## Industrial Seminar

### Industrial Seminar - Open to the public

**Sunday, May 15**  14:00 – 17:30

**Large Hall (2F)**

Chair: Noriko Kawakami, TMEIC

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
<th>Company/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00</td>
<td>Naoto Fujishima</td>
<td>Development Division, Semiconductors Business Group, Fuji Electric Co., Ltd.</td>
<td>“Technical Trend of Power Semiconductor Devices”</td>
</tr>
<tr>
<td>14:28</td>
<td>Issei Takeuchi</td>
<td>Abstech Co., Ltd.</td>
<td>“System Abstraction Based on Element Description Method”</td>
</tr>
<tr>
<td>14:56</td>
<td>Chieko Umeno</td>
<td>Toshiba Mitsubishi-Electric Industrial Systems Corporation</td>
<td>“Power Electronics Technology Contributing to Realization of Sustainable Society”</td>
</tr>
<tr>
<td>15:40</td>
<td>Ryohei Kitayoshi</td>
<td>YASKAWA Electric Corporation</td>
<td>“Vibration Suppression of Two Inertia System Using an Equivalent Rigid-body Observer”</td>
</tr>
<tr>
<td>16:08</td>
<td>Akihiro Shibuya</td>
<td>Alliance PED, Powertrain and EV Engineering Division, Nissan Motor Co., Ltd.</td>
<td>“e-POWER technology in Nissan’s electrification strategy”</td>
</tr>
<tr>
<td>16:36</td>
<td>Masaya Inoue</td>
<td>Mitsubishi Electric Corporation</td>
<td>“Development of a 48V Integrated Starter Generator for Mild Hybrid Vehicle”</td>
</tr>
</tbody>
</table>
Plenary Sessions

Monday, May 16  9:00 - 10:45

Chair: Prof. Keiichiro Kondo (Vice co-chair, Steering Committee)

9:00  Prof. Seung Ki Sul
Seoul National University, Korea
“Realistic Simulation of Traction Motors in the Power Train of Electric Vehicle”

Chair: Prof. Kan Akatsu (Chair, Steering Committee)

9:35  Prof. Zhengming Zhao
Tsinghua University, China
“Discrete State Event-Driven Modeling and Simulation for Power Electronic Systems”

Chair: Prof. Hiroshi Fujimoto (Vice Co-chair, Program Committee)

10:10  Dr. Takahiro Mizoguchi
Motion Lib, Inc., Japan
“Academic research results in use; a case in real-haptics”
Tuesday, May 17  16:55 - 18:40

Chair: Prof. Keiichiro Kondo (Vice Co-chair, Steering Committee)

16:55  **Prof. Chris Gerada**  
*University of Nottingham, UK*  
“Advanced Electrical Machines and Drives for Net Zero Transport”

Chair: Prof. Hiroshi Fujimoto (Vice Co-chair, Program Committee)

17:30  **Prof. Wen-Hua Chen**  
*Loughborough University, UK*  
“Nonlinear Disturbance Observer Design and Disturbance Observer-Based Control”

Chair: Prof. Kan Akatsu (Chair, Steering Committee)

18:05  **Prof. Rik W. De Doncker**  
*Director E.ON Energy Research Center & Research Campus FEN, RWTH Aachen University*  
“Power Electronics – a key enabling technology for the European Green Deal”

Wednesday, May 18  9:00 - 10:10

Chair: Prof. Keiji Wada (Vice Co-chair, Steering Committee)

9:00  **Prof. David Perreault**  
*Massachusetts Institute of Technology, USA*  
“Opportunities, Progress and Challenges in Piezoelectric-Based Power Electronics”

Chair: Prof. Keiji Wada (Vice Co-chair, Steering Committee)

9:35  **Prof. Tsorng-Juu Liang**  
*National Cheng-Kung University, Taiwan*  
“Implementation and Applications of Grid-forming Inverter with SiC for Power Grid Conditioning”
Session Chairs: Toshihisa Shimizu (Tokyo Metropolitan University, Japan)
Masahiro Yamaguchi (Tohoku University, Japan)
Ko Matsumoto (Nagoya University, Japan)

Talk 1 Tatsuo Oomori
Mitsubishi Electric Corporation, Japan
Overview of MEXT-Program “Innovative Power-Electronics Technologies (INNOPEL)”

Talk 2 Yoshikazu Takahashi1, Yoshitaka Iwaji2, Shuji Katoh3, Tetsuo Endoh1
1) Tohoku University, Japan, 2) Ibaraki University, Japan
Integrated Power Electronics Technology for Decarbonized Society

Talk 3 Yukihiro Sato, Hiroo Sekiya, Daisuke Miyagi, Hideo Saotome, Kenji Natori, Hiroyasu Kobayashi, Makoto Chiba
Chiba University, Japan
Development of high-switching-frequency power converters with GaN power devices: From elemental technology to system design

Talk 4 Satoshi Okamoto
Tohoku University, Japan
Ultra-low loss magnetic materials for innovative power electronics

Talk 5 Tsutomu Mizuno1, Yoshiro Sato1, Kousuke Miyaji1, Makoto Sonehara1, Mitsuhide Sato3, Tsuyoshi Funaki2, Takaaki Ibechi2, Shuhei Fukunaga2
1) Shinshu University, Japan, 2) Osaka University, Japan
Development of transformers and inductors for high-frequency power conversion using magnetic anisotropic soft magnetic materials

Talk 6-1 Hiromi Habazaki1, Hidenori Okusuzaki2, Kazunori Hasegawa3, Shunzo Suematsu4
1) Hokkaido University, Japan, 2) Yamanashi University, Japan, 3) Kyushu Institute of Technology, Japan, 4) Nippon Chemi-Con Corporation, Japan
Toward the development of novel capacitors for next-generation power electronics systems

Talk 6-2 Hiroki Taniguchi1, Manabu Hagiwara2
1) Nagoya University, Japan, 2) Keio University, Japan
Toward the development of novel capacitors for next-generation power electronics systems

Talk 7 Hiroshi Amano, Jun Suda
Nagoya University, Japan
Present Status and Future Prospects of GaN Vertical Power Devices
Technical Sessions

Monday, May 16: 11:05-13:10

Room A

Session 16A1  Power and Energy Circuits and Systems for Communications (OS)

Chairs: Hiroo Sekiya (Chiba University, Japan)
        Junrui Liang (ShanghaiTech University, China)

16A1-1  A Self-powered Extensible SECE Rectifier For Piezoelectric Energy Harvesting

Invited Paper
Jiacong Qiu, Junrui Liang
ShanghaiTech University, China


Invited Paper
Taichi Mishima, Yuki Ito, Shingo Nagaoka, Takeshi Uematsu
OMRON Corporation, Japan

16A1-3  Energy Storage System with Intelligent Hot-plug Switch (IHS) Combined Use of Different Types of Batteries

Invited Paper
Kazuhiro Takehara, Fumiaki Nakao, Kimihiro Nishijima, Eiji Sakai
1) NExT-e Solutions Inc., Japan, 2) Sojo University, Japan

16A1-4  Performance Characteristics of 1500V Two Series Connection Type Converter

Invited Paper
Kazuhito Kajiwara, Yuji Ohta, Ryuya Daimon, Akio Segami, Fujio Kurokawa
1) Nagasaki Institute of Applied Science, Japan, 2) Isahaya Electronics Corporation, Japan

16A1-5  Optimized Energy Allocation Method Based on Capital Asset Pricing Model for Multi-use of Battery Energy Storage System

Invited Paper
Kazufumi Yuasa, Yoshiharu Takeuchi, Tadatoshi Babasaki, Ichiro Omura
1) Kyushu Institute of Technology, Japan, 2) NTT Facilities, Inc., Japan

Room B

Session 16B1  Power Electronics and Motor Drives for Automobiles (OS)

Chairs: Kantaro Yoshimoto (Tokyo Denki University, Japan)
        Masatoshi Uno (Ibaraki University, Japan)

16B1-1  Magnetic Form applying a C-Shaped Magnet for Hybrid Electric Vehicles

Invited Paper
Shingo Soma, Yoshihisa Kubota, Tatsuya Ohzu
Honda motor Co., Ltd., Japan

16B1-2  Technology trends of automotive semiconductors for CASE application

Invited Paper
Hiroomi Eguchi
MIRISE Technologies Corporation, Japan

16B1-3  Control method of a dual inverter system for EV with one battery

Invited Paper
Tomonori Kimura, Takahiro Yamada, Ryoya Kazaoka, Toshihiko Noguchi
1) MIRISE Technologies Corporation, Japan, 2) DENSO CORPORATION, Japan, 3) Shizuoka University, Japan

16B1-4  Impact of Magnet Temperature Distribution on Output Capability of PMSM and its Estimation Methodology

Invited Paper
Kensuke Sasaki, Atsushi Okada, Takashi Kato, Kan Akatsu
1) Nissan Motor Co., Ltd, Japan, 2) Yokohama National University, Japan
Session 16C1  Power Electronics for Enhancing Motion Control Systems (OS)

Chairs: Kenji Natori (Chiba University, Japan)
Yuki Yokokura (Nagaoka University of Technology, Japan)

16C1-1  Direct Torsion Torque Control of Geared SPMSM for Quick Backward-Drivenablility
Invited Paper
Yuki Yokokura, Kiyoshi Ohishi
Nagaoka University of Technology, Japan

16C1-2  Effect of Harmonic Current Suppression on Iron Loss of IPMSM Using Repetitive Perfect Tracking Control
Invited Paper
Yuhiro Inagaki1, Masahiro Mae1, Osamu Shimizu1, Sakahisa Nagai1, Hiroshi Fujimoto1, Takayuki Miyajima2,
Yoshiki Yasuda2, Akio Yamagita2
1) The University of Tokyo, Japan, 2) DAIKIN Industries, Ltd., Japan

16C1-3  A Study of 10MHz Multi-Sampling Deadbeat Control for PMSM Drive System using USPM Controller
Invited Paper
Daisuke Hiroe, Zhang Xiaohan, Ryosuke Suzuki, Kazuki Nakamura, Kotaro Sato, Kantaro Yoshimoto,
Tomoki Yokoyama
Tokyo Denki University, Japan

16C1-4  PI Current Control Method for Realizing Deadbeat Characteristics
Invited Paper
Shota Kuroda, Kenji Natori, Yukihiko Sato
Chiba University, Japan

16C1-5  Circuit Architecture and Design of A Megahertz Wireless Power Transfer System for Drones
Invited Paper
Yaoxia Shao1, Ruihan Ma1, Huan Zhang1, Ming Liu1, Chengbin Ma1
1) University of Michigan-Shanghai Jiao Tong University Joint Institute, China, 2) Shanghai Jiao Tong University, China

Room D

Session 16D1  Control and Analysis of Converters I

Chairs: Ikuya Sato (Fuji Electric Co., Ltd., Japan)
Rolando Burgos (Virginia Polytechnic Institute and State University, USA)

16D1-1  Capacitor-Voltage-Balancing Control for an Isolated Secondary-Resonant AC-DC Modular Matrix Converter
Kohei Budo, Takaharu Takeshita
Nagoya Institute of Technology, Japan

16D1-2  Statistical Performance Verification of the FS-MPC Algorithm Applied to the Matrix Converter
Mateja Novak1, Iwona Grobelna2, Ulrik Nyman1, Pawel Szczesniak2, Frede Blaabjerg1
1) Aalborg University, Denmark, 2) University of Zielona Gora, Poland

16D1-3  A Unified PWM Strategy to Reduce Minimum Switching Number for Matrix Converters
Paiboon Kiatsookkanatorn1, Somboon Sangwongwanich2
1) Rajamangala University of Technology Suvannabhum, Thailand, 2) Chulalongkorn University, Thailand

16D1-4  Adjustable Carrier Phase Shift Operation of Switching Cycle Control for Modular Multilevel Converters
Jayesh Kumar Motwani, Boran Fan, Slavko Mocevic, Jianghui Yu, Yu Rong, Dushan Boroyevich, Dong Dong,
Rolando Burgos
Virginia Tech, USA

16D1-5  A New Control Method to Realize Wide Output Voltage Range for Three Phase AC/DC Converter Based on
Matrix Converter
Kazuma Tomida1, Kenji Natori1, Jin Xu2, Noboru Shimosato2, Yukihiko Sato1
1) Chiba University, Japan, 2) Myway Plus Corporation, Japan
Session 16E1  Grid Forming Converters I

Chairs: Yuko Hirase (Toyo University, Japan)
       Chen Zhang (Shanghai Jiaotong University, China)

