier-Based Realization of Arbitrary Space-Vector PWM Methods for Three-Level Inverters**
14:55 Somboon Sangwongwanich, Supakorn Paiboon
Chulalongkorn University, Thailand
- 22B2-3 Multi-Level Topology Based Linear Amplifier Family for Realization of Noise-Less Inverters**
15:20 Hidemine Obara, Tatsuki Ohno, Atsuo Kawamura
Yokohama National University, Japan
- 22B2-4 A New Zero-Voltage Switching Three-Level Converter with Reduced Rectifier Voltage Stress**
15:45 Keon-Woo Kim, Cheon-Yong Lim, Dong-Kwan Kim, Yu-Jin Jang, Gun-Woo Moon
KAIST, Korea
- 22B2-5 Model Predictive Control of a Three-Level NPC Rectifier with a Sliding Manifold Term**
16:10 Xiaonan Gao¹, Wei Tian¹, Xicai Liu¹, Zhenbin Zhang², Ralph Kennel¹
1) Technical University of Munich, Germany, 2) Shandong University, China

Room C

Oral Session (Organized) 22C2 Motion Control II

Chair: Tomoyuki Shimono (*Yokohama National University*)

Kenji Natori (*Chiba University*)

- 22C2-1 H_∞ Control-Based Vibration Suppression in Robot Arm with Strain Wave Gearing**
Invited Paper Tran Vu Trung, Makoto Iwasaki
14:30 *Nagoya Institute of Technology, Japan*
- 22C2-2 Fine Force Sensorless Force Control Based on Friction-Free Disturbance Observer**
Invited Paper Kiyoshi Ohishi, Naoki Kamiya, Toshimasa Miyazaki, Yuki Yokokura
14:55 *Nagaoka University of Technology, Japan*
- 22C2-3 Kinematics and Tracking Control of a Four Axis Antenna for Satcom on the Move**
Invited Paper Oguz Kaan Hancioglu^{1,2}, Mustafa Celik^{1,3}, Ugur Tumerdem⁴
15:20 *1) PROFEN Communication Technologies & Services, Inc., Turkey, 2) Istanbul Technical University, Turkey, 3) Ankara University, Turkey, 4) Marmara University, Turkey*
- 22C2-4 Position Sensorless Position Control for Dual Solenoid Actuator**
Invited Paper Sakahisa Nagai, Atsuo Kawamura
15:45 *Yokohama National University, Japan*

Room D

Oral Session 22D2 Modeling, Simulation, EMI and Reliability -Simulation-

Chair: Tomoki Yokoyama (*Tokyo Denki University*)

Faisal Khan (*University of Missouri-Kansas City*)

- 22D2-1 CAE Technology Application Trend for Large-Capacity Power Electronics Development**
14:30 Teruo Yoshino, Kuniaki Nagasaka, Shigeaki Nakabayashi, Ikuto Udagawa, Isamu Tominaga, Junya Konno
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan
- 22D2-2 Xilinx System Generator Based Modelling of Finite State MPC**
14:55 Vijay Kumar Singh, Ravi Nath Tripathi, Tsuyoshi Hanamoto
Kyushu Institute of Technology, Japan
- 22D2-3 Power Hardware-in-the-Loop Setup for Stability Studies of Grid-Connected Power Converters**
15:20 Tommi Reinikka, Henrik Alenius, Tomi Roinila, Tuomas Messo
Tampere University of Technology, Finland

- 22D2-4 Passivity-Based LCL Filter Design of Grid-Connected VSCs with Converter Side Current Feedback**
 15:45 Shih-Feng Chou, Xiongfei Wang, Frede Blaabjerg
Aalborg University, Denmark
- 22D2-5 Adaptive Control of DC Power Distribution Systems: Applying Pseudo-Random Sequences and Fourier Techniques**
 16:10 Tomi Roinila¹, Hessamaldin Abdollahi², Silvia Arrua², Enrico Santi²
1) Tampere University of Technology, Finland, 2) University of South Carolina, USA

Room E

Oral Session 22E2 Predictive Control for Machine Drives

Chair:

Shinji Doki (Nagoya University)

- 22E2-1 An Improved Finite-Set Model Predictive Torque Control for Interior Permanent Magnet Synchronous Motor Drives**
 14:30 Xinan Zhang¹, Gilbert Foo², Tung Ngo²
1) Nanyang Technological University, Singapore, 2) Auckland University of Technology, New Zealand
- 22E2-2 Predictive Torque Control for Five Phase Induction Motor Drive with Common Mode Voltage Reduction**
 14:55 Apekshit Bhowate¹, Mohan Aware¹, Sohith Sharma¹, Yogesh Tatte²
1) Visvesvaraya National Institute of Technology, India, 2) SJITMR, India
- 22E2-3 Indirect Matrix Converter for Permanent-Magnet-Synchronous-Motor Drives by Improved Torque Predictive Control**
 15:20 Yun Jang, Yeongsu Bak, Kyo-Beum Lee
Ajou University, Korea
- 22E2-4 Predictive DC-Link Current Control Based on IPMSM Discrete State Equation for Inverter without Inductor or Electrolytic Capacitor**
 15:45 Yousuke Akama, Kodai Abe, Kiyoshi Ohishi, Yuki Yokokura, Koji Kobayashi, Tatsuki Kashihara
Nagaoka University of Technology, Japan
- 22E2-5 New Search Algorithm of Model Predictive Control to Reducing Calculation Amount for Improving Steady Current Control Performance**
 16:10 Masahiro Shimaoka, Shinji Doki
Nagoya University, Japan

Room F

Oral Session 22F2 AC Microgrids

Chair: *Yuko Hirase (Kawasaki Technology Co., Ltd)*

Jia Liu (Osaka University)

- 22F2-1 Distributed Power Sharing Strategy for Islanded Microgrids without Frequency and Voltage Deviations**
 14:30 Tuan V. Hoang, Hong-Hee Lee
University of Ulsan, Korea
- 22F2-2 Lifetime-Oriented Droop Control Strategy for AC Islanded Microgrids**
 14:55 Yanbo Wang¹, Dong Liu¹, Fujin Deng², Dao Zhou¹, Zhe Chen¹
1) Aalborg University, Denmark, 2) Southeast University, China
- 22F2-3 Experiment on Hierarchical Control Based Power Quality Enhancement for Standalone Microgrid**
 15:20 Darith Leng¹, Sompob Polmai², Kittichot Soontorntaweesub³
King Mongkut's Institute of Technology Ladkrabang, Thailand
- 22F2-4 A Distributed Predictive Control Strategy Based on State Estimator for Islanded Microgrid**
 15:45 Mi Dong, Li Li, Xiaoyu Tian
Central South University, China

Oral Session 22G2 Trends in PV Systems Applications I

Chair: Rolando Burgos (*Virginia Tech, CPES*)

Yusuke Hayashi (*Toshiba Corporate Research & Development Center*)

22G2-1 Maximum Power Point Tracking Method for PV Module under Wide Range Varying Irradiance Levels

14:30 Hwa-Dong Liu, Chang-Hua Lin
National Taiwan University of Science and Technology, Taiwan

22G2-2 Dual MPPT Control and Field Testing for Switched Capacitor-Based Cell-Level Power Balancing Utilizing Diffusion Capacitance of Photovoltaic Cells

14:55 Masatoshi Uno¹, Yota Saito¹, Masaya Yamamoto¹, Shinichi Urabe²
1) Ibaraki University, Japan, 2) Toyota Motor Corporation, Japan

22G2-3 Series Resonant DC-DC Converter with Dual-Mode Rectifier for PV Microinverters

15:20 Yanfeng Shen, Huai Wang, Zhan Shen, Yongheng Yang, Frede Blaabjerg
Aalborg University, Denmark

22G2-4 Voltage-Reference Active Power Decoupling Based on Boost Converter for Single-Phase Bridge Inverter

15:45 Shuang Xu¹, Meiqin Mao², Riming Shao¹, Liuchen Chang¹
1) University of New Brunswick, Canada, 2) Hefei University of Technology, China

22G2-5 A Single-Phase Common Ground Boost Inverter for Photovoltaic Applications

16:10 Tan-Tai Tran¹, Minh-Khai Nguyen², Young-Cheol Lim¹, Joon-Ho Choi¹
1) Chonnam National University, Korea, 2) Chosun University, Korea

Oral Session 22H2 Railway Power Supply Systems

Chair:

Alvaro J. Lopez-Lopez (*Comillas Pontifical University*)

22H2-1 Study for Further Introduction of the Electronic Frequency Converters to the Tokaido Shinkansen

14:30 Toshimasa Shimizu¹, Ken Kunomura¹, Masahiko Kai¹, Hiroki Miyajima², Teruhisa Matsui³
1) Central Japan Railway Company, Japan, 2) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 3) Toshiba Corporation, Japan

22H2-2 Countermeasure for Partial Turn-Off of Thyristor Changeover Switch Introduced to Tohoku Shinkansen Shin-Yono Sectioning Post

14:55 Yuki Mizumoto, Nobuhito Kurosawa
East Japan Railway Company, Japan

22H2-3 Hardware-in-the-Loop Real-Time Simulation Experiment Platform for Traction Power Supply System Based on dSPACE-Xsim

15:20 Runze Zhang¹, Fei Lin¹, Zhongping Yang¹, Hu Cao², Yuping Liu²
1) Beijing Jiaotong University, China, 2) CCRC Qingdao Sifang Rolling Stock Research Institute Co. Ltd., China

22H2-4 Evaluating the Non-Sinusoidal and Non-Symmetric Regimes from a Railway Supplying Substation

15:45 Ileana-Diana Nicolae, Petre-Marian Nicolae, Radu-Florin Marinescu
University of Craiova, Romania

22H2-5 A Fundamental Train Running Experiment for a Basic Performance Verification of a Train Power Demand Control System by Decentralized Control Algorithm

16:10 Yusuke Oki¹, Tomoyuki Ogawa², Yoko Takeuchi², Tatsuhito Saito², Jun'ichiro Kawaguchi³
1) The University of Tokyo, Japan, 2) Railway Technical Research Institute, Japan, 3) Japan Aerospace Exploration Agency, Japan

Oral Session (Organized) 22K2 Advanced Power Conversion Systems Using SiC-MOSFET Devices: Fundamental and Applied Research II

Chair: Atsuo Kawamura (*Yokohama National University*)

22K2-1 Verification of SiC Based Modular Multilevel Cascade Converter (MMCC) for HVDC Transmission Systems

Invited Paper Y. Ishii, T. Jimichi

14:30 *Mitsubishi Electric Corporation, Japan*

22K2-2 Control of a 6.6-kV Transformerless STATCOM Based on the MMCC-SDBC Using SiC MOSFETs

Invited Paper Laxman Maharjan, Toshihisa Tajyuta, Hiroshi Shinohara, Akio Suzuki, Akio Toba

14:55 *Fuji Electric Co., Ltd., Japan*

22K2-3 Isolated Three-Phase AC/DC Converter Using a Soft-Switching Technique for Battery Charger

Invited Paper Yuto Matsui, Kazuma Suzuki, Takaharu Takeshita, Wataru Kitagawa

15:20 *Nagoya Institute of Technology, Japan*

22K2-4 Implementation of a Miniaturized SiC Inverter

Invited Paper Hideaki Fujita, Cristian Andres Garces Guajardo

15:45 *Tokyo Institute of Technology, Japan*

22K2-5 Design Consideration of Flying Capacitor Multilevel Inverters Using SiC MOSFETs

Invited Paper Yukihiro Sato, Kenji Natori

16:10 *Chiba University, Japan*

Tuesday, May 22: 16:55-18:35

Oral Session 22A3 Control Techniques for Converters/Inverters

Chair: Shohei Komeda (*Tokyo University of Marine Science and Technology*)

Wensheng Song (*Southwest Jiaotong University*)

22A3-1 A Control Method of Overvoltage Suppression Across the DC Capacitor in a Grid-Connection Converter Using Leg Short-Circuit of Power MOSFETs during the Initial Charge

16:55

Tomoyuki Mannen, Keiji Wada

Tokyo Metropolitan University, Japan

22A3-2 The Essential Relationship between Deadbeat Predictive Control and Continuous-Control-Set Model Predictive Control for PWM Converters

17:20

Bi Liu¹, Tao Chen², Wensheng Song¹

1) Southwest Jiaotong University, China, 2) CRRC Zhuzhou Institute Co., Ltd, China

22A3-3 Deadbeat Control for Multi-level Inverter Using 1MHz Multisampling Method for Utility Interactive System

17:45

Ryosuke Kikuchi, Ryunosuke Araumi, Tomoki Yokoyama

Tokyo Denki University, Japan

22A3-4 1MHz Multisampling Deadbeat Control with Disturbance Compensation Method for Three Phase PWM Inverter

18:10

Hiroaki Ueta, Tomoki Yokoyama

Tokyo Denki University, Japan

Oral Session 22B3 Modular Multi-level Converters I

Chair: Shota Urushibata (*Meidensha Corporation*)

Ching-Jan Chen (*National Taiwan University*)

22B3-1 Modular Multilevel Converter Replaced One Module with High Voltage IGBT

16:55

Kazunobu Oi, Kenta Takasho, Yugo Tadano

Meidensha Corporation, Japan

- 22B3-2 Increased Efficiency and Reduced Realization Effort of DSBC and DSCC Modular Multilevel Converters (MMCs)**
17:20 A. Hillers, J. Biela
ETH Zürich, Switzerland
- 22B3-3 Common-Mode Voltage Injection Techniques for Quasi Two-Level PWM-Operated Modular Multilevel Converters**
17:45 Jakub Kucka, Axel Mertens
Leibniz Universität Hannover, Germany
- 22B3-4 Current Tracking and Cell-Voltage Limitations of Modular Multilevel Converters with Direct Digital Control**
18:10 T.-F. Wu, T.-C. Chou, K.-E. Lin, T.-Y. Li
National Tsing Hua University, Taiwan

Room C

Oral Session (Organized) 22C3 Passive Components in Power Electronics Applications

Chair: Huai Wang (Aalborg University)

Kazushige Nakao (Fukui University of Technology)

- 22C3-1 Switching Loss Analysis of SiC-MOSFET Based on Stray Inductance Scaling**
Invited Paper Keiji Wada, Masato Ando
16:55 *Tokyo Metropolitan University, Japan*
- 22C3-2 Modeling and Optimization of Displacement Windings for Transformers in Dual Active Bridge Converters**
Invited Paper Zhan Shen¹, Yanfeng Shen¹, Zian Qiny², Huai Wang¹
17:20 *1) Aalborg University, Denmark, 2) Delft University of Technology, The Netherlands*
- 22C3-3 Optimized Selection and Utilization of DC-Link Capacitor in a Single-Phase PV Grid Inverter System**
Invited Paper Caspar Collins, Li Ran
17:45 *University of Warwick, UK*
- 22C3-4 An Evaluation Circuit for DC-Link Capacitors Used in a High-Power Three-Phase Inverter with Condition Monitoring**
Invited Paper Kazunori Hasegawa¹, Ichiro Omura¹, Shin-ichi Nishizawa²
18:10 *1) Kyushu Institute of Technology, Japan, 2) Kyushu University, Japan*

Room D

Oral Session (Organized) 22D3 Copper Die-Cast Squirrel-Cage Induction Motors

Chair: Katsumi Yamazaki (Chiba Institute of Technology)

Shu Yamamoto (Polytechnic University)

- 22D3-1 Recent Market and Technical Trends in Copper Rotors for High-Efficiency Induction Motors**
Invited Paper Daniel Liang, Victor Zhou
16:55 *International Copper Association, China*
- 22D3-2 Overview of the Latest Research and Development for Copper Die-Cast Squirrel-Cage Rotors**
Invited Paper Shu Yamamoto
17:20 *Polytechnic University, Japan*
- 22D3-3 A Novel Heat-Resistant Insulation-Processing Agent Applicable to Copper Die-Cast Squirrel-Cage Rotors**
Invited Paper Junichi Uchida, Yuki Sueuchi, Naosumi Kamiyama
17:45 *Nihon Parkerizing Co., Ltd, Japan*
- 22D3-4 Experimental Verification on the Effects of Insulation-Processing of Copper Die-Cast Squirrel-Cage Rotor on Motor Efficiency in High-Speed Operation over 10,000 r/min**
Invited Paper Hideaki Hirahara, Akira Tanaka, Shu Yamamoto
18:10 *Polytechnic University, Japan*

Room E

Oral Session 22E3 High Speed and High Power Drives

Chair: Yoshitaka Iwaji (*Hitachi, Ltd.*)

Yipeng Song (*Aalborg University*)

- 22E3-1 High-Precision Rotor Position Estimation for High-Speed SPMSM Drive Based on State Observer and Harmonic Elimination**
16:55 Peng Yang¹, Xi Xiao¹, Meng Zhang², Shkodyrev Vyacheslav³
1) *Tsinghua University, China*, 2) *Beijing Institute of Control Engineering, China*, 3) *Saint-Petersburg Polytechnic University, Russia*
- 22E3-2 Harmonic Loss Reduction in High Speed Motor Drive Systems by Flying Capacitor Multilevel Inverter**
17:20 Anudari Tumurbaatar¹, Sae Mochidate¹, Koji Yamaguchi², Tomohiro Matsuda², Yukihiko Sato¹
1) *Chiba University, Japan*, 2) *IHI Corporation, Japan*
- 22E3-3 Current Source Type PMSG Wind Turbine System with Three-Phase Three-Switch Buck-Type Rectifier for Machine-Side Converter**
17:45 Beomseok Chae¹, Tahyun Kang², Yongsug Suh¹
1) *Chonbuk National University, Korea*, 2) *Milimsyscon Co, Korea*
- 22E3-4 A Study of 10MW Load Commutated Inverter for Gas-Turbine Start-Up**
18:10 Hyunsung An, Hanju Cha
Chungnam National University, Korea