16E1-1 Improved Adaptive Inertia and Damping Coefficient Control Strategy of VSG Based on Optimal Damping Ratio
Qingyi Wang$^{1,2,3}$, Dan Zhou$^{1,2,3}$, Shuai Yin$^{1,2,3}$, Yudi Lei$^{1,2,3}$, Tao He$^{1,2,3}$
1) China University of Geosciences, China, 2) Hubei Key Laboratory of Advanced Control and Intelligent Automation for Complex Systems, China, 3) Ministry of Education, China

16E1-2 A Study on Emulated Inertia Control of Grid-Connected Inverter-Based Power Supply Sources for Mass Integration of Renewable Energy Resources
Hirofumi Uemura$^1$, Sachio Takano$^1$, Atsushi Harada$^1$, Takahiro Matsuura$^2$, Satoshi Miyazaki$^2$, Hiromu Hamada$^1$
1) Fuji Electric Co., Ltd., Japan, 2) Tokyo Electric Power Company Holdings, Inc., Japan

16E1-3 Uninterrupted Switching based on VSG Control between Grid-connected and Stand-alone Operation of Single-Phase Grid-Tied Inverter
Kodai Nishikawa, Keisuke Kusaka, Jun-ichi Itoh
Nagaoka University of Technology, Japan

16E1-4 The Effects of Virtual Inertia Control on Power Converters in Nonideal Grid Conditions
Yang Haoxin$^1$, Tang Yi$^1$, Zhang Lei$^2$
1) Nanyang Technological University, Singapore 2) Chengdu Technological University, China

---

Session 16F1  Reliability and Diagnostics of Power Converters I

Chairs: Takushi Jimichi (Mitsubishi Electric Corporation, Japan)
       Lee Chia-Tse (Delta Electronics Inc., Taiwan)

16F1-1 Identification Method for Various Failure Modes with Shared Kelvin and Power Wires Configuration in IGBT Power Modules
Qiang Wu$^1$, Yu Chen$^1$, Haoze Luo$^1$, Jian Zhang$^1$, Wuhua Li$^1$, Xiangning He$^1$, Naoto Fujishima$^2$, Haruhiko Nishio$^2$, Hitoshi Sumida$^2$
1) Zhejiang University, China, 2) Fuji Electric Co., Ltd., Japan

16F1-2 Failure Mechanism Investigation of Die-Attach Solder Based on the Birth and Death Technology
Zhiliang Xu, Qianxia Ke, Xinglai Ge, Huimin Wang, Zongyuan Dai
Southwest Jiaotong University, China

16F1-3 Mission-Profile Based Reliable Analysis Scheme of IGBT Modules for Traction Rectifier
Qianxia Ke, Zhiliang Xu, Xinglai Ge, Qingli Deng, Huiming Wang, Linlin Zhang, Jin Li
Southwest Jiaotong University, China

16F1-4 Reliable design of SiC MOSFET power modules: experimental characterization for aging prediction
Shuhei Fukunaga$^1$, Alberto Castellazzi$^2$, Tsuyoshi Funaki$^3$
1) Osaka University, Japan, 2) Kyoto University of Advanced Science, Japan

16F1-5 Continuous Operation of High-Power Half-Bridge with 12 Paralleled GaN Power Devices
Takashi Sawada$^1$, Hiroshi Tadano$^2$, Koji Shiozaki$^2$, Takanori Isobe$^3$
1) Naturanix Co., Ltd., Japan, 2) Nagoya University, Japan, 3) University of Tsukuba, Japan
Session 16G1  Wireless Power Transfer I

Chairs: Mami Mizutani (Toshiba Infrastructure Systems & Solutions Corporation, Japan)
Yijie Wang (Harbin Institute of Technology, China)

16G1-1  A Novel Driving Scheme for Inductive Power Transfer Systems Using Decoupled Transmitter Coils
Kai Zhao, Minfan Fu, Guangdong Ning, Rong He, Hengzhao Yang, Haoyu Wang
ShanghaiTech University, China

16G1-2  Effect of Angle Offset of the Power Receiving Coil in Underwater Wireless Power Transfer Using a Cone Spiral Coil
Suguru Mototani, Ryo Yamamoto, Kae Doki, Akihiro Torii
Aichi Institute of Technology, Japan

16G1-3  Analysis and Design of a Wide Air Gap IPT System with Multi-Load CV Characteristics Based on Cylindrical Solenoid Coupler
Yijie Wang, Zhimin Liu, Peng Gu, Dianguo Xu
Harbin Institute of Technology, China

16G1-4  Feasibility Study on Wireless Power Transfer for AUV with Novel Pressure-Resistant Ceramic Materials
Haibing Wen, Jiayuan Li, Lei Yang, Xiangqian Tong
Xi’an University of Technology, China

16G1-5  Stability Analysis of Flying-capacitor Linear Amplifier for Wireless Power Transfer system
Rintaro Kusui, Keisuke Kusaka, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Monday, May 16: 14:10-16:15

Session 16A2  Data Driven Methods in Power Electronics Systems: Applications in Analysis and Stability (OS)

Chairs: Marta Molinas (Norwegian University of Science and Technology, Norway)
Chen Zhang (Shanghai Jiao Tong University, China)

16A2-1  Impedance Model Identification of DFIG-Based Wind Turbine Based on Neural Network
Invited Paper
Zhong Wang, Jing Lyu, Xu Cai
Shanghai Jiao Tong University, China

16A2-2  Instability Mode Recognition of Grid-Tied Voltage Source Converters with Nonstationary Signal Analysis
Invited Paper
Yu Zhang1, Sjur Føyen2, Chen Zhang1, Marta Molinas2, Olav Bjarte Fosso2, Xu Cai1
1) Shanghai Jiao Tong University, China, 2) Norwegian University of Science and Technology, Norway

16A2-3  Impedance-Based Stability Analysis of Systems with the Dominant Presence of Distributed Power Sources
Invited Paper
Kazuki Ohuchi1, Yuko Hirase1, Marta Molinas2
1) Toyo University, Japan, 2) Norwegian University of Science and Technology, Norway

16A2-4  Impedance scanning with chirps for single-phase converters
Invited Paper
Sjur Føyen1, Chen Zhang2, Marta Molinas2, Olav Fosso2, Takanori Isobe1
1) Norwegian University of Science and Technology, Norway, 2) Shanghai Jiao Tong University, China, 3) University of Tsukuba, Japan

16A2-5  Mechanism and Suppression Control of Wideband Oscillations in MMC-HVDC Connected Offshore Wind Farms
Invited Paper
Jing Lyu, Honglei Lin, Yiming Rao, Xu Cai
Shanghai Jiao Tong University, China
Session 16B2  Achievements and Findings from Vehicle Grid Integration Project and Research (OS)

Chairs: Masatoshi Uno (Ibaraki University, Japan)
Kensuke Sasaki (Nissan Motor Co., Ltd., Japan)

16B2-1 Frequency Adjustment with Integrated Control of EVs and Storage Batteries
Invited Paper
Takehiko Ashiya¹, Ayumu Izuhara¹, Koji Kudo²
1) Kansai Transmission and Distribution, Inc., Japan, 2) NEC Corporation, Japan

16B2-2 Charging infrastructure - how to contribute to the power grid -
Invited Paper
Makoto Yoshida¹, Osamu Maruta¹, Tomoko Blech Yamabe², Mika Zaurin Casanova²
1) CHAdeMO Association, Japan, 2) CHAdeMO Association, France

16B2-3 Frequency Control for AC Microgrid Using Onboard DC/DC Converter of Electric Vehicles
Invited Paper
Tatsuhito Nakajima¹, Yutaka Ota¹, Takuya Ishikawa¹, Kazumasa Ide³
1) Tokyo City University, Japan, 2) Osaka University, Japan, 3) Hitachi Power Solutions Co., Ltd., Japan

16B2-4 Evaluation of Electric Vehicles (EVs) Impact on Electric Grid
Invited Paper
Inam Ullah Nutkani, Jing Cheng Lee
RMIT University, Australia

Session 16C2  Sensing and Actuation for Human Assistive Systems (OS)

Chairs: Naoki Motoi (Kobe University, Japan)
Tomoyuki Shimono (Yokohama National University, Japan)

16C2-1 Safe High Stiffness Impedance Control for Series Elastic Actuators using Collocated Position Feedback
Invited Paper
Razvan Andrei Budau Petrea, Roberto Oboe, Giulia Micheletto
University Of Padova, Italy

16C2-2 Study on Disturbance Response of a Magnetic Lead Screw Actuator
Invited Paper
Akira Heya¹, Yoshihiro Nakata¹, Tetsuya Abe¹, Katsuhiro Hirata¹
1) Osaka University, Japan, 2) The University of Electro-Communications, Japan

16C2-3 Modeling and Analysis of a Magnetic Geared Linear Motor
Invited Paper
Nguyen Duc Khuong¹, Tomoyuki Shimono¹,²
1) Yokohama National University, Japan, 2) Kanagawa Institute of Industrial Science and Technology, Japan

16C2-4 Study on Displaying Images to Prevent VR Sickness as Maintaining Rich-Presence
Invited Paper
Satoshi Okuno, Sota Shimizu
Shibaura Institute of Technology, Japan

16C2-5 Path Planning Method Considering Blind Spots Based on ROS Navigation Stack and Dynamic Window Approach for Wheeled Mobile Robot
Invited Paper
Masato Kobayashi, Naoki Motoi
Kobe University, Japan

Session 16D2  IoT Technologies for Realizing Smart Facilities (OS)

Chairs: Shinobu Ishigami (Tohoku Gakuin University, Japan)
Nobuyuki Yamaguchi (Tokyo University of Science, Japan)

16D2-1 Selective Allocation Management System of Environmental Value and Electric Power Consumption
Invited Paper
Hiroki Oshima, Keishi Ooshima, Yoshihiro Machida, Masashi Amano, Takayuki Suzuki, Hiroshi Mine, Ko Takahashi, Kazuya Syojiki, Masahiro Aoki
Hitachi, Ltd., Japan

16D2-2 Simulation of Energy Management Considering Remote Work of Office Buildings With Storage Batteries in the Case of Disaster
Invited Paper
Kazuhiro Yuasa¹, Sota Kinoshita¹, Nobuyuki Yamaguchi¹, Fuyuki Sato², Shinichiro Ohtani²
1) Tokyo University of Science, Japan, 2) Mitsubishi Electric Corporation, Japan

13
<table>
<thead>
<tr>
<th>Session 16E2 Control and Analysis of Converters II</th>
</tr>
</thead>
</table>
| **Chairs**: Hidemine Obara (National Yokohama University, Japan)  
Kantoaro Yoshimoto (Tokyo Denki University, Japan) |

16E2-1 Harmonic Calculation of Parallel Interleaved Voltage-Source Converters in Digital Systems  
Haozhe Wang, Jie Ye, Baojin Li, Songtao Huang, Jinbang Xu, Anwen Shen  
Huazhong University of Science and Technology, China

16E2-2 A New Trapezoidal Modulation Technique to Reduce Acoustic Noise  
Hideki Ayano\(^1\), Takumi Nakagaki\(^1\), Yushi Araki\(^1\), Tatsuki Kashihara\(^1\), Koji Kobayashi\(^2\)  
\(^1\) National Institute of Technology, Japan, \(^2\) SANDEL CORPORATION, Japan

16E2-3 Frequency-Doubler Half-Bridge Modulation For Reduced Junction Temperatures in the Low-Gain Operation of the Isolated Full-Bridge Converter  
Philipp Rehlaender, Shobhit Sharma, Frank Schafmeister, Joachim Böcker  
Paderborn University, Germany

16E2-4 Verification of 1MHz Multisampling Disturbance Compensation Deadbeat Control for Megawatt-Level Grid-Tied Multi-level Inverter using Controller Hardware-in-the-Loop  
Ryoko Kato\(^1\), Kazuki Nakamura\(^1\), Kaya Kawashima\(^1\), Kohsuke Seki\(^2\), Kenta Yamabe\(^2\), Kantoaro Yoshimoto\(^1\), Tomoki Yokoyama\(^1\)  
\(^1\) Tokyo Denki University, Japan, \(^2\) Tohiba Mitsubishi-Electric Industrial Systems Corporation, Japan

16E2-5 A Data Modulation Strategy Based on LLC Resonant Converter  
Lingyu Li, Sheng Liu, Jinghui Chen, Jiande Wu, Xiangning He  
Zhejiang University, China