Room F

Oral Session (Organized) 22F3 HVDC System Technology Applied to Offshore Wind Farms

Chair: Tatsuhito Nakajima (*Tokyo City University*)

Salvatore D'Arco (*SINTEF Energy Research*)

- 22F3-1 Prototyping of 500 kVA Medium Frequency Transformer for Offshore Direct-Current Collection Grid**
Invited Paper Tomoyuki Hatakeyama, Naoyuki Kurita, Mamoru Kimura
16:55 *Hitachi, Ltd., Japan*
- 22F3-2 PSCAD/EMTDC and RTDS Simulation Analysis of Multivendor Multi-Terminal HVDC System Connected to Offshore Windfarms**
Invited Paper Hiroshi Suwa¹, Takuro Arai², Takahiro Ishiguro³, Tohru Yoshihara⁴, Mamoru Kimura⁴, Tsuneshisa Wachi⁵, Takahiro Horikoshi⁵, Tatsuhito Nakajima⁶
17:20 1) *Tokyo Electric Power Company Holdings, Inc., Japan*, 2) *Toshiba Corporation, Japan*, 3) *Toshiba Energy Systems and Solutions Corporation, Japan*, 4) *Hitachi, Ltd., Japan*, 5) *JP Business Service Corporation, Japan*, 6) *Tokyo City University, Japan*
- 22F3-3 Interoperability of Modular Multilevel Converters and 2-Level Voltage Source Converters in a Laboratory-Scale Multi-Terminal DC Grid**
Invited Paper 17:45 Salvatore D'Arco, Atsede G. Endegnanew, Giuseppe Guidi, Jon Are Suu
SINTEF Energy Research, Norway
- 22F3-4 Principle Experiment of Current Commutated Hybrid DCCB for HVDC Transmission Systems**
Invited Paper Ryuta Hasegawa¹, Kazuhisa Kanaya², Yushi Koyama², Toshiaki Matsumoto², Takahiro Ishiguro³
18:10 1) *Toshiba Infrastructure Systems & Solutions Corporation, Japan*, 2) *Toshiba Corporation, Japan*, 3) *Toshiba Energy Systems & Solutions Corporation, Japan*

Room G

Oral Session 22G3 Trends in PV Systems Applications II

Chair: Minh-Khai Nguyen (*Chosun University*)

Kazuhiro Umetani (*Okayama University*)

- 22G3-1 A Three-Input Central Capacitor DC/DC Converter**
16:55 Jiaxin Liu, Feng Gao
Shandong University, China

22G3-2 Series/Parallel Switching Circuits Using Power MOSFETs for Photovoltaic Modules

17:20 Masamichi Tanemo, Koki Matsudate, Shinichi Nomura
Meiji University, Japan

22G3-3 Modularized Equalization Architecture Based on Switched Capacitor Converter to Virtually Unify Mismatched Photovoltaic Panel Characteristics

17:45 Masatoshi Uno, Masaya Yamamoto
Ibaraki University, Japan

22G3-4 Buck-Boost Type MPPT Circuit Suitable for Photovoltaic Generation of Vehicle Installation

18:10 Fumihisa Kano^{1,2}, Yuji Kasai³, Hideki Kimura⁴, Kouhei Sagawa⁴, Junnosuke Haruna¹, Hirohito Funato¹
1) Utsunomiya University, Japan, 2) National Institute of Technology, Oyama College, Japan, 3) National Institute of Advanced Industrial Science and Technology, Japan, 4) Tokai University, Japan

Room H

Oral Session (Organized) 22H3 Advanced Power Conversion and Control for Railway Vehicles

Chair: Takafumi Koseki (*The University of Tokyo*)

Xiaoqiong He (*Southwest Jiaotong University*)

22H3-1 Verification Test of Energy-Efficient Operations and Scheduling Utilizing Automatic Train Operation System

Invited Paper Shoichiro Watanabe¹, Yasuhiro Sato¹, Takafumi Koseki², Eisuke Isobe³, Jun Kawashita⁴
16:55 *1) National Traffic Safety and Environment Laboratory, Japan, 2) The University of Tokyo, Japan, 3) Japan Subway Association, Japan, 4) Osaka Municipal Transportation Bureau, Japan*

22H3-2 The Direct Benefit of SiC Power Semiconductor Devices for Railway Vehicle Traction Inverters

Invited Paper Shingo Makishima¹, Kazuki Fujimoto¹, Keiichiro Kondo²
17:20 *1) Toyo Electric Mfg. Co., Ltd, Japan, 2) Waseda University, Japan*

22H3-3 The Loss Characteristics of PSFB ZVS DC-DC Converter Applied to the Auxiliary Power System

Invited Paper Xianjin Huang, Juan Zhao, Fei Lin
17:45 *Beijing Jiaotong University, China*

22H3-4 Survey on Electromagnetic Interference Analysis for Traction Converters in Railway Vehicles

Invited Paper Zhichang Yang, Hong Li, Chao Feng, Yanfeng Jiang, Fei Lin, Zhongping Yang
18:10 *Beijing Jiaotong University, China*

Room K

Oral Session (Organized) 22K3 Power Electronics and Motor Drives for Automobiles

Chair: Takashi Kosaka (*Nagaoya Institute of Technology*)

Subrata Saha (*AISIN AW Co., Ltd.*)

22K3-1 Development of Traction Motor for New Zero-Emission Vehicle

Invited Paper Akinobu Iwai, Satoshi Honjo, Toshio Okazawa, Hirofumi Suzumori
16:55 *Honda R&D Co., Ltd., Japan*

22K3-2 EMC Design and Development Methodology for Traction Power Inverters of Electric Vehicles

Invited Paper Isao Hoda¹, Jia Li², Hiroki Funato¹
17:20 *1) Hitachi, Ltd., Japan, 2) Hitachi America, Ltd., USA*

22K3-3 Simulation-Driven Design Optimization of a Multilayer EMC Input Filter

Invited Paper Fatou Diouf¹, Nadim Sakr¹, Anna Gheonjian²
17:45 *1) RENAULT, France 2) EMCoS, Georgia*

22K3-4 EV Traction Inverter Employing Double-Sided Direct-Cooling Technology with SiC Power Device

Invited Paper Takashi Hirao, Masami Onishi, Yusuke Yasuda, Akihiro Namba, Kinya Nakatsu
18:10 *Hitachi, Ltd., Japan*

Room A

Oral Session (Organized) 23A1 High Performance Power Converters

Chair: Huang-Jen Chiu (*National Taiwan University of Science & Technology*)

Fujio Kurokawa (*Nagasaki University*)

23A1-1 An Overview of Stability Improvement Methods for Wide-Operation-Range Flyback Converter with Variable Frequency Peak-Current-Mode Control

Invited Paper

8:35 Ching-Hsiang Cheng¹, Ching-Jan Chen¹, Shinn-Shyong Wang²

1) *National Taiwan University, Taiwan*, 2) *Richtek Technology Corporation, Taiwan*

23A1-2 Design and Implementation of a High Power Density Active-Clamped Flyback Converter

Invited Paper

9:00 Yu-Chen Liu¹, Bing-Siang Huang², Cheng-Hung Lin², Katherine A. Kim³, Huang-Jen Chiu²

1) *National Ilan University, Taiwan*, 2) *National Taiwan University of Science and Technology, Taiwan*, 3) *Ulsan National Institute of Science and Technology Ulsan, Korea*

23A1-3 Optimized Variable On-Time Control for LED Lighting Driver

Invited Paper

9:25 Jizhe Wang¹, Haruhi Eto¹, Fujio Kurokawa²

1) *Nagasaki University, Japan*, 2) *Nagasaki Institute of Applied Science, Japan*

23A1-4 Design of Multimode Battery Charger with Dynamic Voltage Tracking Control

Invited Paper

9:50 Pang-Jung Liu, Lin-Hao Chien, Song-Kai Lee, Ang-Tung Chen

National Taipei University of Technology, Taiwan

23A1-5 Dual-Slot Power-Pickup Structure for Contactless Strip Inductive Power Track System

Invited Paper

10:15 Jia-You Lee, I-Lin Chen, Chien-Tzu Ko

National Cheng Kung University, Taiwan

Room B

Oral Session 23B1 Three-phase Inverters

Chair: Tomoyuki Mannen (*Tokyo University of Science*)

Ke Ma (*Shanghai Jiao Tong University*)

23B1-1 Discontinuous SVM Technique for Three-Leg VSI Fed Balanced/Unbalanced Two-Phase Loads

8:35

Supanut Charoensuksirikul, Yuttana Kumsuwan

Chiang Mai University, Thailand

23B1-2 Reduction of Power Losses Based on Generalized Two-Level PWM Algorithm for a Nine-Switch VSI

9:00

Neerakorn Jarutus, Yuttana Kumsuwan

Chiang Mai University, Thailand

23B1-3 SiC-Based Three-Phase Quasi-Z-Source Inverter Versus the Two-Stage Topology - a Comparison

9:25

Kornel Wolski, Mariusz Zdanowski, Jacek Rabkowski

Warsaw University of Technology, Poland

23B1-4 DC-Side Circuit Implementation of a Three-Phase Inverter for Balancing Phase-Leg Capacitor Currents

9:50

Takashi Hirao, Keiji Wada, Toshihisa Shimizu

Tokyo Metropolitan University, Japan

23B1-5 A Three-Phase Hybrid Switched-Boost Inverter

10:15

Minh-Khai Nguyen¹, Tan-Tai Tran², Hoan-Tien Luong³, Kyoung-Won Lee¹, Youn-Ok Choi¹, Geum-Bae Cho¹

1) *Chosun University, Korea*, 2) *Chonnam National University, Korea*, 3) *HCMC University of Technology and Education, Vietnam*

Oral Session 23C1 Passive Components and Design

Chair: Alberto Castellazzi (*The University of Nottingham*)

Kazunori Hasegawa (*Kyushu Institute of Technology*)

- 23C1-1 The Effect of Built-in CR Snubber Capacitor into the Power Module**
8:35 Ryotaro Hata, Shigeki Nishiyama
Murata Manufacturing Co., Ltd., Japan
- 23C1-2 Evaluation of Novel Hybrid Protection Based on Pyroswitch and Fuse Technologies**
9:00 Tomokazu Sakuraba¹, Rémy Ouaida², Song Chen³, Thibaut Chailloux²
1) MERSEN Japan, Japan, 2) MERSEN France SB, France, 3) MERSEN Shanghai, China
- 23C1-3 Optimal Design of a Magnetically Coupled Filter for High Efficiency, Low Cost and Low Volume Dc-Dc Battery Storage Converter**
9:25 Timothé Delaforge¹, Robert Pasterczyk², Mickaël Robert², Hervé Chazal³, Jean-Luc Schanen³, Sébastien Mariethoz¹
1) Bern University of Applied Sciences, Switzerland, 2) Schneider Electric ITB, France, 3) Grenoble Electrical Engineering Laboratory G2ELab, France
- 23C1-4 High Power/Current Inductor Loss Measurement with Shunt Resistor Current-sensing Method**
9:50 Pin Yu Huang, Toshihisa Shimizu
Tokyo Metropolitan University, Japan
- 23C1-5 Sensitivity Analysis of Medium Frequency Transformer Design**
10:15 Marko Mogorovic, Drazen Dujic
École Polytechnique Fédérale de Lausanne – EPFL, Switzerland

Oral Session (Organized) 23D1 Practical Modeling and Simulation Techniques for Power Electronics Systems

Chair: Takashi Abe (*Nagasaki University*)

Wilmar Martinez (*KU Leuven University*)

- 23D1-1 Standard Models for Power Electronic System Simulation**
Invited Paper 8:35 Koichi Shigematsu¹, Hiroki Ishikawa², Taku Noda³, Kentarou Fukushima³, Yoichi Sekiba⁴, Yusuke Kouno⁵, Takashi Abe⁶, Takayuki Sekisue⁷, Shinji Katoh⁸
1) CYBERNETSYSTEMS Co. Ltd., Japan, 2) Gifu University, Japan, 3) Central Research Institute of Electric Power Industry, Japan, 4) Denryoku Computing Center, Japan, 5) Toshiba Co., Ltd., Japan, 6) Nagasaki University, Japan, 7) ANSYS Japan, Japan, 8) Kobe City College of Technology, Japan
- 23D1-2 Modeling and Model Parameter Extraction of Wide Bandgap Power Semiconductor Device, Package, and Circuit for Simulating Fast Switching Behavior**
Invited Paper 9:00 Tsuyoshi Funaki
Osaka University, Japan
- 23D1-3 Stability Analysis Methods of a Grid-Connected Inverter in Time and Frequency Domains**
Invited Paper 9:25 Toshiji Kato, Kaoru Inoue, Taiki Sakiyama
Doshisha University, Japan
- 23D1-4 Finite Element Methods for Multi-Objective Optimization of a High Step-Up Interleaved Boost Converter**
Invited Paper 9:50 Wilmar Martinez^{1,2}, Camilo Cortes², Ahmad Bilal³, Jorma Kyyra³
1) KU Leuven, Campus Diepenbeek, Belgium, 2) Universidad Nacional de Colombia, Colombia, 3) Aalto University, Finland
- 23D1-5 High Fidelity Real-Time Simulation of Multi-Level Converters**
Invited Paper 10:15 Jost Allmeling, Niklaus Felderer, Min Luo
Plexim GmbH, Switzerland

Room E

Oral Session 23E1 Sensorless PM Drives

Chair: Yukinori Inoue (*Osaka Prefecture University*)

Seung-Ki Sul (*Seoul National University*)

- 23E1-1 **An Enhanced High Frequency Pulsating Voltage Injection Method Based on Immune Algorithm for Sensorless IPMSM Drives**
8:35 Yanping Zhang¹, Zhonggang Yin¹, Chao Du¹, Youyun Wang², Xiangdong Sun¹
Xi'an University of Technology, China, 2) Tianshui Electric Drive Research Institute, China
- 23E1-2 **Position Estimation Accuracy Improvement for Magnetic Saliency Based Sensorless Control Including Cross-Coupling Factor**
9:00 Keita Shimamoto, Shinya Morimoto
Yaskawa Electric Corporation, Japan
- 23E1-3 **Sensorless Drive in the Low Speed Region and Auto-Tuning Method for Permanent Magnet Synchronous Motors**
9:25 Naofumi Nomura, Shinichi Higuchi
Fuji Electric Co.,Ltd., Japan
- 23E1-4 **High Stability V/f Control of PMSM Using State Feedback Control Based on n-t Coordinate System**
9:50 Yosuke Matsuki¹, Shinji Doki²
1) DENSO CORPORATION, Japan, 2) Nagoya University, Japan
- 23E1-5 **Stabilization Method Using Equivalent Resistance Gain Based on V/f Control for IPMSM with Long Electrical Time Constant**
10:15 Jun-Ichi Itoh, Takato Toi, Koroku Nishizawa
Nagaoka University of Technology, Japan

Room F

Oral Session 23F1 Solid-state Transformers (SST)

Chair: Yuhei Okazaki (*ABB Corporate Research*)

Marco Stieneker (*RWTH Aachen University*)

- 23F1-1 **Single-Phase Solid-State Transformer Using Multi-Cell with Automatic Capacitor Voltage Balance Capability**
8:35 Jun-ichi Itoh, Kazuki Aoyagi, Keisuke Kusaka, Masakazu Adachi
Nagaoka University of Technology, Japan
- 23F1-2 **A Developed Dual MMC Isolated DC Solid State Transformer and Its Modulation Strategy**
9:00 Yang Chen¹, Yan Li², Miao Zhu¹, Chao Liu², Xu Cai¹
1) Shanghai Jiao Tong University, China, 2) China Electric Power Research Institute, China
- 23F1-3 **DC Fault Ride-Through of a Three-Phase Dual-Active Bridge Converter for DC Grids**
9:25 Jingxin Hu, Shenghui Cui, Rik W. De Doncker
RWTH Aachen University, Germany
- 23F1-4 **High-Power High-Step-Up Ratio DC Solid-State Transformer Based on Medium-Frequency Inversion**
9:50 Fang Liu, Jie Zhang, Zhe Zhang, Xing Zhang, Shuying Yang
Hefei University of Technology, China
- 23F1-5 **A Compound 10kV DVR System Based on Solid State Transformer Structure**
10:15 Yaqian Zhang, Jianzhong Zhang, Xing Hu, Zakiud Din
Southeast University, China

Room G

Oral Session (Organized) 23G1 Conversion Technologies for Renewable Energy and Energy Saving II

Chair: Kazuto Yukita (*Aichi Institute of Technology*)

Frede Blaabjerg (*Aalborg University*)

- 23G1-1 **A Dual-Energy-Source Uninterruptible Power Supply (UPS)**
Invited Paper Hao Wang, Dehong Xu, Binci Xu, Haijin Li, Ye Zhu
8:35 *Zhejiang University, China*

- 23G1-2 Influence of Wind Power Forecasts on Equitable Distribution Method of Wind Power Curtailment**
Invited Paper Daisuke Iioka, Hiroumi Saitoh
 9:00 Tohoku University, Japan
- 23G1-3 Comparison of Optimized Demand of EGs for Minimizing Fuel Consumption and EGs Model with Power Grid Frequency Using a Hospital Load with PV**
Invited Paper Yuji Mizuno, Teppei Baba, Fujio Kurokawa, Nobumasa Matsui
 9:25 Nagasaki Institute of Applied Science, Japan
- 23G1-4 Coordinated DFIG Wind Turbines and Solar PV Generators for Inter-area Oscillation Damping**
Invited Paper Tossaporn Surinkaew, Issarachai Ngamroo
 9:50 King Mongkut's Institute of Technology Ladkrabang, Thailand
- 23G1-5 Energy Management Using a Quick Charger with Storage Batteries for Electric Vehicles**
Invited Paper Taku Ishibashi, Toyonari Shimakage, Norikazu Takeuchi, Takaaki Kikuchi, Midori Nonogaki
 10:15 NTT Facilities, Inc., Japan

Room H

Oral Session 23H1 Various Related Topics to Power Electronic Converters

Chair: Kazuhiro Umetani (*Okayama University*)

Jaeho Choi (*Chunbuk National University*)

- 23H1-1 A Method for Junction Temperature Estimation Utilizing Turn-on Saturation Current for SiC MOSFET**
 8:35 Hui-Chen Yang¹, Rejeki Simanjourang², Kye Yak See¹
 1) Nanyang Technological University, Singapore, 2) Rolls-Royce Singapore Pte. Ltd., Singapore
- 23H1-2 Field Bus for Data Exchange and Control of Modular Power Electronic Systems with High Synchronisation Accuracy**
 9:00 Stefan Rietmann, Simon Fuchs, André Hillers, Jürgen Biela
 ETH Zürich, Switzerland
- 23H1-3 Analytical Investigation on Asymmetric LCC Compensation Circuit for Trade-off between High Efficiency and Power**
 9:25 Kodai Takeda, Takafumi Koseki
 The University of Tokyo, Japan
- 23H1-4 Probabilistic PCA-Support Vector Machine Based Fault Diagnosis of Single Phase 5-Level Cascaded H-Bridge MLI**
 9:50 Nagendra Vara Prasad.Kuraku, Yigang He, Murad Ali
 Hefei University of Technology, China
- 23H1-5 A Study on Edge Supported Electromagnetic Levitation System: Fundamental Consideration on Levitation Performance of Thin Steel Plate**
 10:15 Yoshiho Oda, Yasuaki Ito, Kengo Okuno, Masahiro Kida, Toshiki Suzuki, Takayoshi Narita, Hideaki Kato, Hiroyuki Moriyama
 Tokai University, Japan

Room K

Oral Session (Organized) 23K1 Power Electronics Applied to HVDC and FACTS Systems

Chair: Noriko Kawakami (*Toshiba Mitsubishi-Electric Industrial Systems Corp.*)

Guangfu Tang (*Global Energy Interconnection Research Institute*)

- 23K1-1 Application of FACTS Devices for a Dynamic Power System within the USA**
Invited Paper Dan Sullivan¹, Bryan Buterbaugh¹, Jan Paramalingam¹, Fuminori Nakamura², Akihiro Matsuda²,
 8:35 Daisuke Yamanaka², Taichiro Tsuchiya³
 1) Mitsubishi Electric Power Products Inc., USA, 2) Mitsubishi Electric Corporation, Japan, 3) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan
- 23K1-2 Capacitor Voltage Balancing in Semi-Full-Bridge Submodule with Differential-Mode Choke**
Invited Paper Kalle Ilves, Yuhei Okazaki, Nan Chen, Muhammad Nawaz, Antonios Antonopoulos
 9:00 ABB Corporate Research, Sweden

23K1-3 Research on Key Technology and Equipment for Zhangbei 500kV DC Grid

Invited Paper Guangfu Tang, Hui Pang, Zhiyuan He, Xiaoguang Wei
9:25 Global Energy Interconnection Research Institute, China

23K1-4 What Led to Success in Academic Research on the Family of Modular Multilevel Cascade Converters?

Invited Paper Hirofumi Akagi
9:50 Tokyo Institute of Technology, Japan

Wednesday, May 23: 11:00-12:40

Room A

Oral Session 23A2 Resonant Converters for Information and Communication Systems

Chair: Masahito Shoyama (*Kyushu University*)

23A2-1 Operating Principle of Current Resonant Converter Using Air Core Transformer for Isolated Power Supply on Chip
11:00

Seiya Abe, Hikaru Kaishakuji, Satoshi Matsumoto
Kyushu Institute of Technology, Japan

23A2-2 Analysis for High-Frequency LLC Resonant Converter with Planar Transformer at Light-Load Condition

11:25 Keon-Woo Kim¹, Jae-Il Baek¹, Yeonho Jeong¹, Ki-Mok Kim^{1,2}, Gun-Woo Moon¹
1) KAIST, Korea, 2) Gumi Campus of Korea Polytechnic College, Korea

23A2-3 A Novel Full Digital Control H-Bridge DC-DC Converter for Power Supply on Chip Applications

11:50 Shigeki Nakano, Toshiomi Oka, Seiya Abe, Satoshi Matsumoto
Kyushu Institute of Technology, Japan

23A2-4 A High-Efficiency Power Supply from Magnetic Energy Harvesters

12:15 Cheon-Yong Lim¹, Yeonho Jeong¹, Keon-Woo Kim¹, Feel-Soon Kang², Gun-Woo Moon¹
1) Korea Advanced Institute of Science and Technology, Korea, 2) Hanbat National University, Korea

Room B

Oral Session 23B2 Modular Multi-level Converters II

Chair: Theodore Soong (*University of Toronto*)

Dewei Xu (*Ryerson University*)

23B2-1 Opportunities for Leveraging Low-Voltage GaN Devices in Modular Multi-Level Converters for Electric-Vehicle Charging Applications
11:00

Mojtaba Ashourloo, Mohammad Shawkat Zaman, Miad Nasr, Olivier Trescases
University of Toronto, Canada

23B2-2 A New Control Strategy for Modular Multilevel Converter Operating in Quasi Two-Level PWM Mode

11:25 Chao Wang, Kui Wang, Zedong Zheng, Yongdong Li
Tsinghua University, China

23B2-3 A Current-Source Type MMC with Delta-Connected Arms for SMES

11:50 Yushi Miura, Toshifumi Ise
Osaka University, Japan

23B2-4 New Module with Isolated Half Bridge or Isolated Full Bridge for Modular Medium Voltage Converter

12:15 Yunpeng Si, Yifu Liu, Qin Lei
Arizona State University, USA

Room C

Oral Session 23C2 Power Module Design

Chair: Umamaheswara Vemulapati (*ABB Switzerland Ltd.*)

Tsuyoshi Funaki (*Osaka University*)

- 23C2-1** **Development of a 700-V-Class Reverse-Blocking IGBT for Advanced T-Type Neutral Point-Clamped Power Conversion System**
11:00 Hiroki Wakimoto¹, Haruo Nakazawa¹, David H. Lu¹, Takashi Matsumoto², Yoichi Nabetani²
1) *Fuji Electric Co., Ltd. Japan*, 2) *University of Yamanashi, Japan*
- 23C2-2** **Ceramic Embedding as Packaging Solution for Future Power Electronic Applications**
11:25 Hoang Linh Bach¹, Tobias Maximilian Endres¹, Daniel Dirksen¹, Sigrid Zischler¹, Christoph Friedrich Bayer¹, Andreas Schletz¹, Martin März^{1,2}
1) *Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany*, 2) *Friedrich-Alexander University Erlangen-Nürnberg, Germany*
- 23C2-3** **Microelectromechanical System (MEMS) Resonator: A New Element in Power Converter Circuits Featuring Reduced EMI**
11:50 A. N. M. Wasekul Azad¹, Sourov Roy¹, Abu Saleh Imtiaz², Faisal Khan¹
1) *University of Missouri-Kansas City, USA*, 2) *Globalfoundries, USA*
- 23C2-4** **A Lumped Thermal Model Including Thermal Coupling Effects and Boundary Conditions for Capacitor Banks**
12:15 Haoran Wang¹, Qiusheng Wang², Huai Wang¹
1) *Aalborg University, Denmark*, 2) *Anyang Vibrator Co., Ltd (Group), China*

Room D

Oral Session 23D2 Modeling, Simulation, EMI and Reliability -Modeling I-

Chair: Hiroki Ishikawa (*Gifu University*)

Yi Tang (*Nanyang Technological University*)

- 23D2-1** **Hysteresis Modeling of Magnetic Devices Based on Reluctance Network Analysis**
11:00 Yoshiki Hane, Kenji Nakamura
Tohoku University, Japan
- 23D2-2** **Optimal Sizing and Placement of Solar Powered Charging Station under EV Loads Penetration Using Artificial Bee Colony Technique**
11:25 Yuttana Kongjeen¹, Kulsomsup Yenchanthalit², Krischonme Bhumkittipich¹
1) *Rajamangala University of Technology Thanyaburi, Thailand*, 2) *Thepsatri Rajabhat University, Thailand*
- 23D2-3** **A Comparison of Average Model, Sampled-Data Model and Multi-Frequency Model Based on DC/DC Converters**
11:50 Xiangpeng Cheng, Jinjun Liu, Zeng Liu, Yiming Tu, Danhong Xue
Xi'an Jiaotong University, China
- 23D2-4** **Small-Signal Discrete-Time Modeling and Digital Control of the Bi-Directional DC/DC Converters**
12:15 Jia Yaoqin, Xu Yingchun, Hou Yijie
Xi'an Jiaotong University, China

Room E

Oral Session 23E2 Energy Management Systems and Modelling of Batteries

Chair: Kichiro Yamamoto (*Kagoshima University*)

Alfred Rufer (*EPFL, Ecole Polytechnique Fédérale de Lausanne*)

- 23E2-1** **Energy Management of Hydrogen-Storage Photovoltaic Generation System with a Function of Suppressing Short-Period Components**
11:00 Yuuki Machida, Akihisa Goto, Akiko Takahashi, Shigeyuki Funabiki
Okayama University, Japan
- 23E2-2** **A Dynamic Battery Charging Approach for Energy Trading in the Smart Grid**
11:25 Avinash Sharma¹, Akshay Kumar Rathore¹, Rajesh Kumar²
1) *Concordia University, Canada*, 2) *MNIT, India*

23E2-3 A Forced Commutation Method of the Solid-State Transfer Switch in the Uninterrupted Power Supply

11:50 Applications

Meng-jiang Tsai, Jiuyang Zhou, Po-tai Cheng
National Hsing-hua University, Taiwan

23E2-4 Online Internal Impedance Measurements of Li-Ion Battery Using PRBS Broadband Excitation and Fourier Techniques: Methods and Injection Design

12:15

Jussi Sihvo, Tuomas Messo, Tomi Roinila, Roni Luhtala
Tampere University of Technology, Finland

Room F

Oral Session 23F2 HVDC Transmission Systems and DC Circuit Breakers I

Chair: Takanori Isoe (*University of Tsukuba*)

Wu Chen (*Southeast University*)

23F2-1 A DC Current Flow Controller for Meshed HVDC Grids

11:00

Viktor Hofmann, Mark-M. Bakran
University of Bayreuth, Center of Energy Technology, Germany

23F2-2 An Isolated Soft-Switching Hybrid-Source DC-DC Converter for DC Offshore Wind Farms

11:25

Shenghui Cui, Jingxin Hu, Marco Stieneker, Rik W. De Doncker
RWTH Aachen University, Germany

23F2-3 A Transformerless Multi-Cell Solid-State Fault Current Limiter for Medium Voltage Power System

11:50

Pantarote Techama, Sompob Polmai, Chanin Bunlaksananusorn
King Mongkut's Institute of Technology Ladkrabang, Thailand

23F2-4 A Novel DC Power Flow Controller for HVDC Grids with Different Voltage Levels

12:15

Ya'nan Wu¹, Han Ye², Wu Chen², Xiaokun He²
1) State Key Laboratory of Advanced Power Transmission Technology (Global Energy Interconnection Research Institute), China, 2) Southeast University, China

Room G

Oral Session (Organized) 23G2 Conversion Technologies for Renewable Energy and Energy Saving III

Chair: Dong-Choon Lee (*Yeungnam University*)

Masayoshi Yamamoto (*Nagoya University*)

23G2-1 Design and Control of Single-Phase Grid-Connected Photovoltaic Microinverter with Reactive Power Support Capability

Invited Paper

11:00

Geon-Hong Min¹, Kyung-Hwan Lee¹, Jung-Ik Ha¹, Myong Hwan Kim²
1) Seoul National University, Korea, 2) LG Electronics, Korea

23G2-2 Optimal Size and Multi-Objective Control of Battery Energy Storages in Distribution System with High Penetration of Distributed PV Generators

Invited Paper

11:25

Meiqin Mao¹, Lei Zhou¹, Yangyang Wang¹, Liuchen Chang²
1) Hefei University of Technology, China, 2) University of New Brunswick, Canada

23G2-3 Mission Profile-Oriented Control for Reliability and Lifetime of Photovoltaic Inverters

Invited Paper

11:50

Ariya Sangwongwanich, Yongheng Yang, Dezso Sera, Frede Blaabjerg
Aalborg University, Denmark

23G2-4 Discontinuous Current Mode Control for Minimization of Three-Phase Grid-Tied Inverter in Photovoltaic System

Invited Paper

12:15

Hoai Nam Le, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Oral Session (Organized) 23H2 Advanced Electrified Railway Systems

Chair: Masafumi Miyatake (*Sophia University*)

Fei Lin (*Beijing Jiaotong University*)

23H2-1 A Theoretical Analysis on Static Characteristics of Voltage Based Control Method and Current Based Control

Invited Paper **Method for the Wayside Energy Storage System in DC-Electrified Railway**

11:00 Hiroyasu Kobayashi¹, Keiichiro Kondo¹, Diego Iannuzzi²

1) Chiba University, Japan, 2) University Federico II of Naples, Italy

23H2-2 Improvement of a DC Electrical Railway Simulator Using Artificial Intelligence

Invited Paper Alvaro J. Lopez-Lopez, Ramon R. Pecharroman, Antonio Fernandez-Cardador, Asuncion P. Cucala

11:25 Comillas Pontifical University, Spain

23H2-3 Feeding-Loss Reduction by Higher-Voltage DC Railway Feeding System with DC-to-DC Converter

Invited Paper Hidenori Shigeeda¹, Hiroaki Morimoto¹, Kazuhiko Ito¹, Toshiyuki Fujii², Naoki Morishima³

11:50 1) Railway Technical Research Institute, Japan, 2) Mitsubishi Electric Corporation, Japan, 3) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

23H2-4 Modeling and Simulation of Novel Railway Power Supply System Based on Power Conversion Technology

Invited Paper Minwu Chen¹, Ruofei Liu¹, Shaofeng Xie¹, Xiaofang Zhang², Yimin Zhou²

12:15 1) Southwest Jiaotong University, China, 2) Wenzhou Mass Transit Railway Investment Group Co., Ltd, China

Room K

Oral Session (Organized) 23K2 Static Wireless EV Charging

Chair: Nobukazu Hoshi (*Tokyo University of Science*)

Seung-Ki Sul (*Seoul National University*)

23K2-1 Comparative Study on Front-End Parameter Identification Methods for Wireless Power Transfer Without Wireless

Invited Paper **Communication Systems**

11:00 Sinan Li¹, S. Y. (Ron)Hui^{1,2}

1) The University of Hong Kong, China, 2) Imperial College, UK.