---

<table>
<thead>
<tr>
<th>Session 16F2 Non-isolated DC-DC Converters</th>
</tr>
</thead>
</table>
| **Chairs**: Masataka Ishihara (Okayama University, Japan)  
Yao-Ching Hsieh (National Sun Yat-sen University, Taiwan) |

16F2-1 Performance of Three-phase Inverter Using Multiple Bidirectional Choppers for 1.5-kV PV Systems Capable of Wide MPPT Range  
Linyue Qiao, Makoto Hagiwara  
Tokyo Institute of Technology, Japan

16F2-2 Internal Reference Compensation Technique for Constant On-time Buck Converter with Ceramic Capacitor  
Pang-Jung Liu\(^1\), Chi-Hung Wang\(^1\), Mao-Hui Kuo\(^1\), Xin-Wei Huang\(^1\)  
\(^1\) National Taipei University of Technology, Taiwan, \(^2\) Richtek Technology Corporation, Taiwan

16F2-3 Charge Equalization with Differential Current Allocation for Series-connected Batteries  
Liang-Chien Lin\(^1\), Cheng-Xiu Xie\(^1\), Tzu-Hsiang Weng\(^2\), You-Chun Huang\(^2\), Yao-Ching Hsieh\(^2\), Chin-Sien Moo\(^2\)  
\(^1\) Delta Electronics Inc., Taiwan, \(^2\) National Sun Yat-sen University, Taiwan

16F2-4 Boost Derived Full-Bridge ZCS Resonant Converter Using Inductive Output Filter  
Somboon Sooksatra, Wanchai Subsingha  
Rangsit University Pathumthani, Thailand
Session 16G2  PMSM Sensorless Drives

Chairs: Takayuki Miyajima (Daikin Industries, Ltd., Japan)  
Kichiro Yamamoto (Kagoshima University, Japan)

16G2-1  Performance Evaluation of Startup and Driving Strategy at Overall Speed with Extended ElectroMotive Force for Position Sensorless Permanent Magnet Synchronous Motor  
Rongjiao Hao, Takamasa Kozakura, Shinji Doki  
Nagoya University, Japan

16G2-2  Compensation of Zero Current Clamping Phenomenon of Sensorless IPMSM Drives with Ultrasonic Signal Injection  
Hisao Kubota, Naoya Hayashi  
Meiji University, Japan

16G2-3  Sensorless PMSM Harmonic Suppression Strategy Based on PLL with Embedded Double Quasi-Proportional-Resonant Controllers  
Bo Wang, Pengcheng Du, Yong Yu, Dianguo Xu  
Harbin Institute of Technology, China

16G2-4  Harmonic Reduction Method Using Minor Sampling Process for Signal Injection Position Sensorless Technique  
Yuki Ito, Yoshitaka Iwaji  
Ibaraki University, Japan

16G2-5  Parameter Estimation for Sensorless Position Control of PMSM Drives with Long Cable in Subsea Applications  
Virendra Singh, Mriganka Ghosh Majumder, Kaushik Rajashekara, Ravi Prakash Reddy Siddavatam  
University of Houston, USA

---

Session 16H2  Special machines

Chairs: Makoto Ito (Hitachi, Ltd., Japan)  
Jihad Furqani (Bandung Institute of Technology, Indonesia)

16H2-1  Three-Phase Air-Core Rotary Transformer with Halbach AC Windings for Wound-Field Motors  
Masahiro Aoyama  
Shizuoka University, Japan

16H2-2  Design of Slotless Single-Drive Bearingless Permanent Magnet Motor for High-Speed Applications  
Junichi Asama  
Shizuoka University, Japan

16H2-3  Estimation of Magnetic Suspension Loss in a 30000 r/Min One-Axis Actively Positioned Single-Drive Bearingless Motor  
Theeraphong Srichiangsai1, Hiroya Sugimoto2, Yusuke Fujii1, Kyohei Kiyota1, Akira Chiba1  
1) Tokyo Institute of Technology, Japan, 2) Tokyo Denki University, Japan

16H2-4  Development of Direct Cooling Stator Structure Using High Thermal Conductive Epoxy Molding Compounds  
Shinya Yamamoto, Atsunori Nishikawa, Takahiro Harada, Wataru Kosaka  
SUMITOMO BAKELITE CO., LTD., Japan

16H2-5  PM Magnetic Levitation Train Using Hybrid Electromagnetic- and Electrodynamic-Suspension System  
Shun Inoue, Yasutaka Fujimoto  
Yokohama National University, Japan
Room A

Session 16A3  Grid Forming Converters II
Chairs: Shinichi Imai (Takaoka Toko Co., Ltd., Japan)
Frede Blaabjerg (Aalborg University, Denmark)

16A3-1 Stability Analysis of Grid-Following and Grid-Forming Converters Based on State-Space Model
Xian Gao, Dao Zhou, Amjad Anvari-Moghaddam, Frede Blaabjerg
Aalborg University, Denmark

16A3-2 Impact of Circular Current Limiters on Transient Stability of Grid-Forming Converters
Bo Fan, Xiongfei Wang
Aalborg University, Denmark

16A3-3 Impact of DC-Link Voltage Control on Transient Stability of PLL-Synchronized Voltage-Source Converters
Teng Liu1, Xiongfei Wang1, Fangcheng Liu2
1) Aalborg University, Denmark, 2) Huawei Digital Power Technologies Company Ltd., China

16A3-4 Design-Oriented Analysis of Grid-Forming Control with Hybrid Synchronization
Hong Gong, Xiongfei Wang
Aalborg University, Denmark

Room B

Session 16B3  Thermal Management
Chairs: Koji Orikawa (Hokkaido University, Japan)
Jonas Huber (ETH Zurich, Switzerland)

16B3-1 On-line Junction Temperature Estimation Method of Power Device with Deterioration Based on On-state Voltage Measurement
Hayato Higa1, Takanori Hayashi1, Masashi Takiguchi1, Shota Urushibata1, Yugo Tadano1
1) Meidensha Corporation, Japan

16B3-2 Estimation of Both Junction Temperature and Load Current of IGBTs from Output Voltage of Gate Driver
Hiromu Yamasaki, Katsuhiro Hata, Makoto Takamiya
The University of Tokyo, Japan

16B3-3 Junction Temperature Estimation for IGBT Modules Through Knee Voltage
Xing Wei, Bo Yao, Yingzhou Peng, Huai Wang
Aalborg University, Denmark

16B3-4 Temperature Sensorless Thermal Management Strategy for Interleaving Power Converters
Zehui Li, Mingde Zhou, Haoyu Wang
ShanghaiTech University, China

Room C

Session 16C3  GaN Device Application
Chairs: Katsuya Nomura (Kwansei Gakuin University, Japan)
Jens Friebe (Leibniz University Hannover, Germany)

16C3-1 Efficiency Improving Strategies on GaN-based LLC Converter with Non-uniform Air Gap Transformer
Ching-Guo Chen1, Shiu-Hui Lee2, Wen-Nan Huang1, Chih-Ming Yu1, Hsiang-Chi Meng1
1) Potens Semiconductor Corp., Taiwan, 2) National Taipei University of Technology, Taiwan

16C3-2 Multi-Mode Control with GaN High Operating Frequency Four-Switch Step-Up/Down Converter
Jiann-Fuh Chen, Zih-Yue Chen, Chen-Ming Zhang
National Cheng Kung University, Taiwan
16C3-3 Parasitic Effects from Cooling of GaN Power Transistors - Impact on Switching Losses and Common-Mode Currents
Pelle Weiler, Bart Bokmans, Erik Lemmen, Bas Vermulst, Korneel Wijnands
Eindhoven University of Technology, The Netherlands

16C3-4 GaN-based High Frequency NIBB dc-dc Converter with Feedback Control Using FPGA
Ravi Nath Tripathi, Alberto Castellazzi
Kyoto University of Advanced Science (KUAS), Japan

Room D

Session 16D3  Industrial Instrumentation and Control I
Chairs: Yasutaka Fujimoto (Yokohama National University, Japan)
Naoki Motoi (Kobe University, Japan)

16D3-1 Accurate Ion Energy Control in Plasma Processing by Switched-Mode Power Converter
Qihao Yu, Erik Lemmen, Korneel Wijnands, Bas Vermulst
Eindhoven University of Technology, The Netherlands

16D3-2 Optimization Approaches for the Signal Processing of Hybrid Current Sensors
Philipp Ziegler, Michael Bura, Jörg Haarer, Philipp Marx, David Hirning, Jörg Roth-Stielow
University of Stuttgart, Germany

16D3-3 Design and Control of Single-Phase Controlled VSCs with Saturable Inductor-Based LCL Filters
Ziya Özkan, Dao Zhou, Frede Blaabjerg
Aalborg University, Denmark

16D3-4 A VSD-Embedded Machine Learning Misalignment and Unbalance Diagnosis Methodology
Saïd Talbi1, Alain Dutrey2
1) Médiane Système for STIE, France, 2) Schneider Toshiba Inverter Europe, France

Room E

Session 16E3  DC-DC Converters I
Chairs: Kantaro Yoshimoto (Tokyo Denki University, Japan)
Yu-Chen Liu (National Ilan University, Taiwan)

16E3-1 Multi-stage charging strategy with constant resonant current of LCC resonant circuit
Mengjie Qin, Aizhen Ye, Fan Zhang, Wenjie Chen, Xu Yang, Yao Xiao
Xi’an Jiaotong University, China

16E3-2 Analysis and Comparison of Isolated Converter based Step-Down Partial Power Processing Configurations
Chao Liu, Zhe Zhang, Ziwei Ouyang, Michael A. E. Andersen, Tiberiu-Gabriel Zsurzsan
Technical University of Denmark, Denmark

16E3-3 1.5-MHz High-Performance 380-V/12-V LLC Resonant Converter
Yun-Yen Chen1, Yu-Chen Liu2, Chen Chen1, Kai-De Chen1, Yong-Long Syu1, Wen-Hao Xue1, Huang-Jen Chiu1
1) National Taiwan University of Science and Technology, Taiwan, 2) National Ilan University, Taiwan

16E3-4 Secondary-Side Resonating LLC Converter for Reducing Transformer Voltage in High Power Applications
Hayato Nakamura1, Kazuhiro Umetani1, Masataka Ishihara1, Eiji Hiraki1
Okayama University, Japan

Room F

Session 16F3  Control and Analysis of Modular Multi-level Converters
Chairs: Hirofumi Uemura (Fuji Electric Co., Ltd., Japan)
Georgios Konstantinou (The University of New South Wales, Australia)

16F3-1 Impedance Shaping Effects of Circulating Current Controllers in Modular Multilevel Converters
Ye Zhu1, Josep Pou2, Georgios Konstantinou1
1) University of New South Wales, Australia, 2) Nanyang Technological University, Singapore
16F3-2 Non-Linear Model Predictive Control for Modular Multilevel Converters
Saad Hamayoon1, Morten Hovd1, Jon Are Suul1,2
1) Norwegian University of Science and Technology, Norway, 2) SINTEF Energy Research, Norway

16F3-3 A Study of 1MHz Multi-Sampling SVPWM Method for Low Carrier Three Phase Modular Multilevel Converter
Kotaro Sato, Kazuki Nakamura, Sakyu Takeuchi, Tomoki Yokoyama
Tokyo Denki University, Japan

Room G

Session 16G3 Special Motor Drives
Chairs: Takahiro Suzuki (Hitachi Ltd., Japan)
Ufot Ekong (TMEIC, Japan)

16G3-1 Predictive Control of Sensorless Flux-Switching Motor Drive Systems with DC-Field Excitation
Tian-Hua Liu, Yu-Hao Xu
National Taiwan University of Science and Technology, Taiwan

16G3-2 Stability Improvement Method of Position Sensorless Control for Single Inverter Dual Parallel IPMSMs Drive System by Using Signal Injection
Cheonsu Park, Shinji Doki
Nagoya University, Japan

16G3-3 Characteristic Evaluation of Linear Switched Reluctance Motor with High-temperature Superconducting Excitation Windings for Application to Ropeless Linear Elevator
Tadashi Hirayama, Shuma Kawabata
Kagoshima University, Japan

16G3-4 Reduction of Common Mode Disturbances in Parallel Modules of Integrated Modular Motor Drives
Philipp Marx, Jan Assenheimer, Philipp Ziegler, Jörg Haarer, Jörg Roth-Stielow
University of Stuttgart, Germany

Room H

Session 16H3 Motor design & control
Chairs: Yu Hasegawa (Hitachi Ltd., Japan)
Wolfgang Gruber (Johannes Kepler University Linz, Austria)