23K2-2 A New Type of Wireless V2X System with a Dual-Active Bidirectional Single-Ended Converter and Optimized

Invited Paper **SiC-MOSFET**

11:25 Hideki Omori¹, Aoto Yamamoto¹, Naoki Mukaiyama¹, Masahito Tsuno², Kenji Fukuda³, Hisato Michikoshi³, Noriyuki Kimura¹, Toshimitsu Morizane¹

1) Osaka Institute of Technology, Japan, 2) Nichicon Corporation, Japan, 3) National Institute of Advanced Industrial Science and Technology, Japan

23K2-3 Metal Object Detection System with Parallel-Mistuned Resonant Circuits and Nullifying Induced Voltage for Wireless EV Chargers

Invited Paper **Wireless EV Chargers**

11:50 Seog Y. Jeong, Van X. Thai, Jun H. Park, Chun T. Rim

GIST, Korea

23K2-4 Wireless EV Charging System without Air-Gap and Misalignment

Invited Paper Wenxing Zhong, Dehong Xu

12:15 Zhejiang University, China

Room P

Poster Session 23P1 Matrix Converters

Chair: Tomoyuki Mannen (*Tokyo University of Science*)

Jing Lyu (*Nanyang Technological University*)

23P1-1 Fixed Slope Carrier PWM for Indirect Matrix Converter

Tzung-Lin Lee, Chun-Yao Hung, Yen-Wen Chen, Wen-Mei Huang
National Sun Yat-sen University, Taiwan

23P1-2 Carrier-Based Overmodulation Strategy for Matrix Converters

Paiboon Kiatsookkanatorn¹, Somboon Sangwongwanich²
1) *Rajamangala University of Technology, Thailand*, 2) *Chulalongkorn University, Thailand*

**23P1-3 Three-Phase to High-Frequency Single-Phase Matrix Converter
-A Frequency Control Suitable for Soft Switching-**

Wataru Kodaka¹, Satoshi Ogasawara¹, Koji Orikawa¹, Masatsugu Takemoto¹, Takashi Hyodo², Hiroyuki Tokusaki²
1) *Hokkaido University, Japan*, 2) *Omron Corporation, Japan*

23P1-4 Two-Step Commutation for Isolated DC-AC Converter with Matrix Converter

Shunsuke Takuma, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Poster Session 23P2 Multi-level Converters and MMC III

Chair: Masanori Ishigaki (*Toyota Central R&D Labs., Inc.*)

Xingxing Chen (*Xi'an Jiaotong University*)

23P2-1 A DC-Link Capacitor Voltage Oscillation Reduction Method for a Modular Multilevel Cascade Converter with Single Delta Bridge Cells (MMCC-SDBC)

Takaaki Tanaka¹, Huai Wang², Frede Blaabjerg²
1) *Fuji Electric Co., Ltd, Japan*, 2) *Aalborg University, Denmark*

23P2-2 Optimized Decoupling Control of Flying Capacitor in ANPC Five-Level Inverter

Fusheng Wang, Deyou Zheng, Jianing Wang, Fei Li, Fang Liu, Shuying Yang, Zhen Xie
Hefei University of Technology, China

23P2-3 Cascaded Dual-Buck AC-AC Converter Using Coupled Inductors

Sanghun Kim¹, Duekjin Jang¹, Heung-Geun Kim¹, Honnyong Cha²
1) *Kyungpook National University, Korea*, 2) *Kyungpook National University, Korea*

23P2-4 Instantaneous Power Loss Calculation for MMC Based on Virtual Arm Mathematical Model

Yin Shiyuan, Wang Yue, Yin Taiyuan, Nie Cheng, Duan Guozhao, Wang Zhang
Xi'an Jiaotong University, China

23P2-5 Comparison of Current Control Strategies in Modular Multilevel Converter

Jianzhao Wei¹, Anirudh Budnar Acharya¹, Lars Norum¹, Pavol Bauer²
1) *IME, NTNU, Norway*, 2) *EEMCS Faculty, TUD, The Netherlands*

23P2-6 Model Predictive Control of a Modular Multilevel Converter with an Improved Capacitor Balancing Method

Shichong Zhang, Baodong Bai, Dezhi Chen
Shenyang University of Technology, China

Poster Session 23P3 DC-DC Converters II

Chair: Takafumi Okuda (*Kyoto University*)

Heung-Geun Kim (*Kyungpook National University*)

23P3-1 High Step-Up DC-DC Converter Based on Multi-Cell Coupled Inductor Diode-Capacitor Network

Xinying Li, Yan Zhang, Jinjun Liu, Pengxiang Zeng
Xi'an Jiaotong University, China

- 23P3-2 Novel Active Clamping Step-Down DC-DC Converter with Lower Voltage Stress**
Chi-Hsuan Hsu, Jun-Min Jian, Jiann-Fuh Chen, Hsuan Liao
National Cheng Kung University, Taiwan
- 23P3-3 Design and Evaluation of a Magnetically-Loosely-Coupled Inductor for a Four-Phase Interleaved Boost Chopper**
Hiroki Kowatari, Toshinori Kitamura, Nobukazu Hoshi
Tokyo University of Science, Japan

Poster Session 23P4 Grid-tied Converters II

Chair: Kansuke Fujii (*Fuji Electric Co., Ltd.*)
Jun Wang (*Virginia Tech*)

- 23P4-1 A Synchronous-Reference-Frame I-V Droop Control Method for Parallel-Connected Inverters**
Mingshen Li, Yonghao Gui, Zheming Jin, Yajuan Guan, Josep M. Guerrero
Aalborg University, Denmark
- 23P4-2 Transient Stability Impact of the Phase-Locked Loop on Grid-Connected Voltage Source Converters**
Heng Wu, Xiongfei Wang
Aalborg University, Denmark
- 23P4-3 Comprehensive Analysis of Virtual Impedance-Based Active Damping for LCL Resonance in Grid-Connected Inverters**
Teng Liu, Zeng Liu, Jinjun Liu, Yiming Tu, Zipeng Liu
Xi'an Jiaotong University, China
- 23P4-4 A Comparative Study of the Traditional FS-MPC and the Proposed CSF-PCC for the Three-Phase Grid-Connected Inverters**
ZhiXun Ma^{1,2}, Xin Zhang¹, Jingjing Huang^{1,3}
1) Nanyang Technological University, Singapore, 2) Tongji University, Shanghai, 3) Xi'an University of Technology, China
- 23P4-5 Constant Switching-Frequency Predictive- Current-Control Method with a Dichotomy Solution for the Grid-Tied Inverters**
ZhiXun Ma^{1,2}, Xin Zhang¹, Jingjing Huang^{1,3}, Zhao Binl, Lyu Jing⁴
1) Nanyang Technological University, Singapore, 2) Tongji University, China, 3) Xi'an University of Technology, China, 4) Shanghai Jiao Tong University, China
- 23P4-6 Observer-Based Active Damping for Grid-Connected Converters with LCL Filter**
Y. Zhang, M. G. L. Roes, M. A. M. Hendrix, J. L. Duarte
Eindhoven University of Technology, The Netherlands

Poster Session 23P5 Isolated DC-DC Converters III

Chair: Kenichi Onda (*Nippon Chemi-Con Corporation*)

- 23P5-1 Conduction Loss Analysis and Optimization Design of Full Bridge LLC Resonant Converter**
Yugang Yang, Lifei Zhang, Tianshu Ma
Liaoning Technical University, China
- 23P5-2 Full-Bridge T-type Isolated DC/DC Converter with Wide Input Voltage Range**
Dong Liu¹, Yanbo Wang¹, Fujin Deng², Zhe Chen¹
1) Aalborg University, Denmark, 2) Southeast University, China
- 23P5-3 Research on High Efficiency LLC DC-DC Converter Based on SiC MosFet**
Pengcheng Han¹, Xiaoqiong He^{1,2}, Haijun Ren¹, Zhiqing Zhao¹, Xu Peng¹
1) Southwest Jiaotong University, China, 2) National Rail Transit Electrification and Automation Engineering Technique Research Center, China
- 23P5-4 An Improved Dual Phase Shift Control Strategy for Dual Active Bridge DC-DC Converter with Soft Switching**
Miao Hong, Gao Xuanjie, Zeng Chengbiand, Duan Shujiang
Sichuan University, China

Poster Session 23P6 Wide Band Gap Devices II

Chair: Wilmar Martinez (*KU Leuven University*)

Yoshinari Ikeda (*Fuji Electric Co., Ltd.*)

- 23P6-1 Development of an SiC High-Frequency PWM Inverter Using a Thick Multilayer PCB to Minimize Stray Inductance**
Kohsuke Ishikawa, Satoshi Ogasawara, Masatsugu Takemoto, Koji Orikawa
Hokkaido University, Japan
- 23P6-2 Fast Switching Planar Power Module with SiC MOSFETs and Ultra-Low Parasitic Inductance**
Arash Edvin Risseh¹, Hans-Peter Nee¹, Konstantin Kostov²
1) *KTH Royal Institute of Technology, Sweden*, 2) *The Mads Clausen Institute, SDU Electrical Engineering, Denmark*
- 23P6-3 Experimental Evaluation of Inverter System Consisting of 4-Parallel GaN Devices Unit**
Yoshiya Ohnuma¹, Satoshi Miyawaki¹, Fumiya Hattori², Masayoshi Yamamoto²
1) *Nagaoka Power Electronics, Japan*, 2) *Nagoya University, Japan*

Poster Session 23P7 Si Devices

Chair: David Hongfei Lu (*Fuji Electric Co., Ltd.*)

Satoshi Shiraki (*DENSO Corporation*)

- 23P7-1 Impact of the Thermal-Interface-Material Thickness on IGBT Module Reliability in the Modular Multilevel Converter**
Yi Zhang, Huai Wang, Zhongxu Wang, Yongheng Yang, Frede Blaabjerg
Aalborg University, Denmark
- 23P7-2 Nanoscale Investigation of the Power MOSFET by the AFM/KFM/SCFM**
Mizuki Nakajima¹, Yuuki Uchida¹, Nobuo Satoh¹, Hidekazu Yamamoto²
Chiba Institute of Technology, Japan
- 23P7-3 Simulation Analysis of Optimum Gate Driving Conditions of IGBTs**
Satoshi Sugahara, Masaki Kawakami, Kousuke Kamakura
Fukuyama University, Japan
- 23P7-4 Improvement of the I²t Capability for xEV Active Short Circuit Protection by Combination of RC-IGBT and Leadframe Technologies**
Keiichi Higuchi, Hayato Nakano, Akihiro Osawa, Akio Kitamura, Shunji Takenoiri, Daisuke Inoue, Souichi Yoshida, Hiromichi Gohara, Masahito Otsuki
Fuji Electric Co., Ltd, Japan
- 23P7-5 Investigation of Switching Behavior of an IGBT under Soft Turn-off in Application for Dual-Active Bridge Converters**
Eri Ogawa¹, Yuichi Onozawa¹, Rik W. De Doncker²
1) *Fuji Electric Co., Ltd., Japan*, 2) *RWTH Aachen University, Germany*

Poster Session 23P8 Packaging and Circuit Integration II

Chair: Abhijit Choudhury (*Experimental Power Grid Centre, ASTAR*)

Jun Imaoka (*Nagoya University*)

- 23P8-1 600V High Voltage Gate Driver IC (HVIC) with 1.0 MHz High Frequency Operation for LLC Current Resonant Power Supply**
Masaharu Yamaji, Masashi Akahane, Takahide Tanaka, Akihiro Jonishi, Hidetomo Ohashi, Masahiro Sasaki, Hitoshi Sumida
Fuji Electric Co. Ltd., Japan
- 23P8-2 An Integrated Voltage and Current Balancing Strategy of Series-Parallel Connected IGBTs**
Xiaotong Du, Fang Zhuo, Haotian Sun, Hao Yi, Yanlin Zhu
Xi'an Jiaotong University, China
- 23P8-3 Thermal Design and Analysis of a Cable Charger Used for Portable Electronics**
Mofan Tian, Xu Yang, Naizeng Wang, Yang Chen, Laili Wang
Xi'an Jiaotong University, China

23P8-4 Parasitic Inductance Design Considerations to Suppress Gate Voltage Oscillation of Fast Switching Power Semiconductor Devices

Yusuke Sugihara¹, Kimihiro Nanamori¹, Masayoshi Yamamoto², Yasuki Kanazawa²
1) Shimane University, Matsue, Japan, 2) Nagoya University, Japan

Poster Session 23P9 Electric Machines, Actuators and Sensors

Chair: Wataru Kitagawa (Nagoya Institute of Technology)
Masayuki Sanada (Osaka Prefecture University)

23P9-1 The Examination of Increasing Operation Speed of Consequent Pole Type Axial Gap Motor for Higher Output Power Density

Toru Ogawa^{1,2}, Tomohira Takahashi³, Masatsugu Takemoto², Satoshi Ogasawara², Hideaki Arita³, Akihiro Daikoku¹
1) Mitsubishi Electric Corp., Japan, 2) Hokkaido Univ., Japan, 3) Mitsubishi Electric Corp., Japan

23P9-2 Basic Study of PMASynRM with Bonded Magnets for Traction Applications

Marika Kobayashi, Shigeo Morimoto, Masayuki Sanada, Yukinori Inoue
Osaka Prefecture University, Japan

23P9-3 Study on Rotor Structure Suitable for Improving Power Density and Efficiency in IPMSMs for Automotive Applications

R. Imoto, M. Sanada, S. Morimoto, Y. Inoue
Osaka Prefecture University, Japan

23P9-4 Examination of the Demagnetization Suppression Effect of Placing Flux Barriers in an IPMSM Using Rare-Earth Bonded Magnets

Takashi Umeda, Masayuki Sanada, Shigeo Morimoto, Yukinori Inoue
Osaka Prefecture University, Japan

23P9-5 A Novel Pole-Changing Method with a Multiple Three-Phase Inverter

Yuki Hidaka¹, Taiga Komatsu¹, Hideaki Arita²
1) Mitsubishi Electric Corporation, Japan, 2) Mitsubishi Electric Corporation, Japan

23P9-6 Starting Characteristics of an Ultra-Lightweight Motor Using Magnetic Resonance Coupling

Kenta Takishima, Kazuto Sakai
Toyo University, Japan

23P9-7 Design and Basic Characteristics Analysis of Toroidal Winding Axial Gap Induction Motor

Ryosuke Sakai, Yukihiro Yoshida, Katsubumi Tajima
Akita University, Japan

23P9-8 Magnet Arrangement suitable for Large Air Gap Length in Linear PM Vernier Motor

Tatsuya Ninomiya, Abdulaziz Gasim, Shoji Shimomura
Shibaura Institute of Technology, Japan

23P9-9 Micro Electromagnetic Vibration Energy Harvester with Mechanical Spring and Iron Frame for Low Frequency Operation

Yecheng Shen, Kaiyuan Lu, Yongming Xia
Aalborg University, Denmark

23P9-10 Measurement of Two-Level Inverter Induced Current Slopes at High Switching Frequencies for Control and Identification Algorithms of Electrical Machines

Simon Decker¹, Andreas Liske¹, Daniel Schweiker¹, Johannes Kolb², Michael Braun¹
1) Karlsruhe Institute of Technology, Germany, 2) Schaeffler Technologies AG & Co. KG, Germany

Poster Session 23P10 PV Systems II

Chair: Hidemine Obara (Yokohama National University)
Hideki Ayano (National Institute of Technology, Tokyo College)

23P10-1 A New Topology of Switched-Capacitor Multilevel Inverter for Single-Phase Grid-Connected with Eliminating Leakage Current

Mehdi Samizadeh¹, Xu Yang¹, Bagher Karami², Wenjie Chen¹, Mohamad Abou Houran¹, Adib Abrishamifar², Abdolreza Rahmati²
1) Xi'an Jiaotong University, China, 2) Iran University of Science & Technology, Iran

23P10-2 An Interleaved Buck-Cascaded Buck-Boost Inverter for PV Grid-Connection Applications

Chien-Hsuan Chang, Chun-An Cheng, Hung-Liang Cheng
I-Shou University, Taiwan

- 23P10-3 A Novel PV Array Connection Strategy with PV-Buck Module to Improve System Efficiency**
Chi Shao¹, Wenjie Wang¹, Lijun Hang¹, Anping Tong², Shitao Wang³
1) Hangzhou Dianzi University, China 2) Shanghai Jiao Tong University, China, 3) State Grid of China Technology College, China
- 23P10-4 A Common-Mode Voltage Reduction for Two-Stage Three-Phase Transformerless PV Inverters**
Adisak Promyoo, Surapong Suwankawin
Chulalongkorn University, Thailand
- 23P10-5 A Grid-Connected PV-Energy Storage System with Synchronous Generator Characteristics**
Huadian Xu, Jianhui Su, Ning Liu, Yong Shi, Yan Du
Hefei University of Technology, China

Poster Session 23P11 Wind Power Systems and Grid-tied Distributed Power Systems

Chair: Jaeho Choi (*Chungbuk National University*)

Hideki Ayano (*National Institute of Technology, Tokyo College*)

- 23P11-1 A Transformerless Bidirectional DC-DC Converter Based on Power Units with Unipolar and Bipolar structure for MVDC Interconnection**
Lejia Sun¹, Fang Zhuo¹, Feng Wang¹, Hao Yi¹, Baohui Ma²
1) Xi'an Jiaotong University, China, 2) State Key Laboratory of Large Electric Drive System and Equipment Technology, China
- 23P11-2 New Modulation Control of Converter System Applied for Offshore Wind Farms**
Naoki Kawabata, Noriyuki Kimura, Toshimitsu Morizane, Hideki Omori
Osaka Institute of Technology, Japan
- 23P11-3 Sphere Decoding Based Long-Horizon Predictive Control of Three-Level NPC Back-to-Back PMSG Wind Turbine Systems**
Ferdinand Grimm^{1,2}, Zhenbin Zhang¹, Ralph Kennel²
1) Shandong University, China, 2) Technische Universitat Munchen, Germany
- 23P11-4 Based on PCHD and HPSO Sliding Mode Control of D-PMSG Wind Power System**
Lijun Hou, Xuemei Zheng, Chao Wang, Yangman Li, Haoyu Li
Harbin Institute of Technology, China
- 23P11-5 Establishment and Dynamic Control of Wind Induction Generator**
M. Z. Lu, V. K. Ganisetti, C. M. Liaw
National Tsing Hua University, Taiwan
- 23P11-6 Middle Frequency Solid State Transformer for HVDC Transmission from Offshore Windfarm**
Noriyuki Kimura¹, Toshimitsu Morizane¹, Isao Iyoda², Kazushige Nakao³, Tomoki Yokoyama⁴
1) Osaka Institute of Technology, Japan, 2) Osaka Electro-Communication University, Japan, 3) Fukui Institute of Technology, Japan, 4) Tokyo Denki University, Japan
- 23P11-7 Simulation of Wind Power Generation System Using Switched Reluctance Generator and Capacitor-less AC-AC Converter**
Guyuan Ji, Kazuhiro Ohyama
Fukuoka Institute of Technology, Japan
- 23P11-8 A Multi-Phase Series-Connected Modular Converter for Offshore Wind Energy Conversion System**
Baiyan Sun¹, Congzhe Gao¹, Xiangdong Liu¹, A. Haddad², Jun Liang², Zhen Chen¹, Tong Zheng¹
1) Beijing Institute of Technology, China, 2) Cardiff University, UK
- 23P11-9 Variable Frequency Control and Filter Design for Optimum Energy Extraction from a SiC Wind Inverter**
Abdallah Hussein, Alberto Castellazzi
The University of Nottingham, UK

Poster Session 23P12 Power Electronics Applied to Transmission, Smart Grid, DC Grid and Distribution Systems II

Chair: Yushi Miura (*Osaka university*)

Salvatore D'Arco (*SINTEF Energy Research*)