16H3-1 Multiobjective Particle Swarm Optimization Design of Permanent Magnet Machine for Torque Density Improvement and Torque Ripple Suppression
Jiaxuan Huang1, Yi Sui2, Zuosheng Yin1, Guopeng Liu1, Ping Zheng1, Yongjian Li2
1) Harbin Institute of Technology, China, 2) Hebei University of Technology, China

16H3-2 Anti-Demagnetization Design of IPMSM Using an Automatic Design System Combining Coarse-Mesh FEM and GA
Yutaro Mambo1, Masayuki Sanada2, Shigeo Morimoto2, Yukinori Inoue2
1) Osaka Prefecture University, Japan, 2) Osaka Metropolitan University, Japan

16H3-3 Fitting Method of Experimentally Measured 3D Loss and Torque Maps to design Optimal Trajectories for IPMSM
Kaoru Inoue, Yusuke Naito, Toshiji Kato
Doshisha University, Japan

16H3-4 Stable Equilibrium Rotor Positions for a Three-Phase Switched Reluctance Machine
Georg Tobias Götz, Philipp Tillmann, Anne von Hoegen, Rik W. De Doncker
RWTH Aachen University, Germany
Session 17A1  Emerging Technology for Cutting Edge Wide Band Gap Semiconductor Device (OS)

Chairs: Tsuyoshi Funaki (Osaka University, Japan)
        Yan Zhang (Xi’an Jiaotong University, China)

17A1-1  Development of $\alpha$-Ga$_2$O$_3$ Power Devices
Invited Paper
Takashi Shinohe
FLOSFIA INC., Japan

17A1-2  Gallium Oxide Power Device Technologies
Invited Paper
Masataka Higashiwaki
National Institute of Information and Communications Technology, Japan

17A1-3  GaN-based Solutions for Cost-effective Direct and Indirect Time-of-Flight Lidar Transmitters Are Changing the Way We Live
Invited Paper
Alex Lidow, John Glaser
Efficient Power Conversion Corporation, USA

17A1-4  R&D Bridging over Device and System Engineers Through the Electric-Mileage Estimation of a Motor System
Invited Paper
Ken Nakahara, Hirokatsu Umeegami, Toshikazu Harada, Takukazu Otsuka, Atsushi Yamaguchi
ROHM Co., Ltd., Japan

17A1-5  Reliability and robustness of SiC power devices –how to ensure the quality level established in the silicon world
Invited Paper
Peter Friedrichs
Infineon, Germany

Session 17B1  Motor Drive Technologies for Industrial Applications (OS)

Chairs: Shizunori Hamada (Meidensha Corporation, Japan)
        Ikuya Sato, (Fuji Electric Co., Ltd., Japan)

17B1-1  Improved Power Density of Large-capacity Drives for Steel Plants
Invited Paper
Katsuhiko Fukuma, Haruyuki Yamaguchi, Ufot Ufot Ekong, Masahiko Tsukakoshi
1) Toshiba-Mitsubishi-Electric Industrial Systems Corporation, Japan

17B1-2  High-Precision Torque Control of IPMSM Considering Magnetic Saturation and Magnet Temperature Variation
Invited Paper
Yoshisaku Takase, Yasumasa Hamabe, Hengbin Rui, Shinya Morimoto, Koji Higashikawa
YASKAWA ELECTRIC CORPORATION, Japan

17B1-3  Electrolytic Capacitor-less Inverter Technology for Miniaturization of Air Conditioning System
Invited Paper
Tatsuki Inoue, Hirotaka Doi, Takayuki Miyajima
Daikin Industries, LTD., Japan

17B1-4  Improvement of system efficiency by variable switching frequency control for converter
Invited Paper
Koji Tsukii¹, Masahiro Tamura¹, Wataru Hatsuse², Yasuo Notohara²
1) Johnson Controls-Hitachi Air Conditioning, Inc., Japan, 2) Hitachi Ltd., Japan

17B1-5  Torque Enhancement of Surface Permanent Magnet Motors utilizing Reluctance Torque for High-speed Motors with Bonded Magnets
Invited Paper
Koji Yamaguchi, Tomoya Yamamoto, Naoki Omura, Takehiro Jikumaru
IHI Corporation, Japan
Session 17C1  Advanced Power Conversion and Control for Railways (OS)

Chairs: Takaumi Koseki (The University of Tokyo, Japan)  
Hiroyasu Kobayashi (Chiba University, Japan)

17C1-1  Position Sensorless Control of Synchronous Reluctance Machines based on Fundamental Saliency Method for Railway Traction  
Invited Paper  
Tetsuya Kojima¹, Toshiki Suzuki¹, Kota Teramoto¹, Tetsuo Sugahara¹, Tatsuro Takahashi², Takuya Saito²  
¹) Mitsubishi Electric Corporation, Japan, ²) Tokyo Metro Co., Ltd., Japan

17C1-2  Wheel Slip Control Technologies on Japanese Railways  
Invited Paper  
Shingo Makishima¹, Keiichiro Kondo², Hiroki Shimoyama³, Daiki Sato³, Satoru Takahashi¹, Takaumi Koseki⁵  
¹) Toyo Denki Seizo K. K., Japan, ²) Waseda University, Japan, ³) Central Japan Railway Company, Japan, ⁴) Tokyo Denki University, Japan, ⁵) The University of Tokyo, Japan

17C1-3  Integration of Onboard Batteries and Supercapacitors Based on the Multi-Source Inverter for Light Rail Vehicles  
Invited Paper  
Emanuele Fedele, Antonio Di Pasquale, Diego Iannuzzi, Mario Pagano  
Università di Napoli “Federico II”, Italy

17C1-4  Study on Interconnecting Operation Control of Electronic Frequency Converters Realizing the Replacement of All Rotary Frequency Changers in Nishisagami Substation in the Tokaido Shinkansen  
Invited Paper  
Toshimasa Shimizu¹, Ken Kunomura¹, Hiroki Miyajima², Takumi Nagai²  
¹) Central Japan Railway Company, Japan, ²) Toshiba Infrastructure Systems & Solutions Corporation, Japan

17C1-5  Outstanding Technical Features of Traction System in N700S Shinkansen New Generation Standardized High Speed Train  
Invited Paper  
Kenji Sato, Hirokazu Kato, Takaumi Fukushima  
Central Japan Railway Company, Japan

Session 17D1  Industrial Instrumentation and Control II

Chairs: Seiichiro Katsura (Keio University, Japan)  
Rae-Young Kim (Hanyang University, Korea)

17D1-1  Data-Driven Analysis of Distributed Generator-Based Power Systems Using Koopman Mode Decomposition  
Yuko Hirase, Yuki Ohara, Takeaki Yamazaki  
Toyo University, Japan

17D1-2  Model Predictive Control with Reduced Computation for N-cell Cascaded Flying Capacitor H-Bridge Converter in Solid-State Transformer  
Dong-Hwan Park, Rae-young Kim  
Hanyang University, Korea

17D1-3  An Improved Finite Control Set Model Predictive Control for LC-filter VSI against Model LC Mismatch  
Van-Tien Le¹, Huu-Cong Vu², Hong-Hee Lee¹  
¹) University of Ulsan, Korea, ²) Hanoi University of Civil Engineering, Viet Nam

17D1-4  An Optimized Intelligent Technique for Bearing Fault Diagnosis using Motor Current Signal Analysis  
Jiang Xinjie¹, Hasmat Malik², Sanjib Kumar Panda¹  
¹) National University of Singapore, Singapore, ²) Berkeley Education Alliance for Research in Singapore (a research center of the University of California, USA), Singapore

17D1-5  Vibration Suppression Using Vibration Coordinate System Based on dq Transform with Specific Frequency  
Tatsuya Kani, Masato Koyama  
Mie University, Japan
Session 17E1   Latest solution for EMI and EMC
Chairs: Tomoyuki Mannen (Univeseity of Tsukuba, Japan)
        Changsheng Hu (Zhejiang University, China)

17E1-1 Evaluation of Factors Impacting Reflected Wave Phenomenon in WBG Based Motor Drives
Kushan Choksi, Yuxuan Wu, Mustafeez-ul-Hassan, Fang Luo
Stony Brook University, USA

17E1-2 Overmodulation Technique on Common Mode Voltage Reduction PWM Inverter using Saw-Wave Carrier Signal
Tatsuki Kashihara, Yushi Araki, Hiroshi Yoshida, Koji Kobayashi
SANDEN CORPORATION, Japan

17E1-3 Common Mode Noise Reduction of Two-Phase Interleaved Boost Converters with Integrated Magnetics Utilizing Balanced Technique
Tomotaka Nagai¹, Mamoru Sasaki¹, Jun Imaoka¹, Masayoshi Yamamoto¹, Akira Nakano²
1) Nagoya University, Japan, 2) ALPS ALPINE CO., LTD., Japan

17E1-4 An Investigation on the Relationship between CM Noise and Distribution of Parasitic Capacitance
Mamoru Sasaki, Jun Imaoka, Masayoshi Yamamoto
Nagoya University, Japan

——— Room F ———

Session 17F1   Latest Applications of Power Converters from Industry
Chairs: Hirohito Funato (Utsunomiya University, Japan)
        Yushi Koyama (Toshiba Infrastructure Systems & Solutions Corporation, Japan)

17F1-1 Inter-cluster balancing of Solid-State Transformer Based on a Feedforward Negative-Sequence Power Control
Tsuyoshi Nagano, Koroku Nishizawa, Laxman Maharjan, Toshihisa Tajyuta, Koji Maruyama
Fuji Electric Co., Ltd., Tokyo, Japan

17F1-2 Design and Installation of STATCOM System for Wind and Photovoltaic Power Plant
Takayuki Yachida, Ryota Okuyama, Naoki Morishima, Yusuke Ashizaki, Yohei Itaya
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

17F1-3 Development of 500KW Class PCS for Hydrogen-powered Fuel Cell Applications
Haiqing Li, Kohki Morisaki
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

17F1-4 Proposal and Evaluation of High-Heat Insulation System for Spacecraft by Using WPT
Sayuri Honda¹, Shuhei Shimada¹, Kosuke Tanaka¹, Kana Nakamura², Takehiro Imura³,
Katsuhiro Hata⁴ and Yoichi Hori³
1) Japan Aerospace Exploration Agency, Japan, 2) University of Tsukuba, Japan, 3) Tokyo University of Science, Japan, 4) The University of Tokyo, Japan

——— Room G ———

Session 17G1   Induction Motor Drives
Chairs: Hisao Kubota (Meiji University, Japan)
        Kazuhiro Ohyama (Fukukoka Institute of Technology, Japan)

17G1-1 Current Vector Control System Based on a New Discrete dq-Axis IM Model for High Speed Drive
Takuma Takeuchi¹, Shinji Doki¹
Nagoya University, Japan

17G1-2 FEA-Assisted Experimental Parameter Identification of Induction Motor
Jiwon Yoo¹, Joon-Hee Lee², Seung-Ki Sul¹
1) Seoul National University, Korea, 2) LG Electronics, Korea

17G1-3 Current Optimization for Low-Frequency Ride-Through in Speed-Sensorless Induction Motor Drives
Cheng Luo, Ruhan Li, Kai Yang, Bo Wang, Yong Yu, Dianguo Xu
Huazhong University of Science and Technology, China
17G1-4 Improvement of Start-Up Performance at the Standstill Condition of Induction Motor Speed Sensorless Vector Control Using Adaptive Flux Observer
Erina Izumi¹, Masaki Nagataki¹, Keiichiro Kondo¹, Shunsuke Tobayashi², Hiromitsu Suzuki²
¹) Waseda University, Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

17G1-5 A Method for Determining Equivalent Circuit Constant of Linear Induction Motors Using Locked Mover and Standstill Impedance Tests
Hideaki Hirahara, Mikito Inoue, Shu Yamamoto
Polytechnic University, Tokyo, Japan

Room H

Session 17H1  Reluctance machines
Chairs: Kyohei Kiyota (Tokyo Institute of Technology, Japan)
        Fuat Kucuk (Kyoto University of Advanced Science, Japan)

17H1-1 Efficiency Improvement of Switched Reluctance Motor with three-dimensional Gap Structure
Jie Zhang, Kazuhiro Ohyama
Fukuoka Institute of Technology, Japan

17H1-2 An Innovative Mutually Coupled Switched Reluctance Motor for Torque Enhancement and Torque Ripple Mitigation
Dongshan Fu¹, Hongyu Si¹, Ping Zheng², Yue Liu¹, Xiaojie Wu¹, Yanliang Xu¹, Weilin Zong¹
¹) China University of Mining and Technology, China, 2) Harbin Institute of Technology, China, 3) Shandong University, China

17H1-3 Transverse-Flux-type Switched Reluctance Motor with Permanent Magnets applying Reverse Bias Magnetic Field
Ayumi Nagai, Kazuhide Mitsuya, Kanji Nakamura
Tohoku University, Japan

17H1-4 Modeling of a Modular Stator Segmented Rotor Switched Reluctance Motor for Circuit Simulation
Belle S. Sermeno, Ramon Florentino L. Santos, Lew Andrew R. Tria
University of the Philippines Diliman, Philippines

17H1-5 Examination of non-sinusoidal drive in Direct Current excited Reluctance motor
Akito Yamaguchi, Yudai Koishi, Hiroki Goto
Utsunomiya University, Japan

Tuesday, May 17: 11:35-13:15

Room A

Session 17A2  Reliability Improvement in Power Electronics Systems (OS)
Chairs: Kyo-Beum Lee (Ajou University, Korea)
        Hitoshi Haga (Nagaoka University of Technology, Japan)

17A2-1 Zero-Sequence Current Control for Open-End Winding IPMSM Fed by Dual Inverter with a Common Source
Invited Paper
Sung-Jin Jang, Jun-Ho Hwang, Hyeung-Woo Lee, Kyo-Beum Lee
Ajou University, Korea

17A2-2 Analysis and Suppression of Zero-Sequence Circulating Current in Parallel Three-Level Inverters using Improved Interleaved DPWM
Invited Paper
Jun-Hyeok Park, Hye-Won Choi, Kyo-Beum Lee
Ajou University, Korea

17A2-3 Fault Diagnosis and Tolerance for Open-circuit Faults in Multi-Level Inverters
Invited Paper
Laith M. Halabi, Ibrahim Mohd Alsofyani, Kyo-Beum Lee
Ajou University, Korea
Session 17B2  Multi-level converters I

Chairs: Makoto Hagiwara (Tokyo Institute of Technology, Japan)
       Jiacheng Wang (Simon Fraser University, Canada)

17B2-1  A Five-Level Unity-Gain Active Neutral-Point-Clamped Inverter Designed Using Half-Bridges
Sze Sing Lee¹, Yam P. Siwakoti², Reza Barzegarkhoo¹, Kyo-Beum Lee¹
1) Newcastle University in Singapore, Singapore, 2) University of Technology Sydney, Australia, 3) Ajou University, Korea

17B2-2  An Interleaved Switched-Boost Common-Ground Five-Level Inverter
Majid Farhangi¹, Reza Barzegarkhoo¹, Sze Sing Lee², Dylan Lu¹, Yam Siwakoti¹
1) University of Technology Sydney, Australia, 2) Newcastle University in Singapore, Singapore

17B2-3  A Novel Seven-Level Switched-Boost Common-Ground Inverter With Single-Stage Dynamic Voltage Boosting Gain
Reza Barzegarkhoo¹, Majid Farhangi¹, Sze Sing Lee², Ricardo P. Aguilera¹, Yam P. Siwakoti¹
1) University of Technology Sydney, Australia, 2) Newcastle University in Singapore, Singapore

17B2-4  Operating Scheme of Six-Level Hybrid Inverters with Reduced Capacitor Count
Jonathan Pribadi, Dong-Choon Lee
Yeungnam University, Korea

Session 17C2  DC-DC Converter for Industrial Applications

Chairs: Kazunobu Oi (Meidensha Corporation, Japan)
       Weimin Wu (Shanghai Maritime University, China)

17C2-1  Decoupling Analysis and Modeling for Threeport Resonant Converter
Yuqi Wei¹,², Thiago Pereira¹, Marco Liserre¹, H. Alan Mantooth¹
1) University of Arkansas, USA, 2) Kiel University, Germany

17C2-2  Two-stage Battery Energy Storage Power Conversion System Based on Dual Active Bridge
Liangyi Wang, Ning Gao, Weimin Wu
Shanghai Maritime University, China

17C2-3  Voltage Balancing Control of Bidirectional Input-Series Output-Series Dual Active Bridge DC/DC Converters without Auxiliary Circuits
Kazunobu Oi¹,², Hayato Higa¹, Kazunori Morita¹, Shota Urushibata¹, Yugo Tadano¹, Yukihiro Sato²
1) MEIDENSHA CORPORATION, Japan, 2) Chiba University, Japan

17C2-4  Vibration Power Generation System using a Piezoelectric Element With a Variable Resistance Control for Optimal Generated Power
Naotaka Nakahigashi, Hiroaki Yamada
Yamaguchi University, Japan

Session 17D2  Human and Machine Control System

Chairs: Kaoru Mitsuhashi (Polytechnic University, Japan)
        Hirooki Aoki (Chitose Institute of Science and Technology, Japan)

17D2-1  On selection of topics that users are interested in but are not familiar with
Yuya Sakai, Mitsuharu Matsumoto
University of Electro-Communications, Japan
Room E

Session 17E2  Control and Analysis of Inverters

Chairs: Shin-ichi Hamasaki (Nagasaki University, Japan)
Jung-Ik Ha (Seoul National University, Korea)

17E2-1  Influence of Dead-Time and Diode’s Reverse Recovery on the Input Current Ripple of Three-phase Voltage Source Inverters
Juris Arrozy, Darian V. Retianza, Henk Huisman, Jorge L. Duarte
Eindhoven University of Technology, The Netherlands

17E2-2  Common Mode Voltage Reduction and Neutral-Point Voltage Balance for Quasi-Z-Source Three-Level Neutral-Point-Clamped Inverters
Wenjie Liu1, Yongheng Yang2, Weilin Li1, Xiaobin Zhang1, Oleksandr Husev1, Dmitri Vinnikov1
1) Northwestern Polytechnical University, China, 2) Zhejiang University, China, 3) Tallinn University of Technology, Estonia

17E2-3  Double-Carrier-Based PWM Theory for Independent Power Control of Dual-Input Three-level Inverters
Monchai Ariyapuek1, Surapong Suwankawin1, Somboon Sangwongwianich1, Ariya Sangwongwianich1
1) Chulalongkorn University, Thailand, 2) Aalborg University, Denmark

17E2-4  Voltage Modulation Method for T-type Three-Level Inverter with Reduced Conduction Loss in Low Voltage Modulation Region
Cheolmin Hwang, Gyu Cheol Lim, Jonghun Choi, Jung-Ik Ha
Seoul National University, Korea

Room F

Session 17F2  Wireless Power Transfer II

Chairs: Keisuke Kusaka (Nagaoka University of Technology, Japan)
Yun Yang (The University of Hong Kong, China)

17F2-1  A General Primary-side Coupling Coefficient and Load Monitoring Method for Inductive Power Transfer Systems
Kaiyu Wang, Yun Yang
The Hong Kong Polytechnic University, China

17F2-2  Analysis of Scaling Characteristics for Inductive Power Transfer Coils
Giuseppe Guidi1, Jon Are Suul1,2
1) SINTEF Energy Research, Norway, 2) Norwegian University of Science and Technology, Norway

17F2-3  Four-switch Class-PN Power Amplifier for High Power Handling Capability in Wireless Power Transfer
Faheem Ahmad, Asger Bjorn Jorgensen, Stig Munk-Nielsen
Aalborg University, Denmark

17F2-4  A Primary-Side Gain-Scheduled Controller Based on Dynamic Coupling Estimation for Inductive Battery Charging Systems with Sub-resonant Frequency Control
Jiayu Zhou1, Giuseppe Guidi1, Shuxin Chen1, Yi Tang1, Jon Are Suul1,2
1) Norwegian University of Science and Technology, Norway, 2) SINTEF Energy Research, Norway, 3) Nanyang Technological University, Singapore
Session 17G2  Grid Forming Converters III

Chairs: Yoshinobu Ueda (Meidensha Corporation, Japan)
Yongsug Suh (Jeonbuk National University, Korea)

17G2-1 A Control Method of Reduced Reactive Power Ripple in Grid-connected Converters under Unbalanced Grid Conditions
Jaehoon Choi, Yongsug Suh
Jeonbuk National University, Korea

17G2-2 Global Impedance Identification of Inverter-Based Power Systems Using Grid-Forming-Inverter-Based Current Perturbation Injections at Single Node
Weihua Zhou, Nabil Mohammedy, Behrooz Bahraniz
Monash University, Australia

17G2-3 Artificial Neural Network-based Intelligent Grid Impedance Identification Method for Grid-Connected Inverter
Yuan Qiu, Yanbo Wang, Yanjun Tian, Zhe Chen
Aalborg University, Denmark

17G2-4 Augmentation of Generalized Multivariable Grid-Forming Control for Power Converters with Cascaded Controllers
Meng Chen¹, Dao Zhou¹, Ali Tayyebi², Eduardo Prieto-Araujo¹, Florian Dörfler², Frede Blaabjerg³
1) Aalborg University, Denmark, 2) Swiss Federal Institute of Technology (ETH) Zurich, Switzerland, 3) CITCEA-UPC, Technical University of Catalonia, Spain

Session 17H2  PM machines I

Chairs: Katsutoku Takeuchi (Toshiba Infrastructure Systems & Solutions, Japan)
Kyohei Kiyota (Tokyo Institute of Technology, Japan)

17H2-1 Rotor Structure for Suppressing Irreversible Demagnetization of Magnets in Double-layered Interior Permanent Magnet Synchronous Motors
Atsushi Nakata¹, Masayuki Sanada², Shigeo Morimoto², Yukinori Inoue²
1) Osaka Prefecture University, Japan, 2) Osaka Metropolitan University, Japan

17H2-2 Reduction of Magnetization Current in a Variable-Magnetization IPM Motor with Two Ushaped Arrangement for Electric Vehicles
Wataru Suzuki, Kazuto Sakai
Toyo University, Japan

17H2-3 Prototype Tests of Segment-type Outer-Rotor PM motor
Sho Sakurai, Yutaro Uchiyama, Kenji Nakamura
Tohoku University, Japan

17H2-4 Prototype Test Results of Inset-type Permanent Magnet Machine made of NANOMET® Laminated Core
Yue Yu¹, Shozo Hiramoto², Kenji Nakamura³
1) Tohoku University, Japan, 2) Tohoku Magnet Institute Co., Ltd., Japan
Session 17A3  High performance Isolated DC-DC Converters in Emerging Applications (OS)

Chairs: Kai Sun (Tsinghua University, China)
       Jung-Ik Ha (Seoul National University, Korea)

17A3-1 A Modulation Method of Series-Resonant Dual-Active Half-Bridge Converter for ZVS and Minimum RMS current
Invited Paper
Jin-Su Hong, Sunghyuk Choi, Jung-Ik Ha
Seoul National University, Korea

17A3-2 Optimal Design of a Constant Frequency Series-Resonant DC/DC converter with Wide Voltage Gain Range for Single-Stage Isolated AC/DC Power Conversion
Invited Paper
Jie Liu¹, Yujie Cheng², Yihang Jia¹, Honglei Wu¹
1) Nanjing University of Aeronautics and Aeronautics, China, 2) Nanjing Electronic Devices Institute, China

17A3-3 Analysis of Partial Parallel Dual Active Bridge Converter with Additional Phase Shift Control
Invited Paper
Jiasheng Huang, Chang Wang, Zhe Zhang, Ziwei Ouyang, Gabriel Zsurzsan, Michael A.E. Andersen
Technical University of Denmark, Denmark

17A3-4 Efficiency Improvement of Current-Fed DAB Converter by Triangular Current Mode for Wide Voltage Applications
Invited Paper
Hiroki Watanabe, Akira Tamagawa, Jun-ichi Itoh
Nagaoka University of Technology, Japan

17A3-5 An Inner Phase Shift Control Scheme for the CLLC Converter
Invited Paper
Huan Chen, Kai Sun, Haixu Shi, Leiheng Wang, Kai Zhang
Tsinghua University, China

Room B

Session 17B3  EMI Mitigation for Power Electronics Converters (OS)

Chairs: Dong Jiang (Huazhong University of Science and Technology, China)
Shuo Wang (University of Florida, USA)

17B3-1 EMI Analysis of Three-Phase Three-Level Flying Capacitors Diode Clamped DAB Converter
Invited Paper
Yuxuan Chen, Wenjie Chen, Jinlu Liu, Daoxin Tong, Xin Ma
Xi’an Jiaotong University, China