- 23P12-1 Experimental Verifications of UPFC Using Deadbeat Control with 3-Phase Unbalanced Compensation**
Shin-ichi Hamasaki, Hiroto Fukuda, Syohei Tokumaru, Mineo Tsuji
Nagasaki University, Japan

- 23P12-2 A Control Method for Two Types of Three-Phase Transformerless Unified Power Quality Conditioner**
Fujian Li, Guochun Xiao, Fangzhou Zhao, Shuai Zhang, Baojin Liu
Xi'an Jiaotong University, China
- 23P12-3 Design of Customer-End Converter Systems for Low Voltage DC Distribution from a Life Cycle Cost Perspective**
A. Mattsson, P. Nuutinen, T. Kaipia, P. Peltoniemi, J. Karppanen, V. Tikka, A. Lana, P. Pinomaa, P. Silventoinen, J. Partanen
Lappeenranta University of Technology, Finland
- 23P12-4 A Control Method of DC Capacitor Voltage in MMC for HVDC System Using Negative Sequence Current**
Hanis Afiqah binti Jaffar, Ahmad Arif bin Abd Rahman, Hiroaki Kakigano
Ristumeikan University, Japan
- 23P12-5 A Coordinate and Distributed Control Scheme for Multilevel and Multi-Stage Medium Voltage Solid State Transformer**
Jintong Nie, Liqiang Yuan, Qing Gu, Jianning Sun, Zhengming Zhao
Tsinghua University, China
- 23P12-6 An Improved Harmonic Power Sharing Scheme of Paralleled Inverter System**
Liu Hongpeng, Liu Xiaoxi, Zhang Wei, Wang Wei
Harbin Institute of Technology, China
- 23P12-7 The Grid Impedance Adaptation Dual Mode Control Strategy in Weak Grid**
Ming Li, Xing Zhang, Ying Yang, Pengpeng Cao
Hefei University of Technology, China
- 23P12-8 Transmission Power Analysis and Control of the DC Transformer in Hybrid AC/DC Microgrid**
Jingjin Huang^{1,2}, Xin Zhang², Tengfei Zhang²
1) Xi'an University of Technology, China, 2) Nanyang Technological University, Singapore
- 23P12-9 A Novel Flexible Interconnection Scheme for Microgrid to Optimize the Capacity of Energy Storage System (ESS)**
Jianqiao Zhou, Jianwen Zhang, Xu Cai, Zhuyong Li
Shanghai Jiaotong University, China
- 23P12-10 VSC Control and Parameters Design Based on Virtual Synchronous Generator**
Fang Liu, Meng Wang, Zhen Xie, Fusheng Wang, Jinxin Deng, Xing Zhang
Hefei University of Technology, China
- 23P12-11 Multi-Target Virtual Resistance Control Strategy in a 400 Hz Low Voltage Microgrid**
Yuze Li, Xuejun Pei, Zhi Chen, Hanyu Wang, Yong Kang
Huazhong University of Science and Technology, China
- 23P12-12 An Adaptive Power Compensation Strategy for the Voltage Stabilization of LCL-VSC Based Microgrids**
Sheng Xu¹, Wu Cao², Dongchen Fan², Jianfeng Zhao², Shunyu Wang²
1) Taizhou University, China, 2) Southeast University, China
- 23P12-13 Resonance Detection Strategy for Multiple Grid-Connected Inverters-Based System Using Cascaded Second-Order Generalized Integrator**
Wu Cao¹, Dongchen Fan¹, Kangli Liu¹, Jianfeng Zhao¹, Liheng ruan², Xiaojun Wu²
1) Southeast University, China, 2) Jiangsu Haihang Electric Technology Co. Ltd, China
- 23P12-14 Harmonic Stability Assessment Based on Global Admittance for Multi-Paralleled Grid-Connected VSIs Using Modified Nyquist Criterion**
Wu Cao¹, Dongchen Fan¹, Kangli Liu¹, Jianfeng Zhao¹, Liheng ruan², Xiaojun Wu²
1) Southeast University, China, 2) Jiangsu Haihang Electric Technology Co. Ltd, China
- 23P12-15 The AC Traction Power Supply System for Urban Rail Transit Based on Negative Sequence Current Compensator**
Tianshu Zhao¹, Xu Peng²
1) Chengdu NO. 7 High School, China, 2) Southwest Jiaotong University, China

Poster Session 23P13 Power Electronics for Automobiles

Chair: Hikaru Watanabe (*Toyota Motor Corporation*)

Fatou Diouf (*RENAULT*)

- 23P13-1 Grid Connected Power Generation Control Method for Z-Source Integrated Bidirectional Charging System**
Xu Jia, Guoming Chuai, Haonan Niu, Qianfan Zhang
Harbin Institute of Technology, China

23P13-2 An Isolated PFC Converter with Harmonic Modulation Technique for EV Chargers

Jun Young Lee

Myongji University, Korea

Poster Session 23P14 Industrial Applications II

Chair: Yuichi Mabuchi (*Hitachi, Ltd.*)

Nobuo Hayashi (*Daikin Industries, Ltd.*)

23P14-1 Highly Dynamic Switching Frequency-Based Calculation of Power Quantities, Fundamental Waveforms, and RMS Values of Inverter-Fed Electrical Machines

Alexander Stock, Johannes Teigelkötter, Johannes Büdel

University of Aschaffenburg, Germany

23P14-2 Design and Analysis of High Voltage Power Supply for Industrial Electrostatic Precipitators

Shengwen Fan¹, Yiqin Yuan², Pengyu Jia², Zhigang Chen¹, Haisi Li²

1) University of Science and Technology Beijing, China, 2) North China University of Technology, China

23P14-3 Load Sharing Operation in N+1 UPS System by Using Harmonic Sharing Control Method

Prashant Patel¹, Sagar Naina², Utsav Patel², Premal Patwa²

1) Hitachi India Pvt. Ltd., India, 2) HHPE Pvt. Ltd., India

Poster Session 23P15 Power Converters and Systems II

Chair: Kazunori Hasegawa (*Kyushu Institute of Technology*)

Axel Mertens (*Leibniz Universitaet Hannover*)

23P15-1 Research on Capacity Optimization of PV-Wind-Diesel-Battery Hybrid Generation System

Cailing Zhu¹, Furong Liu¹, Sheng Hu¹, Shu Liu²

1) Wuhan University of Technology, China, 2) Sinomach Intelligence Technology Research Institute, China

23P15-2 A Numerical Analysis and Improvement of Output Characteristics in Different Passive Rectifiers Based on Vibration Generators

Tomoki Sakabe, Masataka Minami, Shin-ichi Motegi, Masakazu Michihira

Kobe City College of Technology, Japan

23P15-3 Circuit Modeling Approach for Analyzing Triboelectric Nanogenerators for Energy Harvesting

Bo-Kyung Yoon, Jeong Min Baik, Katherine A. Kim

Ulsan National Institute of Science and Technology, Korea

Poster Session 23P16 Power Converters and Systems III

Chair: Fuka Ikeda (*National Institute of Technology, Ube College*)

Juergen Biela (*ETH Zürich*)

23P16-1 General Power Electric Converter Model

Jingwen Xie

Schneider Electric, China

23P16-2 A Modular Converter- and Signal-Processing-Platform for Academic Research in the Field of Power Electronics

Rüdiger Schwendemann, Simon Decker, Marc Hiller, Michael Braun

Karlsruhe Institute of Technology, Germany

23P16-3 Control IC for Boost-Flyback Converter for Energy Harvesting Applications

Jhih-Sian Li, Tsorng-Juu Liang, Kai-Hui Chen, Jui-Hung Lai, Jun-Xian Huang

National Cheng Kung University, Taiwan

Room A

Oral Session 23A3 Application of DC-DC Converters

Chair: Kyungmin Sung (*Ibaraki National College of Technology*)

Seog Yong Jeong (*Gwangju Institute of Science and Technology*)

- 23A3-1 **New Concept of the DC-DC Converter Circuit Applied for the Small Capacity Uninterruptible Power Supply**
14:30 Dang Minh Huynh, Yoichi Ito, Shinji Aso, Koji Kato, Kenji Teraoka
Sanken Electric Co., Japan
- 23A3-2 **Comparative Study on the Performance of Dual-Phase Tapped-Inductor Boost Converter and Interleaved Boost Parallel-Input Series-Output Converter in 40 to 400V Applications**
14:55 Niño Christopher Ramos^{1,2}, Tsuyoshi Funaki²
1) *University of the Philippines-Diliman, Philippines*, 2) *Osaka University, Japan*
- 23A3-3 **A New Standby Structure Integrated with Boost PFC Converter for Server Power Supply**
15:20 Jae-Il Baek¹, Jae-Kuk Kim², Jae-Bum Lee³, Moo-Hyun Park¹, Gun-Woo Moon¹
1) *KAIST, Korea*, 2) *In-ha University, Korea*, 3) *KRRI, Korea*
- 23A3-4 **Nonisolated Two-Channel LED Driver with Simple Snubber**
15:45 Jong-Woo Kim¹, Jung-Kyu Han², Jih-Sheng Lai¹
1) *Virginia Tech, USA*, 2) *Electrical Engineering, KAIST, Korea*

Room B

Oral Session 23B3 Modular Multi-level Converters III

Chair: Koji Orikawa (*Hokkaido University*)

Xingxing Chen (*Xi'an Jiaotong University*)

- 23B3-1 **Design and Implementation of Single-Phase Asymmetric Multilevel STATCOM**
14:30 Hao Chen¹, Yang Han¹, Ping Yang¹, Congling Wang¹, Josep M. Guerrero²
1) *University of Electronic Science and Technology of China, China*, 2) *Aalborg University, Denmark*
- 23B3-2 **Submodule Voltage Balancing and Loss Equalisation in Alternate Arm Converters Based on Virtual Voltages**
14:55 Georgios Konstantinou¹, Harith R. Wickramasinghe¹, Salvador Ceballos², Josep Pou³
1) *The University of New South Wales, Australia*, 2) *Tecnalia Research and Innovation, Spain*, 3) *Nanyang Technological University, Singapore*
- 23B3-3 **Balanced Conduction Loss Distribution among SMs in Modular Multilevel Converters**
15:20 Zhongxu Wang, Huai Wang, Yi Zhang, Frede Blaabjerg
Aalborg University, Denmark
- 23B3-4 **Simplification of Model Predictive Control for Modular Multilevel Converter through Direct Voltage Level Selection**
15:45 Xingxing Chen, Jinjun Liu, Shaodi Ouyang, Shuguang Song, Rui Luo
The University of Xi'an Jiaotong, China

Room C

Oral Session 23C3 Multi-phase/Multi-input DC-DC Converters

Chair: Pin-Yu Huang (*Tokyo Metropolitan University*)

Wu Chen (*Southeast University*)

- 23C3-1 **Family of Integrated Multi-Input Multi-Output DC-DC Power Converters**
14:30 Bang Le-Huy Nguyen¹, Honnyong Cha¹, Tien-The Nguyen¹, Heung-Geun Kim²
1) *Kyungpook National University, Korea*, 2) *Kyungpook National University, Korea*

- 23C3-2 Low-Complexity State-Space Based System Identification and Controller Auto-Tuning Method for Multi-Phase DC-DC Converters**
 14:55 Marc Kanzian¹, Harald Gietler², Christoph Unterrieder¹, Matteo Agostinelli¹, Michael Lunglmayr³, Mario Huemer³
 1) Infineon Technologies Austria AG, Austria, 2) Alpen-Adria Universität Klagenfurt, Austria, 3) Johannes Kepler University Linz, Austria
- 23C3-3 A Phase-Shift Double Full-Bridge (PSDB) Converter with Three Shared Leading-Legs**
 15:20 Junjie Zhu, Qinsong Qian, Shengli Lu, Weifeng Sun, Le Zhang
 Southeast University, China
- 23C3-4 Dual Active Bridge Synchronous Rectified Step-Down Converter**
 15:45 Chien-Chun Huang¹, Chang-Lin Tsai¹, Tsung-Lin Tsai¹, Yao-Ching Hsieh², Huang-Jen Chiu¹, Jing-Yuan Lin¹
 1) National Taiwan University of Science and Technology, Taiwan, 2) National Sun Yat-Sen University, Taiwan

Room D

Oral Session 23D3 Modeling, Simulation, EMI and Reliability -Modeling II-

Chair: Toshiji Kato (*Doshisha University*)

Krischonme N. Bhummittipich (*Rajamangala University of Technology Thanyaburi*)

- 23D3-1 Accurate Impedance Model of Grid-Connected Inverter for Small-Signal Stability Assessment in High-Impedance Grids**
 14:30 Tuomas Messo, Roni Luhtala, Aapo Aapro, Tomi Roinila
 Tampere University of Technology, Finland
- 23D3-2 Modeling of Unbalanced Three-Phase Grid-Connected Converters with Decoupled Transfer Functions**
 14:55 Wei Liu, Xiongfei Wang, Frede Blaabjerg
 Aalborg University, Denmark
- 23D3-3 Predicting Voltage Characteristic of Charging Model for Li-Ion Battery with ANN for Real Time Diagnosis**
 15:20 Minella Bezha, Naoto Nagaoka
 Doshisha University, Japan
- 23D3-4 Impedance Modeling and Stability Analysis of the Cascaded Three-Phase Symmetric Systems Using Complex Transfer Functions**
 15:45 Teng Liu, Zeng Liu, Jinjun Liu, Yiming Tu, Zipeng Liu
 Xi'an Jiaotong University, China

Room E

Oral Session 23E3 Reluctance Machines

Chair: Masahiro Aoyama (*Shizuoka University*)

Kenji Nakamura (*Tohoku University*)

- 23E3-1 Acoustic Noise Reduction of 12/8 Poles SRM without Efficiency Drop Using Simple Current Waveforms**
 14:30 Kyohei Kiyota¹, Kenji Amei¹, Takahisa Ohji¹, Jun Jisaki², Masanobu Nakai²
 1) University of Toyama, Japan, 2) Nachi-Fujikoshi Corp., Japan
- 23E3-2 Study of Switched Reluctance Motor Directly Driven by Commercial Three-Phase Power Supply**
 14:55 Masaki Takahashi, Kohei Aiso, Kan Akatsu
 Shibaura Institute of Technology, Japan
- 23E3-3 Double Stator Axial-Flux Switched Reluctance Motor for Electric City Commuters**
 15:20 Hiroki Goto
 Utsunomiya University, Japan
- 23E3-4 Torque Ripple Reduction Using Asymmetric Flux Barriers in Synchronous Reluctance Motor**
 15:45 Yuuto Yamamoto, Shigeo Morimoto, Masayuki Sanada, Yukinori Inoue
 Osaka Prefecture University, Japan

Room F

Oral Session 23F3 Chargers for Transportation Systems

Chair: Masafumi Miyatake (*Sophia University*)

Jung-Ik Ha (*Seoul National University*)

23F3-1 On-board Single-Phase Electric Vehicle Charger with Active Front End

14:30 Theodore Soong, Peter W. Lehn
University of Toronto, Canada

23F3-2 A Bidirectional Buffered Charging Unit for EV's (BBCU)

14:55 Alfred Rufer, Gabriel Fernandez
Ecole Polytechnique Fédérale de Lausanne, Switzerland

23F3-3 Reconfigurable Converter with Multiple-Voltage Multiple-Power for E-Mobility Charging

15:20 Mohamed S A Dahidah¹, He Liu¹, Vassilios G. Agelidis²
1) Newcastle University, UK, 2) Technical University of Denmark, Denmark

23F3-4 Development of a Series Hybrid Electric Vehicle Laboratory Test Bench with Hardware-in-the-Loop Capabilities

15:45 Poria Fajri¹, Nima Lotfi², Mehdi Ferdowsi³
1) University of Nevada Reno, USA, 2) Southern Illinois University, USA, 3) Missouri University of Science and Technology, USA

Room G

Oral Session 23G3 Smart Grids and Distributed Power Sources

Chair: Kaoru Inoue (*Doshisha University*)

Dong-Wook Yoo (*KERI*)

23G3-1 New Three-Phase Static Transfer Switch Using AC SSCB

14:30 Seung-Min Song, Jin-Young Kim, In-Dong Kim
Pukyong National University, Korea

23G3-2 Harmonics Compensation in High Frequency Range of Active Power Filter with SiC-MOSFET Inverter in Digital Control System

14:55 Shin-ichi Hamasaki, Kengo Nakahara, Mineo Tuji
Nagasaki University, Japan

23G3-3 Control of Buck-Boost Direct Matrix Converter with Low Voltage Ride-Through Capability

15:20 Nico Remus, Martin Leubner, Wilfried Hofmann
Technical University Dresden, Germany

23G3-4 An Improved PLL Based Seamless Transfer Control Strategy

15:45 Xin Meng, Jinjun Liu, Zeng Liu, Ronghui An
Xi'an Jiaotong University, China

Room H

Oral Session 23H3 Energy Storage System for Railway Systems

Chair: Shoichiro Watanabe (*National Traffic Safety and Environment Laboratory*)

Minwu Chen (*Southwest Jiaotong University*)

23H3-1 Efficient Urban Railway Design integrating Train Scheduling, Onboard Energy Storage, and Traction Power Management

14:30 Warayut Kampeerawar¹, Takafumi Koseki¹, Fulin Zhou²
1) The University of Tokyo, Japan, 2) Southwest Jiaotong University, China

23H3-2 Optimal Control Method of an Energy Storage System for Energy Saving

14:55 Yoko Takeuchi, Tomoyuki Ogawa, Keisuke Sato, Hiroaki Morimoto, Tatsuhito Saito
Railway Technical Research Institute, Japan