17B3-2 Common-Mode Voltage Mitigation for Three-Phase Hybrid NPC Inverter with Flying-Capacitor Leg
Invited Paper
Xuan Zhao, Dong Jiang, Wei Sun, Jialou Gao
Huazhong University of Science and Technology, China

17B3-3 Conducted EMI Reduction of Modular Multilevel Converter Based on Chaotic Nearest Level Modulation
Invited Paper
Zuoxing Wang¹, Hong Li¹, Zhaoyi Chu¹, Chongmo Zhang¹, Zhichang Yang¹, Tiancong Shao¹
1) Beijing Jiaotong University, China, 2) Global Energy Interconnection Research Institute Co., Ltd., China

17B3-4 Characterization and Design of Filter Inductors and Capacitors to Suppress the Radiated EMI in A Power Converter
Invited Paper
Yingjie Zhang, Shuo Wang
University of Florida, USA

17B3-5 A Low-cost Active Reflected Wave Canceller for MMC Motor Drive using SiC Devices
Invited Paper
Yu Zhang, Zhehui Guo, Hui Li, Fangzheng Peng
Florida State University, USA
Session 17C3  Energy Storage System for Railway Systems (OS)

Chairs: Shingo Makishima (Toyo Denki Seizo K. K., Japan)
       Takafumi Koseki (The University of Tokyo, Japan)

17C3-1  Case study of four battery-powered methods to run electric trains on non-electrified lines

Invited Paper
Masamichi Ogasa
Railway Technical Research Institute, Japan

17C3-2  Contribution of Wayside Energy Storage Systems to Short Circuit Currents in DC Railway Traction Power Systems

Invited Paper
Antonio Di Pasquale, Emanuele Fedele, Diego Iannuzzi, Mario Pagano
Università degli studi di Napoli Federico II, Italy

17C3-3  Overview of Power Electronics Applications for Fixed Installations of Urban Railway Power Supply for Regenerative Energy Utilization

Invited Paper
Takashi Suzuki1, Daisuke Kumagai1, Ryo Takahashi1, Yuuki Mizumoto1, Hidenori Sato1, Yuuki lino1, Shirou Sekijima1, Masashi Nakahira1, Hitoshi Hayashiya1
1) East Japan Railway Company, Japan, 2) Nippon Rietec Co., Ltd., Japan

17C3-4  Traction Energy Storage Systems applied with SCiB

Invited Paper
Nobuhiko Satake1, Masayuki Nogi1, Koji Maki1, Motokatsu Og1, Manato Mori1, Geronimo Anthony Ivan Capitin1, Akira Tanaka2
1) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 2) Toshiba IT & Control Systems Corporation, Japan

17C3-5  Method to Design Control System of Traction Inverter of DC-electrified Railway Vehicle for an Increase in Regenerative Brake Power

Invited Paper
Hiroyasu Kobayashi1, Natsuki Kawagoe1, Keiichiro Kondo1, Tetsuya Iwasaki2, Akihiro Tsumura2
1) Waseda University, Japan, 2) Odakyu Electric Railway Co., Ltd., Japan

Session 17D3  Human Factor and Image Intelligent System (OS)

Chairs: Kaoru Mitsuhashi (Polytechnic University, Japan)
       Takio Kurita (Hiroshima University, Japan)

17D3-1  Summary of Works on Image Classification with Noisy Labels

Invited Paper
Yuichiro Nomura, Takio Kurita
Hiroshima University, Japan

17D3-2  Pixel Relationships-based Regularizer for Retinal Vessel Image Segmentation

Invited Paper
Lukman Hakim, Takio Kurita
Hiroshima University, Japan

17D3-3  Investigation of Training Effects and Services by Skill Motion Training Games

Invited Paper
Akira Tao1, Osamu Ichikawa1, Kaoru Mitsuhashi2
1) Poltechnic University of Japan, Japan, 2) Teikyo University, Japan

17D3-4  Suggestion of AR Presentation Tool for PC Operating Handicapped Users

Invited Paper
Kaoru Mitsuhashi1, Tomoaki Maruyama1, Hiroshi Takeshita1
1) Teikyo University, Japan, 2) National Institute of Technology (KOSEN), Japan, 3) Tsukuba University of Technology, Japan

17D3-5  Interactive Media Art by Applying Depth Sensing

Invited Paper
Hirooki Aoki
Chitose Institute of Science and Technology, Japan
Session 17E3  Parasitics Analysis and Design

Chairs: Shuhei Fukunaga (Osaka University, Japan)
       Liu Jia (Xi’an Jiaotong University, China)

17E3-1 Analysis and Design of a High Power Density Full-Ceramic 900V DC-Link Capacitor for a 550 kVA Electric Vehicle Drive Inverter
   Davide Cittanti¹, Fausto Stella¹, Enrico Vico¹, Chaohui Liu², Jinliang Shen², Guidong Xiu², Radu Bojoi¹
   1) Politecnico di Torino, Italy, 2) National New Energy Vehicle Technology Innovation Center, China

17E3-2 Robust HV Power pLDMOS Components for ESD Protection by the Drain-side Parasitic Schottky Diode and SCR Engineering
   Shen-Li Chen¹, Shi-Zhe Hong¹, Wei-Jung Chen¹
   1) National United University, Taiwan, 2) National Yang Ming Chiao Tung University, Taiwan

17E3-3 Design the Phase Output Bar for Improving Static Current Sharing Among Parallel IGBTs in High Power Stack Application
   Zheng-Feng Li¹, Nobuya Nishida¹, Hirotoshi Aoki¹, Hisashi Shibata³, Chih-Hung Ma¹, Hsiang-Ming Liu¹, Ming-Shi Huang¹
   1) National Taipei University of Technology, Taiwan, 2) Mitsubishi Electric Corporation, Japan, 3) TAMURA Corp., Japan

17E3-4 Passive components facing wideband gap devices’ new thermal and electrical challenges
   Thomas Fouet¹, Simon Dario¹, Tomokazu Sakuraba², Herwig Süncksen¹, Jean-François de Palma¹
   1) Mersen, France, 2) Mersen, Japan, 3) Mersen, Germany

17E3-5 Analysis of Clearance Effect for Perforated Terminals Isolation of a Laminated Busbar to Parasitic Parameters
   Koji Mitsui, Keiji Wada
   Tokyo Metropolitan University, Japan

Session 17F3  Power Supplies

Chairs: Shohei Komeda (Tokyo University of Marine Science and Technology, Japan)
        Yu-Chen Liu (National Ilan University, Taiwan)

17F3-1 Analysis of Winding Coverage in Planar Transformers with Fractional Turns for High Frequency LLC Resonant Converters
   Yu-Chen Liu, Meng-Chi-Tsai, Phuc-Dinh Nguyen
   National Ilan University, Taiwan

17F3-2 A Variable Switching Frequency Control Method for a Dual-Active-Bridge Single-Phase AC-DC Converter with an Active Energy Buffer
   Shohei Komeda¹, Shunsuke Takuma², Yoshiya Ohnuma²
   1) Tokyo University of Marine Science and Technology, Japan, 2) Nagaoka Power Electronics Co., Ltd., Japan

17F3-3 A Butterfly Interleaving Multiphase Coupledinductor Buck Converter for Datacenters with 99.3% Peak Efficiency
   Mingsxiao Li¹,², Yunfeng Liu¹, Ziwei Ouyang¹, Michael A. E. Andersen¹, Teng Long²
   1) Technical University of Denmark, Denmark, 2) University of Cambridge, UK

17F3-4 High-Efficiency Asymmetrical Half-Bridge Converter with Series Capacitor Rectifier and Linear Voltage Gain
   Juhyun Bae, Jae-Sang Kim, Minsu Lee, Jeongchan Park, Gun-Woo Moon
   Korea Advanced Institute of Science and Technology (KAIST), Korea

17F3-5 Proposal of Virtual Transformer-Based Back-To-Back Asynchronous Loss Measurement Using a Single Set of Measurement Instruments for One Inverter and Experimental Verification
   Atsuo Kawamura, Yoshiki Nasu, Yasuhiko Miguchi, Hadi Setiadi, Hidemine Obara
   Yokohama National University, Japan
Session 17G3  Wind Power Generator and Related Control

Chairs: Ryosuke Saito (Toshiba Infrastructure Systems & Solutions Corporation, Japan)
       Dongsheng Li (Hitachi Ltd., Japan)

17G3-1  Research on Control for Grid-connected Brushless Doubly-Fed Power Generation System under Different Quantities
Debin Zhang, Jijun Ma, Shengjia Wang, Yuhui Ji, Kun Jiang, Chengzhi Qu
Shanghai Institute of Space Power-Sources (SISP), China

17G3-2  Power Fluctuation Suppression by Current Balancing Control in Wind Power System Using Wound Rotor Induction Generator Under Unbalanced Grid Voltage
Kichiro Yamamoto, Takahiro Matsumoto, Atsushi Shinohara
Kagoshima University, Japan

17G3-3  Sensorless Control of PMSG Wind Power Systems Based on ROGI-FLL
Anh Tan Nguyen¹, Van Nam Nguyen², Dong-Choon Lee³
1) Hanoi University of Science and Technology, Vietnam, 2) Yeungnam University, Korea

17G3-4  Maximum Torque per Ampere Control of IPMSM Using Online Flux Linkage Plane Estimation Considering Cross Saturation
Suzuka Sasayama¹, Yuki Shimizu¹, Shigeo Morimoto¹, Yukinori Inoue¹, Masayuki Sanada¹
1) Osaka Prefecture University, Japan, 2) Ritsumeikan University, Japan, 3) Osaka Metropolitan University, Japan

17G3-5  Online Identification of Six-Phase IPMSM Parameters Using Prediction-Error Sensitivities to Model Parameters
Aravinda Perera, Roy Nilsen
Norwegian University of Science and Technology, Norway

Session 17H3  PM machines II

Chairs: Yoshihiro Miyama (Mitsubishi Electric Corporation, Japan)
         Yi Sui (Harbin Institute of Technology, China)

17H3-1  Imbalanced Force Suppression Due to Static Eccentricity by Using Triple Three-phase Winding Motor
Kan Yang¹, Kan Akatsu¹, Kodai Okazaki¹, Yoshihiro Miyama¹
1) Yokohama National University, Japan, 2) Mitsubishi Electric Corporation, Japan

17H3-2  A Comparison of Permanent-Magnet Vernier Motor and Interior Permanent-Magnet Motor for Hybrid Electric Vehicles
Libing Cao¹, Yuefei Zuo¹, Shuangchun Xie¹, Chi Cuong Hoang², Boon Siew Han², Christopher H. T. Lee³
1) Nanyang Technological University, Singapore, 2) Schaeffler (Singapore) Pte. Ltd., Singapore

17H3-3  A Permanent Magnet Synchronous Machine with Interior Halbach Arrays
Yuting Gao¹, Takashi Kosaka¹, Yang Liu², You Zhou¹
1) Nagoya Institute of Technology, Japan, 2) Huazhong University of Science and Technology, China, 3) Nanyang Technological University, Singapore

17H3-4  Performance Analysis of Flux-Modulating Consequent Pole Motors
Hiroshi Mitsuda¹,², Tadashi Fukami², Masato Koyama², Kazumasa Ito¹
1) Mitsubishi Electric Corporation, Japan, 2) Kanazawa Institute of Technology, Japan

17H3-5  Prototype Tests of Induction/Synchronous Magnetic Gears
Yuma Mizuana¹, Kenji Nakamura¹, Yuma Suzuki², Yuichi Tachiya², Kingo Kuritani²
1) Tohoku University, Japan, 2) Prospine Co., Ltd., Japan
Wednesday, May 18: 10:30-12:35

Room A

Session 18A1 Renewable Energy Integration by Next-generation Power Electronics Technology (OS)
Chairs: Kazunori Hasegawa (Kyushu Institute of Technology, Japan)
       Kentaro Fukushima (Central Research Institute of Electric Power Industry, Japan)

Invited Paper
Hiroshi Asano¹,², Daisuke Iioka¹, Osamu Kunitomo¹, Yu Nagatomi¹
1) Gifu University, Japan, 2) Chubu University, Japan, 3) Energy Public Group, Tokyo Gas Co., Ltd., Tokyo, Japan,
4) The Institute of Energy Economics, Japan, 5) CRIEPI, Japan

18A1-2 Analytical study on energy scenarios and targets for 2050 in Japan
Invited Paper
Shigeru Bando¹, Kentaro Fukushima¹, Masaaki Takagi¹, Hiroshi Asano¹,², Seiya Abe¹, Daisuke Iioka¹, Dai Orihara⁵
1) Central Research Institute of Electric Power Industry, Japan, 2) Gifu University, Japan, 3) Kyushu Institute
       of Technology, Japan, 4) Chubu University, Japan, 5) National Institute of Advanced Industrial Science and
       Technology, Japan