23H3-3 Start-Up and Transient Operation of a Bidirectional Chopper with an Auxiliary Converter

15:20 Hamzeh J. Ahmad, Haruna Ohnishi, Makoto Hagiwara
Tokyo Institute of Technology, Japan

23H3-4 Experimental Results of Quasi-Optimal Charging Current Patterns to Reduce the Internal Heat Generation of the Lithium-Ion Battery

15:45 Yoshiaki Taguchi, Gaku Yoshikawa
Traction Control, Railway Technical Research Institute, Japan

Room K

Oral Session 23K3 HVDC Transmission Systems and DC Circuit Breakers II

Chair: Teruo Yoshino (*Toshiba Mitsubishi-Electric Industrial Systems Corp.*)
Marta Molinas (*Norwegian University of Science and Technology*)

23K3-1 Development of Test Methods and Evaluation Results for 500kV HVDC Converter

14:30 Keisuke Hattori¹, Asuka Ohtake¹, Takayoshi Kamejima², Haruhisa Wada³
1) *Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan*, 2) *Toshiba Energy Systems & Solutions Corporation, Japan*, 3) *Toshiba Corporation, Japan*

23K3-2 Dissipation Loop for Shoot-Through Faults in HVDC Converter Cells

14:55 Keijo Jacobs, Staffan Norrga, Hans-Peter Nee
KTH Royal Institute of Technology, Sweden

23K3-3 A Suppression Method of Harmonic Instability in Line-Commutated Converters Applying Active Harmonic Filters

15:20 Kenichiro Sano¹, Toshiaki Kikuma¹, Tatsuhito Nakajima², Junya Kanno³
1) *CRIEPI, Japan*, 2) *Tokyo City University, Japan*, 3) *Tokyo Electric Power Company Holdings Inc., Japan*

23K3-4 Experiment of Semiconductor Breaker Using Series-Connected IEGTs for Hybrid DCCB

15:45 Kazuyasu Takimoto¹, Hiroshi Takenaka¹, Toshiaki Matsumoto¹, Takahiro Ishiguro²
1) *Toshiba Corporation, Japan*, 2) *Toshiba Energy Systems & Solutions Corporation, Japan*

Wednesday, May 23: 16:30-18:10

Room A

Oral Session 23A4 Modeling, Simulation, EMI and Reliability -EMI-

Chair: Satoshi Ogasawara (*Hokkaido University*)

23A4-1 Study of EMI Caused by Buck Converter on Controller Area Network

16:30 Ryo Shirai, Toshihisa Shimizu
Tokyo Metropolitan University, Japan

23A4-2 A Study on Reduction Techniques of a Wideband Common-Mode Voltage Produced by a PWM Inverter

16:55 Shotaro Takahashi¹, Satoshi Ogasawara¹, Masatsugu Takemoto¹, Koji Orikawa¹, Michio Tamate²
1) *Hokkaido University, Japan*, 2) *Fuji Electric Co., Ltd., Japan*

23A4-3 A Modified Discontinuous PWM for Commonmode Voltage Elimination in 3-Level 4-Leg PWM Converter System

17:20 Seon-Ik Hwang¹, Jun-Hyung Jung¹, In-Ho Cho², Jang-Mok Kim¹, Yung-Deug Son³
1) *Pusan National University, Korea*, 2) *Hyundai Heavy Industries, Korea*, 3) *Korea University of Technology and Education, Korea*

23A4-4 EMI Analysis of Full-SiC Integrated Power Module

17:45 Xiliang Chen, Wenjie Chen, Yu Ren, Liang Qiao, Yilin Sha, Xu Yang
Xi'an Jiaotong University, China

Room B

Oral Session 23B4 Wireless Power Transfer Systems II

Chair: Takehiro Imura (*The University of Tokyo*)

Juan Rivas-Davila (*Stanford University*)

- 23B4-1 Experimental Verification of Coupling Effect and Power Transfer Capability of Dynamic Wireless Power Transfer**
16:30 Chan Anyapo¹, Nithiphat Teerakawanich¹, Chowarit Mitsantisuk¹, Kiyoshi Ohishi²
1) Kasetsart University, Thailand, 2) Nagaoka University of Technology, Japan
- 23B4-2 Neighboring Effects on the Deactivated Inverter in a Segmented Dynamic Wireless EV Charging System**
16:55 Qingwei Zhu¹, Yanjie Guo², Lifang Wang², Shufan Li², Chenglin Liao²
1) University of Manchester, UK, 2) Chinese Academy of Sciences, China
- 23B4-3 Multiple Exciting Voltage Control for Maximization of Multi-Hop Wireless Power Transfer Efficiency**
17:20 Masato Sasaki, Masayoshi Yamamoto
Nagoya University, Japan
- 23B4-4 General Analytical Model for Inductive Power Transfer System with EMF Canceling Coils**
17:45 Keita Furukawa, Keisuke Kusaka, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Room C

Oral Session 23C4 Output Filter Technologies

Chair: Hideaki Fujita (*Tokyo Institute of Technology*)

Xiongfei Wang (*Aalborg university*)

- 23C4-1 Stability Influence of Filter Components Parasitic Resistance on LCL-Filtered Grid Converters**
16:30 Hiroaki Matsumori¹, Toshihisa Shimizu¹, Frede Blaabjerg², Xiongfei Wang², Dongsheng Yang²
1) Tokyo Metropolitan University, Japan, 2) Aalborg University, Denmark
- 23C4-2 Real-Time Estimation Control of Inductance Parameters Using Dust Core Materials for PWM Inverter**
16:55 Kazu Imai¹, Takuma Yoshino¹, Ohasi Shunsuke², Tomoki Yokoyama¹
1) Tokyo Denki University, Japan, 2) Fuji Electric Co., Ltd, Japan
- 23C4-3 Control Design of Output-Stage Filterless Sinusoidal-Wave Inverter**
17:20 Shinichi Hiroshige, Kenji Yamanaka, Masahide Hojo
Tokushima University, Japan
- 23C4-4 Series Reactive Power Compensator with Reduced Capacitance for Hybrid Transformer**
17:45 Yuki Takahashi, Takanori Isobe, Hiroshi Tadano
University of Tsukuba, Japan

Room D

Oral Session 23D4 SiC Power Devices

Chair: Joachim Wuerfl (*Ferdinand-Braun-Institut*)

Takashi Sato (*Kyoto University*)

- 23D4-1 An Insight into the Voltage Rising Behavior during Turn-off Process of Series Connected SiC MOSFETs on Circuit Level**
16:30 Panrui Wang¹, Feng Gao¹, Yang Jing¹, Yufeng Chen², Lei Zhang²
1) Shandong University, Jinan, China, 2) State Grid Shandong Electric Power Research Institute, China
- 23D4-2 Paralleling Six 320A 1200V All-SiC Half-Bridge Modules for a Large Capacity Power Stack**
16:55 David Hongfei Lu, Hiromu Takubo, Sho Takano, Yuhei Suzuki
Fuji Electric Co., Ltd., Japan
- 23D4-3 3.3kV All-SiC Module for Electric Distribution Equipment**
17:20 Ryohei Takayanagi, Katsumi Taniguchi, Satoshi Kaneko, Naoyuki Kanai, Keishirou Kumada, Motohito Hori, Yoshinari Ikeda, Kouji Maruyama, Itsuo Kawamura
Fuji Electric Co., Ltd., Japan

23D4-4 Present Status of SiC Based Power Converters and Gate Drivers – A Review

17:45 Abhijit Choudhury
Experimental Power Grid Centre, ASTAR, Singapore

Room E

Oral Session 23E4 SRM & FSM Drives

Chair: Kazuhiro Ohyama (*Fukuoka Institute of Technology*)
Dongsheng Li (*Hitachi, Ltd.*)

23E4-1 Method of Applying Force Distribution Function for Linear Switched Reluctance Motor Driven by Current Source Inverter

16:30 Tadashi Hirayama, Shuma Kawabata
Kagoshima University, Japan

23E4-2 A Novel Drive Circuit for Switched Reluctance Motors with Bipolar Current Drive

16:55 Hiroki Ishikawa, Yuma Uesugi, Seiya Sakurai
Gifu University, Japan

23E4-3 Torque Ripple Minimization Control of SRM Based on Novel Motor Model Considering Mutual Coupling Effect

17:20 Sungyong Shin, Hikaru Naruse, Takashi Kosaka, Nobuyuki Matsui
Nagoya Institute of Technology, Japan

23E4-4 Comparison of High Frequency Voltage Injection Methods for Shaft Sensorless Control of Wound-Field Flux Switching Machine

17:45 Hong-Quan Nguyen, Sheng-Ming Yang
National Taipei University of Technology, Taiwan

Room F

Oral Session 23F4 FACTS

Chair: Kenichiro Sano (*Tokyo Institute of Technology*)
Kalle Ilves (*ABB*)

23F4-1 Design and Experimental Verification of a DAB Medium Frequency Transformer for a 6.6kV/200V Solid State Transformer

16:30 Rene Barrera-Cardenas¹, Takanori Isobe¹, Terazono Katsushi², Tadano Hiroshi²
1) University of Tsukuba, Japan, 2) Yaskawa Electric Corporation, Japan

23F4-2 Research on the Unbalanced Compensation Range of Delta-connected Cascaded H-Bridge Multilevel SVG

16:55 Rui Luo, Yingjie He, Yiming Tu, Xingxing Chen, Jinjun Liu
Xi'an Jiaotong University, China

23F4-3 Y-Source Bi-Directional DC Circuit Breaker

17:20 Haider Al-khafaf, Johnson Asumadu
Western Michigan University, USA

23F4-4 Static Synchronous Compensator to Stabilize Grid Voltage for Wind and Photovoltaic Power Plant

17:45 Ryota Okuyama, Naoki Morishima, Yusuke Ashizaki, Yohei Itaya
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

Room G

Oral Session 23G4 Renewable Energy and Storage Applications

Chair: Katherine A. Kim (*Ulsan National Institute of Science and Technology*)
Masatoshi Uno (*Ibaraki University*)

23G4-1 Large Equalization Current Control Strategy for Series Connected Battery Packs Based on Buck-Boost Converter

16:30 XinBo Liu¹²³, Zhuo Gao¹²³, XueHao Huang¹²³, YaoHan Zou¹²³
1) Inverter Technologies Engineering Research Center of Beijing, China, 2) Collaborative Innovation Center of Key Power Energy-Saving Technologies in Beijing, China, 3) North China University of Technology, China

- 23G4-2 A Multi-Port Bidirectional Power Conversion System for Reversible Solid Oxide Fuel Cell Applications**
 16:55 Xiang Lin¹, Kai Sun¹, Jin Lin¹, Zhe Zhang², Wei Kong³
 1) Tsinghua University, China, 2) Technical University of Denmark, Denmark, 3) Shanghai University of Electric Power, China
- 23G4-3 Self-Preheating Method for Li-ion Battery Using Battery Impedance Estimator**
 17:20 Dong-Kwan Kim¹, Young-Dal Lee¹, Sang-Hyun Ha^{1,2}, Yu-Jin Jang¹, Gun-Woo Moon¹
 1) KAIST, Korea, 2) Agency for Defense Development, Korea
- 23G4-4 Active Anti-Islanding Technique with Reduced Non-Detection Zone for Centralized Inverters**
 17:45 Prashant Jain¹, Vivek Agarwal², Bishnu Prasad Muni¹, Eswar Rao¹, Deepak Gehlot¹, S.Gautam Kumar¹
 1) BHEL R&D, India, 2) Indian Institute of Technology Bombay, India

Room H

Oral Session 23H4 Power Electronics and Drives Applied to Railway Vehicles

Chair: Shingo Makishima (*Toyo Denki Seizo K.K.*)

Xianjin Huang (*Beijing Jiaotong University*)

- 23H4-1 Development of SiC Applied Traction System for Shinkansen High-Speed Train**
 16:30 Kenji Sato, Hirokazu Kato, Takafumi Fukushima
Central Japan Railway Company, Japan
- 23H4-2 Development of a High Power Density Auxiliary Converter Based on 1700V 225A SiC MOSFET for Trams**
 16:55 Liu Hao¹, Fei Lin¹, Zhongping Yang¹, Hu Cao², Meng Xia²
 1) Beijing Jiaotong University, China, 2) Qingdao Sifang Rolling Stock Research Institute Co. Ltd., China
- 23H4-3 Experimental Tests Results of Damping Control with Over Voltage Resistor for Regenerative Brake Control of Railway Vehicle**
 17:20 Natsuki Kawagoe¹, Febry Pandu Wijaya¹, Hiroyasu Kobayashi¹, Keiichiro Kondo¹, Tetsuya Iwasaki², Akihiko Tsumura², Takumi Nagashima², Yoshinori Yamashita³, Ryota Gondo³
 1) Chiba University, Japan, 2) Odakyu Electric Railway Co. Ltd., Japan, 3) Mitsubishi Electric Co. Ltd., Japan
- 23H4-4 Coils Layout Optimization of Dynamic Wireless Power Transfer System to Realize Output Voltage Stable**
 17:45 Yi Wang, Fei Lin, Zhongping Yang, Panpan Cai, Zhiyuan Liu
Beijing Jiaotong University, China

Room K

Oral Session 23K4 Isolated Three-phase AC-DC Converters I

Chair: Yuichi Noge (*Tokyo University of Agriculture and Technology*)

Kyo-Beum Lee (*Ajou University*)

- 23K4-1 Quick Charger for a Battery Using Modular Matrix Converter (MMxC)**
 16:30 Kazuma Suzuki, Takaharu Takeshita
Nagoya Institute of Technology, Japan
- 23K4-2 Variable Output Voltage Control of an Isolated Bi-Directional AC/DC Converter with a Soft-Switching Technique**
 16:55 Takumi Hamaguchi, Kazuma Suzuki, Wataru Kitagawa, Takaharu Takeshita
Nagoya Institute of Technology, Japan
- 23K4-3 A New Modulation Method Applying Optimal Duty Cycle and Phase Shift for Bidirectional Isolated Three-Phase AC/DC Converter Based on Matrix Converter**
 17:20 Koji Shigeuchi¹, Jin Xu², Noboru Shimosato², Yukihiro Sato¹
 1) Chiba University, Japan, 2) Myway Plus Corporation, Japan
- 23K4-4 Decoupling Control Method for Eliminating DC Bias Flux of High Frequency Transformer in a Bidirectional Isolated AC/DC Converter**
 17:45 Kensuke Sakuma¹, Koji Shigeuchi¹, Jin Xu², Noboru Shimosato², Yukihiro Sato¹
 1) Chiba University, Japan, 2) Myway Plus Corporation, Japan

Room A

Oral Session 24A1 PFC Converters

Chair: Takanori Isoe (*University of Tsukuba*)
Jen-Hao Teng (*National Sun Yat-Sen University*)

- 24A1-1 **Interleaved Voltage-Doubler Boost Converter for Power Factor Correction**
8:35 Ta-Hsun Lo, Jen-Hao Teng, Bo-Jia Huang
National Sun Yat-Sen University, Taiwan
- 24A1-2 **ZVS Interleaved Totem-pole Bridgeless PFC Converter with Phase-Shifting Control**
9:00 Moo-Hyun Park, Jae-Il Baek, Jung-Kyu Han, Cheon-Yong Lim, Gun-Woo Moon
Korea Advanced Institute of Science and Technology, Korea
- 24A1-3 **A Zero-Voltage-Switching Totem-Pole Bridgeless Boost Power Factor Correction Rectifier Having Minimized Conduction Losses**
9:25 Young-Dal Lee¹, Chong-Eun Kim², Jae-Il Baek¹, Dong-Kwan Kim¹, Gun-Woo Moon¹
1) KAIST, Korea, 2) Solu-m Corp., Korea
- 24A1-4 **Power-Factor-Correction with Power Decoupling for AC-to-DC Converter**
9:50 Wan-Jung Chen¹, Tsung-Hsi Wu¹, Yao-Ching Hsieh¹, Chin-Sien Moo¹, Po-Hsiang Wen²
1) National Sun Yat-Sen University, Taiwan, 2) Lite-On Technology Corporation, Taiwan

Room B

Oral Session (Organized) 24B1 Multi-level Inverters II

Chair: Keiji Wada (*Tokyo Metropolitan University*)
Masanori Ishigaki (*Toyota Central R&D Labs., Inc.*)

- 24B1-1 **Design and Analysis of the Distributed Controller for the Modular Multilevel Cascaded Converter**
Invited Paper Ping-heng Wu, Yu-chen Su, Po-tai Cheng
8:35 *National Tsing Hua University, Taiwan*
- 24B1-2 **Asymmetric Mixed Modular Multilevel Converter Topology in Hybrid Bipolar HVDC Transmission Systems**
Invited Paper Joon-Hee Lee¹, Jae-Jung Jung², Seung-Ki Sul¹
9:00 *1) Seoul National University, Korea, 2) Samsung Electronics Company, Ltd., Korea*
- 24B1-3 **High Power Medium Voltage 10 kV SiC MOSFET Based Bidirectional Isolated Modular DC-DC Converter**
Invited Paper Sayan Acharya, Ritwik Chattopadhyay, Anup Anurag, Satish Rengarajan, Yos Prabowo, Subhashish Bhattacharya
9:25 *North Carolina State University, USA*
- 24B1-4 **Multi-Level Power Converter Using Series-Connected Solid-State Transformers**
Invited Paper Yuichi Mabuchi, Yuki Kawaguchi, Kimihisa Furukawa, Mitsuhiro Kadota, Mizuki Nakahara, Akihiko Kanoda
9:50 *Hitachi, Ltd., Japan*
- 24B1-5 **Capacitor Voltage Control of MMC-STATCOM during Unbalanced AC System Fault**
Invited Paper Kaho Nada¹, Takeshi Kikuchi¹, Tsuguhiko Takuno¹, Toshiyuki Fujii¹, Ryosuke Uda¹, Takashi Sugiyama²
10:15 *1) Mitsubishi Electric Corporation, Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan*

Room C

Oral Session (Organized) 24C1 Recent Advances in Power Semiconductors

Chair: Ulrike Grossner (*ETH Zürich*)
Shiori Idaka (*Mitsubishi Electric Europe B.V.*)

- 24C1-1 **SiC Based Power Semiconductor in Applications – Aspects and Prospects**
Invited Paper Peter Friedrichs
8:35 *Infineon Technologies AG, Germany*
- 24C1-2 **Electromagnetic Modeling Approaches Towards Virtual Prototyping of WBG Power Electronics**
Invited Paper Ivana Kovačević-Badstübner¹, Daniele Romano², Giulio Antonini², Jonas Ekman³, Ulrike Grossner¹
9:00 *1) ETH Zürich, Switzerland, 2) University of L'Aquila, Italy, 3) Luleå University of Technology, Sweden*

24C1-3 Silicon Based Devices for Demanding High Power Applications

Invited Paper A. Kopta, J. Vobecky, M. Rahimo, T. Wikström, U. Vemulapati, C. Papadopoulos, C. Corvasce, M. Andenna,
9:25 F. Dugal, F. Fischer, S. Hartmann
ABB Switzerland, Ltd, Switzerland

24C1-4 Recent Progress in High to Ultra-High-Voltage SiC Power Devices: Development and Application

Invited Paper Yoshiyuki Yonezawa
9:50 *National Institute of Advanced Industrial Science and Technology, AIST, Japan*

24C1-5 Dynamic Drift Effects in GaN Power Transistors: Correlation to Device Technology and Mission Profile

Invited Paper Joachim Würfl¹, Eldad Bahat-Treidel¹, Oliver Hilt¹, Maria Troppen^{1,3}, Mihaela Wolf¹, Jan Böcker², Carsten Kuring²,
10:15 Sibylle Dieckerhoff²
1) Ferdinand-Braun-Institut, Leibniz Institut für Höchstfrequenztechnik, Germany, 2) Technical University of Berlin, Germany, 3) Humboldt Universität zu Berlin, Germany

Room D

Oral Session (Organized) 24D1 Bearingless Machines & Magnetic Bearings I

Chair: Junichi Asama (*Shizuoka University*)

Wolfgang Gruber (*Johannes Kepler University Linz*)

24D1-1 Compensation Method of Radial Unbalance Force at Failure of a Motor Section in a d-q Axis Current Control

Invited Paper **Bearingless Motor**
8:35 Masahide Ooshima
Tokyo University of Science, Japan

24D1-2 A Bearingless Synchronous Reluctance Slice Motor with Rotor Flux-Barriers

Invited Paper Thomas Holenstein¹, Thomas Nussbaumer², Johann W. Kolar¹
9:00 *1) ETH Zürich, Switzerland, 2) Levitronix GmbH, Switzerland*

24D1-3 Parameter Identifications of Current-Force Factor and Torque Constant in Single-Drive Bearingless Motors

Invited Paper Hiroya Sugimoto, Akira Chiba
9:25 *Tokyo Institute of Technology, Japan*

24D1-4 Dampening of Axial Vibrations in a Bearingless Flux-Switching Slice Motor by Field Current Regulation

Invited Paper Bianca Klammer¹, Karlo Radman¹, Wolfgang Gruber²
9:50 *1) Mechatronics GmbH, Austria, 2) Johannes Kepler University, Austria*

24D1-5 Analysis and Design of a Bearingless Axial- Force/Torque Motor with Flex-PCB Windings

Invited Paper Nobuyuki Kurita¹, Walter Bauer², Gerald Jungmayr³, Wolfgang Gruber², Wolfgang Amrhein²
10:15 *1) Gunma University, Japan, 2) Johannes Kepler University, Austria, 3) Linz Center of Mechatronics GmbH, Austria*

Room E

Oral Session (Organized) 24E1 Power Processing and Its Related Topics as SiC Applications

Chair: Hiroo Sekiya (*Chiba University*)

Xiuqin Wei (*Chiba Institute of Technology*)

24E1-1 A Plotter-Based Automatic Measurement and Statistical Characterization of Multiple Discrete Power Devices

Invited Paper Michihiro Shintani¹, Benjamin Dauphin², Kazuki Oishi², Masayuki Hiromoto², Takashi Sato²
8:35 *1) Nara Institute of Science and Technology, Japan, 2) Kyoto University, Japan*

24E1-2 A Novel High-Speed SiC MOSFET Driver with a Low Switch-Voltage Stress

Invited Paper Xiuqin Wei¹, Yuchong Sun², Hiroo Sekiya²
9:00 *1) Chiba Institute of Technology, Japan, 2) Chiba University, Japan*

24E1-3 Enhancement of Driving Capability of Gate Driver Using GaN HEMTs for High-Speed Hard Switching of SiC Power MOSFETs

Invited Paper Takafumi Okuda, Takashi Hikihara
9:25 *Kyoto University, Japan*

24E1-4 Design and Experimental Verification of Robot Arm Operation for Power Packet Dispatching System

Invited Paper Tomoki Yokoyama, Ryunosuke Araumi, Kazunori Asada, Takashi Ando
9:50 *Tokyo Denki University, Japan*

24E1-5 A Resource Sharing Model in a Power Packet Distribution Network

Invited Paper H. Ando¹, R. Takahashi², S. Azuma³, M. Hasegawa⁴, T. Yokoyama⁵, T. Hikiyama⁶

10:15 1) University of Tsukuba, Japan, 2) Aichi University of Technology, Japan, 3) Nagoya University, Japan, 4) Tokyo University of Science, Japan, 5) Tokyo Denki University, Japan, 6) Kyoto University, Japan

Room F

Oral Session 24F1 Grid-tied Converter Control I

Chair: Shigenori Inoue (*Hitachi ABB HVDC Technologies, Ltd.*)

Georgios Konstantinou (*University of New South Wales*)

24F1-1 Decoupled DSOGI-PLL for Improved Three Phase Grid Synchronisation

8:35 A. A. Nazib, D. G. Holmes, B. P. McGrath
RMIT University, Australia

24F1-2 A Deviation Elimination Control Based on Autonomous Current-Sharing Controller for the Parallel-Connected Inverters in AC Microgrids

9:00 Yajuan Guan¹, Wei Feng², Baoze Wei¹, Wenzhao Liu¹, Mingshen Li¹, Juan C. Vasquez¹, Josep M. Guerrero¹
1) Aalborg University, Denmark, 2) Tsinghua University, China

24F1-3 SISO Transfer Functions for Stability Analysis of Grid-Connected Voltage-Source Converters

9:25 Hongyang Zhang¹, Lennart Harnefors², Xiongfei Wang³, Jean-Philippe Hasler¹, Hans-Peter Nee⁴
1) Power Grids Division, ABB, Västerås, Sweden, 2) Corporate Research, ABB, Västerås, Sweden, 3) Aalborg University, Denmark, 4) KTH Royal Institute of Technology, Sweden

24F1-4 A Communication-Independent Reactive Power Sharing Scheme with Adaptive Virtual Impedance for Parallel Connected Inverters

9:50 Ronghui An, Zeng Liu, Jinjun Liu, Shike Wang
Xi'an Jiaotong University, China

24F1-5 Design and Integration of the Bi-Directional Electric Vehicle Charger into the Microgrid as Emergency Power Supply

10:15 Yang Song¹, Pengcheng Li², Yuanliang Zhao³, Shuai Lu¹
1) Chongqing University, China, 2) Electric Power Research Institute of Guizhou Power Grid Co. Ltd., China, 3) Guizhou Power Grid Co. Ltd., China

Room G

Oral Session (Organized) 24G1 Conversion Technologies for Renewable Energy and Energy Saving IV

Chair: Hideki Ayano (*National Institute of Technology, Tokyo College*)

Ruben Inzunza (*Toshiba Mitsubishi-Electric Industrial Systems Corporation*)

24G1-1 Stability Impact of PV Inverter Generation on Medium Voltage Distribution Systems

Invited Paper Ye Tang, Rolando Burgos, Chi Li, Dushan Boroyevich
8:35 *Virginia Tech, USA*

24G1-2 1MW Power Conditioning System with Multiple DC Inputs for PVs and Batteries

Invited Paper Yasuaki Furusho, Yasuyuki Noto, Kansuke Fujii
9:00 *Fuji Electric Co., Ltd., Japan*

24G1-3 A Robust and Flexible DC-Linked 3-Phase Energy Management System with Adaptive Droop Control Strategy

Invited Paper Yue Ma, Yuki Ishikura, Hitoshi Tsuji, Kazuaki Mino
9:25 *Murata Manufacturing Co., Ltd., Japan*

24G1-4 Maximum Power Point Tracking Control for Small Hydroelectric Generation

Invited Paper Kazuya Azegami, Masashi Takiguchi, Junya Yano, Hirohiko Tsutsumi, Toshitake Masuko
9:50 *Meidensha Corporation, Japan*

24G1-5 Design and Experimental Verification of a Three-Phase Dual-Active Bridge Converter for Offshore Wind Turbines

Invited Paper Takushi Jimichi¹, Murat Kaymak², Rik W. De Doncker²
10:15 1) Mitsubishi Electric Corporation, Japan, 2) RWTH Aachen University, Germany

Room H

Oral Session 24H1 Inverters/Converters by WBG Devices

Chair: Takaharu Takeshita (*Nagoya Institute of Technology*)

Jun Wang (*Virginia Tech*)

- 24H1-1** **Optimized Bidirectional PFC Rectifiers & Inverters - Si vs. SiC vs. GaN in 2L and 3L Topologies -**
8:35 Jonas Wyss, Jürgen Biela
ETH Zürich, Switzerland
- 24H1-2** **A Standard Block of “Series Connected SiC MOSFET” for Medium/High Voltage Converter**
9:00 Qin Lei, Chunhui Liu, Yunpeng Si, Yifu Liu
Arizona State University, USA
- 24H1-3** **Design and Testing of 1 kV H-bridge Power Electronics Building Block Based on 1.7 kV SiC MOSFET Module**
9:25 Jun Wang¹, Rolando Burgos¹, Dushan Boroyevich¹, Zeng Liu²
1) Virginia Tech, USA, 2) Xian Jiaotong University, China
- 24H1-4** **A Flyback Converter with SiC Power MOSFET Operating at 10 MHz: Reducing Leakage Inductance for Improvement of Switching Behaviors**
9:50 Kazuki Hashimoto, Takafumi Okuda, Takashi Hikihara
Kyoto University, Japan
- 24H1-5** **A Study on Load Fluctuation of Isolated DC-DC Converter with Class Phi-2 Inverter Using GaN-HFET**
10:15 Yuta Yanagisawa¹, Yushi Miura¹, Hiroyuki Handa², Tetsuzo Ueda², Toshifumi Ise¹
1) Osaka University, Japan, 2) Panasonic Corporation, Japan

Thursday, May 24: 11:00-12:40

Room A

Oral Session 24A2 Control for DC-DC Converters

Chair: Jun Imaoka (*Nagoya University*)

Wilson Komatsu (*University of Sao Paulo - Polytechnic School*)

- 24A2-1** **Single-Inductor Multiple-Output Current-Source Converter with Improved Cross Regulation and Simple Control Strategy**
11:00 Zheng Dong, Xiaolu Lucia Li, Chi K. Tse
Hong Kong Polytechnic University, China
- 24A2-2** **Limit Operating Frequency of Peak Current-Mode Control DC-DC Converter Considering Turn-Off Delay Time**
11:25 Ryo Ute, Kazuya Fujiwara, Jun Imaoka, Masahito Shoyama
Kyushu University, Japan
- 24A2-3** **A Novel Single Switch High Frequency DC/DC Converter and Its Mathematic Model**
11:50 Yueshi Guan, Xihong Hu, Shu Zhang, Yijie Wang, Dianguo Xu, Wei Wang
Harbin Institute of Technology, China
- 24A2-4** **Analysis of Closed Loop Operation of an Isolated Bidirectional DAB DC-DC Converter with LC Coupling**
12:15 Bruno Yukio Enomoto, Kelly C. M. Carvalho, Lourenço Matakas Junior, Wilson Komatsu
University of São Paulo, Brazil

Room B

Oral Session 24B2 Isolated Three-phase AC-DC Converters II

Chair: Dewei Xu (*Ryerson University*)

Yu-Chen Liu (*National Ilan University*)

- 24B2-1** **Isolated AC/DC Converter Using Simple PWM Strategy**
11:00 Naoki Hirose, Yuto Matsui, Takaharu Takeshita
Nagoya Institute of Technology, Japan

- 24B2-2 Analysis of One Phase Loss Operation of Three-Phase Isolated Buck Matrix-Type Rectifier with Eight-Segment PWM Scheme**
 11:25 Jahangir Afsharian¹, Dewei (David)Xu¹, Bin Wu¹, Bing Gong², Zhihua Yang², Jun-Ichi Itoh³
 1) Ryerson University, Canada, 2) Murata Power Solutions, AC/DC Power Module, Canada, 3) Nagaoka University of Technology, Japan
- 24B2-3 Novel Isolated Bidirectional Integrated Dual Three-Phase Active Bridge (D3AB) PFC Rectifier**
 11:50 F. Krismer, E. Hatipoglu, J. W. Kolar
 ETH Zürich, Switzerland
- 24B2-4 Load Voltage Regulation Method for an Isolated AC-DC Converter with Power Decoupling Operation**
 12:15 Shohei Komeda¹, Hideaki Fujita²
 1) Tokyo University of Marine Science and Technology, Japan, 2) Tokyo Institute of Technology, Japan

Room C

Oral Session 24C2 Soft Switching Converters

Chair: Hiroaki Yamada (*Yamaguchi University*)

Duy-Dinh Nguyen (*Shibaura Institute of Technology*)

- 24C2-1 Optimal Design of a Low Cost 20kW 99.1% Efficiency Active ZCS Isolated Dc-Dc Converter**
 11:00 Timothé Delaforge, Sébastien Mariéthoz
 Bern University of Applied Sciences, Switzerland
- 24C2-2 Soft-Switching Analysis and PFM Control Method of Bidirectional DC/DC Converter Topology**
 11:25 Yijie Wang, Haoyu Wang, Hongyu Song, Dianguo Xu
 Harbin Institute of Technology, China
- 24C2-3 A Fully Soft-Switched PWM DC-DC Converter Using An Active-Snubber-Cell**
 11:50 Tran N. Hai, Adhistira M. Naradhipa, Sunju Kim, Ali Tausif, Sewan Choi
 Seoul National University of Science and Technology, Korea
- 24C2-4 Flying Capacitor Resonant Pole Inverter with Direct Inductor Current Feedback**
 12:15 Sjef J. Settels, Jorge L. Duarte, Jeroen Van Duivenbode
 Eindhoven University of Technology, The Netherlands

Room D

Oral Session 24D2 Wireless Power Transfer Systems III

Chair: Masayoshi Yamamoto (*Nagoya University*)

Lifang Wang (*Institute of Electrical Engineering, Chinese Academy of Sciences*)

- 24D2-1 Design of a GaN-Based Wireless Power Transfer System at 13.56 MHz to Replace Conventional Wired Connection in a Vehicle**
 11:00 Kawin Surakitbovorn, Juan Rivas-Davilla
 Stanford University, USA
- 24D2-2 Efficiency Maximization of Inductive Power Transfer System by Impedance and Switching Frequency Control in Secondary-Side Converter**
 11:25 Ryosuke Ota, Dannisworo S. Nugroho, Nobukazu Hoshi
 Tokyo University of Science, Japan
- 24D2-3 Analysis of Optimal Operation Frequency Range for Battery Charging in WPT System**
 11:50 Yongbin Jiang, Min Wu, Junwen Liu, Yue Wang, Laili Wang, Hailong Zhang
 Xi'an Jiaotong University, China
- 24D2-4 Initial Current Injection Method of a Direct Three-Phase to Single-Phase AC/AC Converter for Inductive Charger**
 12:15 Ferdi Perdana Kusumah, Jorma Kyyrä
 Aalto University, Finland

Room E

Oral Session 24E2 Various Topics of PM Drives

Chair: Kyo-Beum Lee (*Ajou University*)

Jung-Ik Ha (*Seoul National University*)

- 24E2-1 Mission Profile Emulator for Permanent Magnet Synchronous Machine Based on Three-Phase Power Electronic Converter**
11:00
Yubo Song, Ran Cheng, Ke Ma
Shanghai Jiao Tong University, China
- 24E2-2 A Variable DC Bus Voltage Based Power Hardware-in-the-Loop Emulation of Electric Motors with Wide Variation in Interface Filter Inductance**
11:25
Tsai-Fu Wu, Mitradatta Misra, Ying-Yi Jhang, Chang-Jun Yang, Yin-Chi Xu
National Tsing Hua University, Taiwan
- 24E2-3 Copper Loss Minimization Control at Zero Output Voltage for Electrolytic Capacitor-Less Inverter**
11:50
Kodai Abe, Haruya Kada, Kiyoshi Ohishi, Hitoshi Haga, Yuki Yokokura
Nagaoka University of Technology, Japan
- 24E2-4 Armature Temperature Estimation Insensitive to Rotor Flux Variation for SPMSM**
12:15
Toshiki Sano¹, Kiyoshi Ohishi¹, Yuki Yokokura¹, Hiroki Iwata¹, Yuji Ide², Daigo Kuraishi², Akihiko Takahashi²
1) *Nagaoka University of Technology, Japan*, 2) *Sanyo Denki Co., Ltd, Japan*