       Losses-
Invited Paper
Seiya Abe¹, Kentaro Fukushima², Daisuke Iioka¹, Dai Orihara⁴
1) Kyushu Institute of Technology, Japan, 2) Central Research Institute of Electric Power Industry, Japan, 3) Chubu
       University, Japan, 4) National Institute of Advanced Industrial Science and Technology, Japan

18A1-4 Universal Smart Power Module (USPM) for Carbon Neutral Society
Invited Paper
Yoshikazu Takahashi¹, Yoshinari Ikeda¹, Hiroki Watanabe², Jun-ichi Itoh¹
1) Tohoku University, Japan, 2) Fuji Electric Co., Ltd, Japan, 3) Nagaoka University of Technology, Japan

18A1-5 Control Method for Single-Phase Active Filter Using Universal Smart Power Module (USPM)
Invited Paper
Mana Sakamoto, Hitoshi Haga
Nagaoka University of Technology, Japan

Room B

Session 18B1 Advanced Motor Drive Technology for Future (OS)
Chairs: Takahiro Suzuki (Hitachi Ltd., Japan)
       Atsushi Matsumoto (Chubu University, Japan)

       of Induction Machine
Invited Paper
Makoto Kaneamru, Ken Hirakida, Hiroshi Inoue, Toshihiko Miyauchi
Mitsubishi Electric Corporation, Japan

18B1-2 Experimental Evaluation of an AI Model Trained with Switching Pattern Based on Long-Horizon Model
       Predictive Control
Invited Paper
Tenjiro Hiwatari, Akira Satake, Sota Sano, Kenya Sugihara, Ryo Yamamoto
Mitsubishi Electric Corporation, Japan

18B1-3 Self-Tuning for each PMSM Controller using Big Data based ANN
Invited Paper
Sari Maekawa
SEIKEI University, Japan

18B1-4 Implementation of Vector Control System On Multi-Core Processor by Using Model-Based Parallelization Tool
Invited Paper
Jinsoo Kim¹, Shota Sagaë¹, Masato Edahiro¹, Shinjo Honda², Shinji Doki¹
1) Nagoya University, Japan, 2) Nanzan University, Japan

18B1-5 Motor-Current-Based Prediction of Bearing Degradation with Kalman Filter and Grease Lifetime Formula
Invited Paper
Akari Kubo, Kohji Maki
Hitachi Ltd., Japan
Session 18C1  Advanced motion control and its applications (OS)

Chairs: Yoshiyuki Urakawa (Nippon Institute of Technology, Japan)
Takenori Atsumi (Chiba Institute of Technology, Japan)

18C1-1  Stochastic Learning Control Framework in the Integrated Frequency and Position Domain
Invited Paper
Hanul Jung, Sehoon Oh
Daegu Gyeongbuk Institute of Science and Technology, Korea

18C1-2  Robotic Arm Trajectory Generation Based on Emotion and Kinematic Feature
Invited Paper
Kaiwen Wu1,2,3, Luefeng Chen1,2,3, Kuanlin Wang1,2,3, Min Wu1,2,3, Witold Pedrycz4, Kaoru Hirota5
1) China University of Geosciences, China, 2) Hubei Key Laboratory of Advanced Control and Intelligent Automation for Complex Systems, China, 3) Ministry of Education, China, 4) University of Alberta, Canada, 5) Tokyo Institute of Technology, Japan

18C1-3  Loop-Shaping Technique for Quadruple-Stage-Actuator System in Hard Disk Drive
Invited Paper
Takenori Atsumi1, Shota Yabui2
1) Chiba Institute of Technology, Japan, 2) Tokyo City University, Japan

18C1-4  Application of Multilayer Kalman Filter to a Flexible Drive System
Invited Paper
Krzysztof Szabat1, Karol Wrobel1, Seiichiro Katsura2
1) Wroclaw University of Sciences and Technology, Poland, 2) Keio University, Japan

18C1-5  Robust interference suppression of three phase structural uncertainty inverter system based on equivalent input interference method
Invited Paper
Meng Ye1,2,3, Min Ding1,2,3, Danyun Li1,2,3, Zhijian Fang1,2,3, Qingyi Wang1,2,3, Luefeng Chen1,2,3
1) China University of Geosciences, China, 2) Hubei Key Laboratory of Advanced Control and Intelligent Automation for Complex Systems, China, 3) Ministry of Education, China

Session 18D1  Smart Facilities

Chairs: Takaharu Ishida (Meisei University, Japan)
Yoshikazu Fukuyama (Meiji University, Japan)

18D1-1  Refrigerated Showcase Fault Detection by an Artificial Neural Network using Correntropy with Improved Adaptive Kernel Size Tuning
Masato Igarashi1, Yoshikazu Fukuyama1, Yuichi Shimasaki2, Yuto Osada2, Kenya Murakami2, Tatsuya Iizaka2, Adamo Santana3, Tetsuro Matsui2
1) Meiji University, Japan, 2) Fuji Electric Co., Ltd., Japan

18D1-2  Improvement of the Accuracy of Photovoltaic Module Equivalent Circuit Model using Irradiance-dependent Variable Shunt Resistor
Kenji Arimatsu1, Yoichi Sekiba2, Hitoshi Haga3
1) Tohoku Electric Power Co., Inc., Japan, 2) Denryoku Computing Center, Ltd., Japan, 3) Nagaoka University of Technology, Japan

18D1-3  Novel Optimization Method Hybridized by MILP and PSO for Operation Planning in Microgrid System
Yu Tanahashi1,2, Hiroshi Kobayashi1, Yuta Nakamura2, Mutsumi Aoki2
1) TOENE Corporation, Japan, 2) Nagoya Institute of Technology, Japan

18D1-4  Data-Driven Hybrid Approach for Early Fault Detection of AHU using Electrical Signals
Hasmat Malik1, Sanjib Kumar Panda2, Kameshwar Poolla1, Costas J. Spanos1
1) National University of Singapore, Singapore, 2) Berkeley Education Alliance for Research in Singapore (a research center of the University of California, Berkeley, USA), Singapore, 3) University of California, Berkeley, USA

18D1-5  Work Element Estimation for Forklift Operation
Toshimasa Aso
Tokyo University of Marine Science and Technology, Japan
Session 18E1  DC-DC Converters II

Chairs: Kazuhiro Umetani (Okayama University, Japan)
       Jun Imaoka (Nagoya University, Japan)

18E1-1 Integrated Coupled-Inductor Based Current and Voltage Balancing Technique for Parallel-Connected Triple-Active-Bridge Converters
Seunghoon Lee, Honnyong Cha, Kisu Kim
Kyungpook National University, Korea

18E1-2 A Dual-Active-Bridge (DAB) Converter Based Bidirectional DC/DC Converter with Reduced Link Capacitance
Dongmin Choi, Minso Lee, Taewoo Kim, Dongmin Kim, Gun-Woo Moon
Korea Advanced Institute of Science and Technology (KAIST), Korea

18E1-3 Design and Characterization of a 500 kW 20 kHz Dual Active Bridge using 1.2 kV SiC MOSFETs
Fabian Sommer1, Nikolas Menger1, Tobias Merz1, Nils Soltau2, Shiori Idaka2, Marc Hiller3
1) Karlsruhe Institute of Technology, Germany, 2) Mitsubishi Electric Europe B.V., Germany

18E1-4 Improvement of Efficiency in Bidirectional DC-DC Converter with Dual Active Bridge Using GaNHEMT
Ryuji Yamada1, Akihiro Hino1, Keiji Wada2
1) Fuji Electric Co., Ltd., Japan, 2) Tokyo Metropolitan University, Japan

18E1-5 Low Temperature Investigation of a Cascode GaN based Resonant Bi-directional DC/DC Converter
Yuqi Wei, Md Maksudul Hossain, H. Alan Mantooth
University of Arkansas, USA

Room F

Session 18F1  Railway Power Supply Systems

Chairs: Satoru Hatsukade (Railway Technical Research Institute, Japan)
        Takashi Suzuki (East Japan Railway Company, Japan)

18F1-1 1000kW DC/DC Converter Development for DC Traction Stationary BESS Considering Various Operation Power Patterns
Wataru Kawamura1, Junya Konno1, Akihiko Sumiya2
1) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan, 2) Toshiba Infrastructure Systems & Solutions Corporation, Japan

18F1-2 Developed energy saving control method for SESS
Hirotaka Takahashi, Tsutomu Miyachi, Motonori Suzuki
Hitachi Ltd., Japan

18F1-3 Confirmation of Correlation between Hourly Electric Power and Instantaneous Maximum Power of Rectifiers for Railway
Shota Ishizaki1, Takashi Suzuki2, Masashi Nakahira2, Daisuke Kumagai2, Hiroto Amata2, Keiichiro Kondo1, Kota Sat01, Hitoshi Hayashiya2
1) Japan Railway Electric Design Co., Ltd., Japan, 2) East Japan Railway Company, Japan, 3) Waseda University, Japan

18F1-4 The converter restart sequence of electronic frequency converters for the Tokaido Shinkansen at a transient fault on the power receiving side
Haruna Ohnishi1, Koji Otsuka1, Yuto Uchiyama1, Katsuyasu Nakano1, Masahiko Kai1, Takumi Nagai2, Naoya Tanigawa1
1) Central Japan Railway Company, Japan, 2) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 3) Mitsubishi Electric Corporation, Japan
Session 18G1  Recent Technologies of Home and Consumer Appliances for Decarbonization (OS)

Chairs: Hideki Omori (Kobe University, Japan)
       Yu-Chen Chang (National Taiwan University of Science and Technology, Taiwan)

18G1-1  Induction Heating Cookers: A Path Towards Decarbonization Using Energy Saving Cookers
       Invited Paper
       Oscar Lucia, Hector Sarnago, Jesus Acero, Claudio Carretero, Jose M. Burdio
       University of Zaragoza, Spain

18G1-2  Design and Implementation of a High-Power Modular WPT System
       Invited Paper
       Wenxing Zhong, Chen Zhu, Dehong Xu, Changsheng Hu
       Zhejiang University, China

18G1-3  Design and Implementation of a Single Phase Inverter in Residential Storage System
       Invited Paper
       Ta-Wei Huang, Chang-Tsai Tsai, Yu-Chen Chang, Huang-Jen Chiu
       National Taiwan University of Science and Technology, Taiwan

18G1-4  A Local VPP with EVs in Very Small Areas
       Invited Paper
       Yoshimitchi Nakamura¹, Hideki Omori²
       1) Smart Energy Laboratory, Japan, 2) Kobe University, Japan

18G1-5  V2X products and social implementation in Japan -future prospects from the point of "Global warming problem"
       Invited Paper
       Shunjiro Yui, Hiroshi Seki, Katsuhiko Furuya, Hiroto Nakamura
       Nichicon Co., Ltd., Japan

Room H

Session 18H1  Wireless power transfer for Automobiles

Chairs: Kantaro Yoshimoto (Tokyo Denki University, Japan)
       Shingo Soma (Honda R&D Co., Ltd., Japan)

18H1-1  Novel Dynamic Wireless Power Transfer System for Battery Electric Vehicles Using In-Tire and In-Wheel Repeater Coil
       Hayato Sumiya¹,², Eisuke Takahashi¹, Nobuhiisa Yamaguchi¹, Keisuke Tani¹, Osamu Shimizu², Sakahisa Nagai²,
       Hiroshi Fujimoto², Daisuke Gunji¹, Isao Kuwayama²
       1) DENSO CORPORATION, Japan, 2) The University of Tokyo, Japan, 3) NSK Ltd., Japan, 4) Bridgestone Corporation, Japan

18H1-2  Wireless recharging of EVs while driving and the effectiveness of novel storage battery
       Shigeyuki Takagi¹, Suguru Kawamura¹, Akito Sasaki², Hideaki Hirabayashi²
       1) Tokyo University of Technology, Japan, 2) Toshiba Materials Co., Ltd., Japan

18H1-3  Wireless EV Charging System Using PWMControlled Variable Capacitor for Maximum Power Transfer under Severe Coil Misalignment
       Ryo Matsumoto, Hiroshi Fujimoto
       The University of Tokyo, Japan