Room F

Oral Session 24F2 Grid-tied Converter Control II

Chair: Toshimitsu Morizane (*Osaka Institute of Technology*)

Donald Grahame Holmes (*RMIT University*)

- 24F2-1 Virtual Synchronous Generator Control with Reliable Fault Ride-through Capability by Adopting Model Predictive Control**
11:00
Jonggrist Jongudomkarn, Jia Liu, Toshifumi Ise
Osaka University, Japan
- 24F2-2 Reshaping Quadrature-Axis Impedance of Three-Phase Grid-Connected Converters for Low-Frequency Stability Improvement**
11:25
Yi Tang, Jingyang Fang, Xiaoqiang Li, Hongchang Li
Nanyang Technological University, Singapore
- 24F2-3 Comparison between Traditional Droop and A New Autonomous Control Scheme for Parallel Inverters**
11:50
Mohammad Bani Shamseh¹, Teruo Yoshino¹, Atsuo Kawamura²
1) *Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan*, 2) *Yokohama National University, Japan*
- 24F2-4 A Novel Microgrid Power Sharing Scheme Enhanced by a Non-Intrusive Feeder Impedance Estimation Method**
12:15
Baojin Liu, Zeng Liu, Jinjun Liu, Ronghui An, Shuguang Song
Xi'an Jiaotong University, China

Room G

Oral Session 24G2 Grid Interconnection of Large-scale PV Applications

Chair: Meiqin Mao (*Hefei University of Technology*)

Takahiro Urakabe (*Mitsubishi Electric Corporation*)

- 24G2-1 Development of a 3.2MW Photovoltaic Inverter for Large-Scale PV Power Plants**
11:00
Naoya Shibata, Tsuguhiro Tanaka, Masahiro Kinoshita
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan
- 24G2-2 Impedance-Based Stability Analysis of Large-Scale PV Station under Weak Grid Condition Considering Solar Radiation Fluctuation**
11:25
YiMing Tu, Jinjun Liu, Teng Liu, Xiangpeng Cheng
Xi'an Jiaotong University, China

24G2-3 Experimental Verification of Grid-Connection of a PV Converter Using a Symmetrically Connected Boost Converter for a High-Leg Delta Transformer

11:50

Daiki Yamaguchi, Hideaki Fujita
Tokyo Institute of Technology, Japan

24G2-4 A Novel Single-Stage High-Frequency Boost Inverter Cascaded by Rectifier-Inverter System for PV Grid-Tie Applications

12:15

Hamdy Radwan^{1,2}, Mahmoud A. Sayed², Takaharu Takeshita², Adel A. Elbaset³, G. Shabib^{1,4}
1) Aswan University, Egypt, 2) Nagoya Institute of Technology, Japan, 3) Minia University, Egypt, 4) Higher Institute of Engineering and Technology, King Mariout, Egypt

Room H

Oral Session 24H2 AC-AC Converter for Industrial Motor Drive Applications

Chair: Shizunori Hamada (Meidensha Corporation)

Po-Tai Cheng (National Tsing Hua University)

24H2-1 Nine Switches Matrix Converter Using Bi-Directional GaN Device

11:00

Takashi Hirota, Kentaro Inomata, Daisuke Yoshimi, Masato Higuchi
Yaskawa Electric Corporation, Japan

24H2-2 A Model Predictive Dual Current Control Method for Indirect Matrix Converter Fed Induction Motor Drives

11:25

Mei Yang¹, Chen Lisha¹, Liang Wang¹, Yunwei Li²
1) North China University of Technology, China, 2) University of Alberta, Canada

24H2-3 Fault Tolerant Predictive Control of Three-Level Neutral-Point-Clamped Back-to-Back Power Converters

11:50

Zhenbin Zhang¹, Xicai Liu^{2,3}, Kejun Cai², Feng Gao¹, Ralph Kennel²
1) Shandong University, China, 2) Technische Universität München, Germany, 3) Huazhong University of Science and Technology, China

24H2-4 Two-Stage Optimization Based Predictive Torque Control with Reduced Complexity for a Three-Level Inverter Driven Induction Motor

12:15

Ilham Osman, Dan Xiao, Faz Rahman
University of New South Wales, Australia

Thursday, May 24: 14:00-16:05

Room A

Oral Session (Organized) 24A3 High Power Converters Using Wide Band Gap Devices

Chair: Subhashish Bhattacharya (NC State University)

Kansuke Fujii (Fuji Electric Co., Ltd.)

24A3-1 Design Challenges of SiC Devices for Low- and Medium-Voltage DC-DC Converters

Invited Paper

14:00

Georges Engelmann, Alexander Sewergerin, Markus Neubert, Rik W. De Doncker
RWTH Aachen University, Germany

24A3-2 Design and Testing of 6 kV H-Bridge Power Electronics Building Block Based on 10 kV SiC MOSFET Module

Invited Paper

14:25

Jun Wang, Slavko Mosevic, Jiewen Hu, Yue Xu, Christina DiMarino, Igor Cvetkovic, Rolando Burgos,
Dushan Boroyevich
Virginia Tech, USA

24A3-3 High Power Medium Voltage Converters Enabled by High Voltage SiC Power Devices

Invited Paper

14:50

Sanket Parashar, Ashish Kumar, Subhashish Bhattacharya
North Carolina State University, USA

24A3-4 Soft-Switching – The Key to High Power WBG Converters

Invited Paper

15:15

Deepak Divan, Zheng An, Prasad Kandula
Georgia Institute of Technology, USA

24A3-5 SiC: Technology Enabler for MV DC/DC Galvanically Insulated Modular Converters

Invited Paper S. Alvarez, M. Bellini, U. Vemulapati, F. Canales, M. Rahimo

15:40 ABB Switzerland, Ltd, Switzerland

Room B

Oral Session (Organized) 24B3 Bearingless Machines & Magnetic Bearings II

Chair: Hiroya Sugimoto (*Tokyo Institute of Technology*)

Elena Lomonova (*Eindhoven University of Technology*)

24B3-1 A Bearingless Slice Motor with a Solid Iron Rotor for Disposable Centrifugal Blood Pump

Invited Paper Tadahiko Shinshi¹, Ryo Yamamoto¹, Yoshiki Nagira¹, Junichi Asama²

14:00 1) *Tokyo Institute of Technology, Japan*, 2) *Shizuoka University, Japan*

24B3-2 Reduced Hardware Parallel Drive for No Voltage Bearingless Motors

Invited Paper Eric L. Severson

14:25 *University of Wisconsin-Madison, USA*

24B3-3 Dual Field-Oriented Control of Bearingless Motors with Combined Winding System

Invited Paper Wolfgang Gruber¹, Siegfried Silber²

14:50 1) *Johannes Kepler University Linz, Austria*, 2) *Linz Center of Mechatronics, Austria*

24B3-4 Open-Circuit Fault Tolerant Study of Bearingless Multi-Sector Permanent Magnet Machines

Invited Paper G. Valente¹, L. Papini^{1,2}, A. Formentini¹, C. Gerada^{1,2}, P. Zanchetta¹

15:15 1) *Univeristy of Nottingham, UK*, 2) *Univeristy of Nottingham, China*

24B3-5 Balance Control of Split Capacitor Potential for Magnetically Levitated Motor System Using Zero-Phase Current

Invited Paper Yusuke Fujii¹, Junichi Asama¹, Takaaki Oiwa¹, Akira Chiba²

15:40 1) *Shizuoka University, Japan*, 2) *Tokyo Institute of Technology, Japan*

Room C

Oral Session 24C3 Isolated DC-DC Converters IV

Chair: Masato Ando (*Hitachi, Ltd.*)

Tsorng-Juu Liang (*National Cheng Kung University*)

24C3-1 Asymmetrical Half-Bridge Converter With Zero DC-offset Current in Transformer Using New Rectifier Structure

14:00 Jung-Kyu Han¹, Jong-Woo Kim², Seung-Hyun Choi¹, Jih-Sheng Lai², Gun-Woo Moon¹

1) *KAIST, Korea*, 2) *Virginia Tech, USA*

24C3-2 Circulating Current-Less Phase-Shifted Full-Bridge Converter With New Rectifier Structure

14:25 Jung-Kyu Han, Gun-Woo Moon

KAIST, Korea

24C3-3 A Bi-Directional Current Detection Using Current Transformers for Bi-Directional DC-DC Converter

14:50 Seiji Iyasu¹, Yuji Hahashi¹, Yuuichi Handa², Kimikazu Nakamura², Keiji Wada³

1) *Soken, Inc., Japan*, 2) *Denso Corporation, Japan*, 3) *Tokyo Metropolitan University, Japan*

24C3-4 A 10 MHz GaNFET Based Isolated High Step-Down DC-DC Converter

15:15 Prasanth Thummala¹, Dorai Babu Yelaverthi², Regan Zane², Ziwei Ouyang¹, Michael A. E. Andersen¹

1) *Technical University of Denmark, Denmark*, 2) *Utah State University, USA*

24C3-5 Analysis and Design of a Parallel Resonant Converter for Constant Current Input to Constant Voltage Output DC-DC Converter Over Wide Load Range

15:40 Tarak Saha, Hongjie Wang, Baljit Riar, Regan Zane

Utah State University, USA

Room D

Oral Session 24D3 AC-AC Converters

Chair: Junnosuke Haruna (*Utsunomiya University*)

Ibrahim Mohd Alsofyani (*Ajou University*)

24D3-1 Novel Sinusoidal Input Current Single-to-Three-Phase Z-Source Buck+Boost AC/AC Converter

14:00 M. Haider¹, D. Bortis¹, J. W. Kolar¹, Y. Ono²
1) *ETH Zürich, Switzerland*, 2) *Nabtesco Corporation, Japan*

24D3-2 Simple PWM Strategy of a Matrix Converter for Minimizing Output Voltage Harmonics

14:25 Takuya Oshima, Takaharu Takeshita
Nagoya Institute of Technology, Japan

24D3-3 Novel Three-Level Back-to-Back Converters: Structure, Modulation Method, and Experiment

14:50 S. Sangwongwanich¹, K. Niyomsatian², S. Samermurn¹, S. Nuchnoi¹, S. Suwankawin¹
1) *Chulalongkorn University, Thailand*, 2) *University of Leuven, Belgium*

24D3-4 Model Predictive Control Using Subdivided Voltage Vectors for Current Ripple Reduction in an Indirect Matrix Converter

15:15 Keon Young Kim, Yeongsu Bak, Jin-Hyuk Park, Kyo-Beum Lee
Ajou University, Korea

24D3-5 DC-Link Ripple Current Reduction in Back-to-Back Converters with DPWM

15:40 Anatolii Tcai, Kyo-Beum Lee
Ajou University, Korea

Room E

Oral Session (Organized) 24E3 High Frequency High Power-density Power Electronics with Its Design Techniques

Chair: Hiroataka Koizumi (*Tokyo University of Science*)

Junrui Liang (*ShanghaiTech University*)

24E3-1 An Analysis of Class DE Voltage-Source Parallel Resonant Inverter

Invited Paper Takeshi Kondo, Tsuyoshi Inaba, Yoshikazu Sakai, Hiroataka Koizumi
14:00 *Tokyo University of Science, Japan*

24E3-2 An Improvement on Extended Impedance Method towards Efficient Steady-State Analysis of High-Frequency Class-E Resonant Inverters

Invited Paper Junrui Liang
14:25 *ShanghaiTech University, China*

24E3-3 Output Power Capability Comparisons of Class-E Power Amplifiers with Harmonic Resonance

Invited Paper Hiroo Sekiya¹, Xiuqin Wei², Yuchong Sun¹
14:50 1) *Chiba University, Japan*, 2) *Chiba Institute of Technology, Japan*

24E3-4 A Class $\Phi 2$ Resonant Buck Converter with Ripple Injection Burst Control Method

Invited Paper Min Lin, Masahiko Hirokawa
15:15 *TDK Corporation, Japan*

24E3-5 Practical Design Technique for High Power Density LLC Resonant Converter

Invited Paper Shingo Nagaoka, Hiroyuki Onishi, Koji Takatori, Toshiyuki Zaito, Takeshi Uematsu
15:40 *Omron Corporation, Japan*

Room F

Oral Session 24F3 DC Microgrids

Chair: Hiroaki Kakigano (*Ritsumeikan University*)

Jinjun Liu (*Xi'an Jiaotong University*)

24F3-1 Operational Study and Protection of a Series Resonant Converter with DC Current Input Applied in DC Current Distribution Systems

14:00 Hongjie Wang, Tarak Saha, Baljit Riar, Regan Zane
Utah State University, USA

- 24F3-2 A Study on Improvement of Power Utilization Rate of Energy Systems with PV and Batteries**
14:25 Hiroaki Endo¹, Masakatsu Kurisaka¹, Tsutomu Ueno¹, Yusuke Yoshioka¹, Kaoru Inoue², Toshiji Kato²
 1) GS Yuasa International Ltd., Japan, 2) Doshisha University, Japan
- 24F3-3 A Novel DC Distribution Network with Multi-Level Bus Voltages and Its Energy Management System Design**
14:50 Jingjin Huang^{1,2}, Xin Zhang², Zhixun Ma^{3,2}, Jianfang Xiao²
 1) Xi'an University of Technology, China, 2) Nanyang Technological University, Singapore, 3) Tongji University, China
- 24F3-4 A Novel DC-Side-Port Impedance Modeling of Modular Multilevel Converters Based on Harmonic State Space Method**
15:15 Jing Lyu¹, Xin Zhang², Zhixun Ma², Xu Cai¹
 1) Shanghai Jiao Tong University, China, 2) Nanyang Technological University, Singapore
- 24F3-5 An Improved Master-Slave Control for Threeport Converter Based Distributed DC Gridconnected PV System**
15:40 Siyue Jiang¹, Kai Sun¹, Hongfei Wu², Haixu Shi¹, Xiaofeng Dong², Syed Muhammad Raza Kazmi³
 1) Tsinghua University, China, 2) Nanjing University of Aeronautics and Astronautics, China, 3) National University of Sciences and Technology, Pakistan

Room G

Oral Session (Organized) 24G3 Conversion Technologies for Renewable Energy and Energy Saving V

Chair: Sanjib Kumar Panda (*National University of Singapore*)
 Tadashi Suetsugu (*Fukuoka University*)

- 24G3-1 Sensorless Position Estimation, Parameter Identification and Control Integration for Permanent Magnet Synchronous Machines Using Current Derivative Measurements**
Invited Paper
14:00 M. X. Bui, M. F. Rahman, D. Xiao
 UNSW, Australia
- 24G3-2 Dynamic Performance Improvement of Bidirectional Switched-Capacitor DC/DC Converter by Right-Half-Plane Zero Elimination**
Invited Paper
14:25 Ding Kaicheng, Zhang Yan, Liu Jinjun, Zeng Pengxiang, Zhang Jinshui
 Xi'an Jiaotong University, China
- 24G3-3 A Matrix Based Isolated Bidirectional AC-DC Converter with LCL type Input Filter for Energy Storage Application**
Invited Paper
14:50 Prathamesh Pravin Deshpande, Amit Kumar Singh, Sanjib Kumar Panda
 National University of Singapore, Singapore
- 24G3-4 On a Study of Voltage Dividing Class Φ Amplifier**
Invited Paper
15:15 Katsutoshi Hirayama¹, Tadashi Suetsugu², Yudai Furukawa¹, Fujio Kurokawa³
 1) Nagasaki University, Japan, 2) Fukuoka University, Japan, 3) Nagasaki Institute of Applied Science, Japan
- 24G3-5 A DPWM Based Control Strategy to Integrate Photovoltaic System and Battery Storage Using Grid Connected Three-Level T-Type Inverter**
Invited Paper
15:40 Mohammad M. Hashempour, Yue-Ting Tsai, T. L. Lee
 National Sun Yat-sen University, Taiwan

Room H

Oral Session 24H3 Applications of Grid -tied Inverters II

Chair: Ruben Inzunza (*Toshiba Mitsubishi-Electric Industrial Systems Corporation*)
 Kazuhiro Umetani (*Okayama University*)

- 24H3-1 Impedance Measurement of Megawatt-Level Renewable Energy Inverters Using Grid-Forming and Grid-Parallel Converters**
14:00 Matias Berg, Tuomas Messo, Tomi Roinila, Henrik Alenius
 Tampere University of Technology, Finland
- 24H3-2 Improved Virtual Inductance Based Control Strategy of DFIG under Weak Grid Condition**
14:25 Ran Fang, Wenjia Chen, Xueguang Zhang, Dianguo Xu
 Harbin Institute of Technology, Harbin, China

- 24H3-3** **Control of VSC-HVDC for Wind Farm Integration with Real-Time Frequency Mirroring and Self-Synchronizing Capability**
14:50
Renxin Yang, Chen Zhang, Xu Cai, Gang Shi, Jing Lyu
Shanghai Jiao Tong University, China
- 24H3-4** **A Study on Steady-State Characteristics of Series-Connected Wind Farm Using an Experimental Set of Laboratory Size**
15:15
Fujio Tatsuta, Shoji Nishikata
Tokyo Denki University, Japan
- 24H3-5** **A Novel Islanding Detection Method with Twophase Magnification Inspection**
15:40
Jian-Tang Liao, Shun-Hao Yeh, Hong-Tzer Yang
National Cheng Kung University, Taiwan