18H1-4  Variable Frequency Control for Constant Current Constant Voltage Inductive Wireless EV Charging System
       Thanet Sriprom¹, Anon Namin¹, Wuttikai Tammawan¹, Samart Yachiangkam¹, Suchart Janjornmanit¹,
       Uthen Kamnarn¹, Juttirit Thongprin¹, Chanyut Karnjanapiboon¹, Phatiphat Thounthong², Noureddine Takorabet³
       1) Rajamangala University of Technology Lanna (RMUTL), Thailand, 2) King Mongkut's University of Technology, Thailand, 3) Université de Lorraine, France
Room A

Session 18A2  Advance Control for Power Converters (OS)

Chairs: Ching-Jan Chen (National Taiwan University, Taiwan)
        Hiroki Watanabe (Nagaoka University of Technology, Japan)

18A2-1  An Arithmetic Series-Based Recursive Equation Used in the Approximation of the Sinusoidal Wave with Reduced Error
        Invited Paper
        Xiao-Ze Lin, Woei-Luen Chen
        Senior Member IEEE

18A2-2  Design of an Interleaved Half-Bridge CLLC Resonant AC-AC Converter
        Invited Paper
        Kuo-Yuan Lo, Shin-Yue Chen, You-Xuan Guo
        National Kaohsiung University of Science and Technology, Taiwan

18A2-3  An Optimal Frequency-Modulated Control for Bidirectional CLLC Resonant Converters
        Invited Paper
        Cheng-Yu Tang, Tzu-Hsuan Ho
        National Taipei University of Technology, Taiwan

18A2-4  Online Grid Impedance Measurement Based on Virtual Reference Axis
        Invited Paper
        Meng-Chun Yang¹, Zhe-Yan Chen¹, Yaow-Ming Chen¹, Chih-Chao Hsu²
        1) National Taiwan University, Taiwan, 2) National Chung-Shan Institute of Science and Technology, Taiwan

18A2-5  A 4-MHz Ultra-Fast Transient Response Capacitor Current Adaptive On-Time (CCAOT) Controlled Buck Converter with Passive Ramp Compensation
        Invited Paper
        Yu-Lin Chao, Chieh-Ju Tsai, Ching-Jan Chen
        National Taiwan University, Taiwan

Room B

Session 18B2  Key Technologies Towards High-speed Electrical Machines (OS)

Chairs: Jing Ou (Harbin Institute of Technology, China)
        Hongfei Lu (Karlsruhe Institute of Technology, Germany)

18B2-1  Analytical Computation of Inductance for High-Speed Spoke-Type Permanent Magnet Synchronous Motor Accounting for Saturation
        Invited Paper
        Peixin Liang¹,², Tianrong He¹,², Lihao Liang¹,², Dingxuan Yue¹, Ningfei Jiao¹,², Weiguo Liu¹,²
        1) Northwestern Polytechnical University, China, 2) Shaanxi Key Laboratory of Small & Special Electrical Machine and Drive Technology, China

18B2-2  Design of a high-speed synchronous reluctance motor made of dual-phase steel
        Invited Paper
        Jing Ou¹, Jingbo Lin¹, Feng Chai¹, Dianguo Xu³, Martin Doppelbauer²
        1) Harbin Institute of Technology, China, 2) Karlsruhe Institute of Technology, Germany

18B2-3  Mechanical Design of a High-Speed Permanent Magnet Assisted Electrically Excited Synchronous Machine as Traction Motor
        Invited Paper
        Hongfei Lu, Johannes Deutsch, Martin Doppelbauer
        Karlsruhe Institute of Technology (KIT), Germany

18B2-4  Vibration characteristic analysis and comparison of high-speed switched reluctance motor with amorphous alloy core
        Invited Paper
        Feng Chai¹, Mengsen Hu¹, Zongyang Li², Lina Geng¹
        1) Harbin Institute of Technology, China, 2) Midea Welling Motor Technology (Shanghai) Co., Ltd., China
Session 18C2  Renewable Energy Systems

Chairs: Masahide Hojo (Tokushima University, Japan)
       Danang Wijaya (Universitas Gadjah Mada, Indonesia)

18C2-1  A Low-Cost Grid-Connected Photovoltaic Microinverter Based on Commutation of Thyristor
Manlin Wang, Su Du
Central South University, Changsha, China

18C2-2  A Control System of PV Sources for DC Microgrid with Seamless Switching Operation between I-V Droop Control and MPPT Control
Yasushi Eto, Yuichi Noge, Masahito Shoyama
Kyushu University, Japan

18C2-3  The Impact of Sun Tracking on the Reliability of Solar Inverters
Ali Azizi¹, Saeed Peyghami¹, Seyed Fariborz Zarei², Frede Blaabjerg¹
1) Aalborg University, Denmark, 2) Qom University of Technology, Iran

18C2-4  Testing Requirements and Control Strategies of Next-Generation Grid Emulator: A Review
Zejie Li, Pavan Ponnaganti, Fangzhou Zhao, Xiongfeng Wang, Birgitte Bak-Jensen, Stig Munk-Nielsen, Frede Blaabjerg
Aalborg University, Denmark

18C2-5  Islanded Wind Farm Microgrid Stability Control Using Synchroverter Algorithm
Mohd. Brado Frasetyo, Fransisco Danang Wijaya, Eka Firmansyah
Universitas Gadjah Mada, Indonesia

Session 18D2  Industrial Instrumentation and Control III

Chairs: Tomoyuki Shimono (Yokohama National University, Japan)
        Masato Koyama (Mie University, Japan)

18D2-1  A Short-Distance Running Algorithm Based MPPT Control Strategy for PV Power Systems Under Partial Shading Conditions
Sy Ngo¹², Chian-Song Chiu¹
1) Chung Yuan Christian University, Taiwan, 2) Thu Dau Mot University, Vietnam

18D2-2  Extrapolation of Band-Limited Frequency Responses for Out-of-Band Modal Synthesis
Weihua Zhou, Jef Beerteny
KU Leuven & EnergyVille, Belgium

18D2-3  Adaptive Protection Scheme with Passive Islanding Detection for AC Microgrids
Yingjia Luo, Inam Ullah Nutkani, Lasantha Meegahapola
RMIT University, Australia

18D2-4  Average Consensus Problem in Multi-Agent System in an Environment with Obstacle
Hiroki Kimura, A. Okuyama
Tokai University, Japan

Session 18E2  DC-DC Converters III

Chairs: Yusuke Hayashi (Toshiba Corporation, Japan)
        Daniel Siemaszko (Hitachi Energy, Switzerland)

18E2-1  A New Secondary Clamp Diode for Phase-Shift Full-Bridge Converter
Minsu Lee, Dongmin Choi, Juhyun Bae, Jongyoon Chae, Gun-Woo Moon
Korea Advanced Institute of Science and Technology (KAIST), Korea

18E2-2  Experimental Insights into the MW Range Dual Active Bridge with Silicon Carbide Devices
Stefanie Heinig¹, Daniel Siemaszko¹, Remo Baumann¹, Noemi Hubatka¹, Martin Klaeusler¹, Raul Ruiz¹, Ralph Burkart¹, ChunMing Yuan¹
1) Hitachi Energy, Switzerland, 2) Hitachi Energy Research, Switzerland, 3) Hitachi Energy Research, China
18E2-3  MHz-Driven Snubberless Zero-Current Soft-Switching High Step-Up DC-DC Converter with Multi-Resonant Circuitry
Tomokazu Mishima¹, Ryusei Miyazaki¹, Ching-Ming Laia²
1) Kobe University, Japan, 2) National Chung Hsing University, Taiwan

18E2-4  A Unified Modeling Approach for a Multi-Active Bridge Converter
Vishwabandhu Uttam, Vishnu Mahadeva Iyer
Indian Institute of Science, India

18E2-5  A Novel Fault-Tolerant Control Strategy for Dual Active Bridge Converter under Open Circuit Fault
Ning Wang¹, Yanbo Wang¹, Zhe Chen¹, Shilin Liu²
1) Aalborg University, Denmark, 2) Anhui Polytechnic University, China

---

Session 18F2  Power Electronics Technologies for Railways
Chairs: Ken Kunomura (Central Japan Railway Company, Japan)
Keiichiro Kondo (Waseda University, Japan)

18F2-1  Control and Performance of Capacitively-Isolated Bidirectional DC-DC Converter with Auxiliary Converters for Electric Railways
Kana Matsumoto, Kazuaki Tesaki, Makoto Hagiwara
Tokyo Institute of Technology, Japan

18F2-2  Overview of CLLC Modulation Strategy
Danni Yang, Yan Zhang, Xue Liu, Wanxing Wang, Jinjun Liu
Xi’an Jiaotong University, China

18F2-3  Impedance Modeling and Harmonic Stability Analysis of MMC-Based Railway Static Power Conditioner
Pengkun Li, Yue Wang, Fengmo Li, Runtian Li, Bole Feng, Cheng Long
Xi’an Jiaotong University, China

18F2-4  Transient Stability of Grid-Forming Converters with Flexible DC-Link Voltage Control
Liang Zhao¹, Zheming Jin², Xiongfei Wang¹
1) Aalborg University, Denmark, 2) Beijing Jiaotong University, China

---

Session 18G2  Devices and DC-DC Converter for Home Appliances
Chairs: Toshiyoki Zaitsu (ROHM Co., Ltd., Japan)
Nobuo Satoh (Chiba Institute of Technology, Japan)

18G2-1  Efficiency-Optimized Control Method for Multiport Converter with Current-Fed H-bridges
Mina Kim¹, Hwa-Pyeong Park¹, Seung Yeol Oh¹, Jung Sik Choi¹, Daeseak Cha¹, Byoung-Sun Ko¹, Jee-Hoon Jung²
1) Korea Electronics Technology Institute (KETI), Korea, 2) Ulsan National Institute of Science and Technology (UNIST), Korea

18G2-2  Evaluation and Comparison of Dynamic ON-state Resistance Measurement Methods for GaN Devices
Rui Zhong, Huiqing Wen
Xi’an Jiaotong-Liverpool University, China

18G2-3  State of Charge Estimation for Liquid Metal Batteries with Gaussian Process Regression Framework
Sheng Wang, Zehang Li, E Zhang, Min Zhou, Kangli Wang
Huazhong University of Science and Technology, China

18G2-4  Design and Implementation of a High Step-Up DCDC Converter with Active Switched Inductor and Coupled Inductor
Peng Luo, Tsorng-Juu Liang, Kai-Hui Chen, Shih-Ming Chen
National Cheng Kung University, Taiwan

18G2-5  A Non-Isolated Bidirectional DC-DC Converter with High Conversion Ratio
Tsorng-Juu Liang, Ru-Cian Lin, Peng Luo, Kai-Hui Chen
National Cheng Kung University, Taiwan
**Session 18H2  Design and Control of Energy Managing Converters for Automobiles**

**Chairs:** Osamu Shimizu *(The University of Tokyo, Japan)*
Nobuyuki Imai *(Honda R&D Co., Ltd., Japan)*

**18H2-1** Improved DC-Charging for Traction Drives with Hybrid Powered Dual Two-Level Inverter  
Kai Kühlmann, Johannes Teigelköttler, Johannes Büdel, Christian Herkommer  
*University of Applied Sciences Aschaffenburg, Germany*

**18H2-2** Variable Coupling Coefficient Integrated Inductor for Hybrid Energy Source Systems  
Masanori Ishigaki, Koji Shigeuchi, Naoki Yanagizawa, Daiki Nitta, Shuji Tomura  
*Toyota Central R&D Labs., Inc., Japan*

**18H2-3** Dual Inverter Integrated DC Charging with Minimal Leakage Current Generation  
Sitan Wang, Mehathan Pathmanathan, Peter W. Lehn  
*University of Toronto, Canada*

---

**Wednesday, May 18: 16:00-18:05**

**Session 18A3  System Integration Technology in Power Electronics (OS)**

**Chairs:** Kazuaki Mino *(Murata Manufacturing Co., Ltd., Japan)*
Neha NAIN *(ETH Zurich, Switzerland)*

**18A3-1** Consideration of Integrated Power Converter for Renewable Energy-Grid-BES Interactive Applications  
Invited Paper  
Goh Teck Chiang, Kyosuke Tanemura, Shuji Tomura  
*Toyota Central R&D Labs. Inc., Japan*

**18A3-2** The Potential of LLC Resonant Converters Equipped With Split Resonant Capacitors: From Three-Phase to Fractal Structures  
Invited Paper  
Akiteru Chiba, Kazuto Takači, Yuuki Aoyagi, Keita Ishikura  
*GS Yuasa Infrastructure Systems Co., Ltd., Japan*

**18A3-3** High Power Density Design of Single-Phase AC/DC Converter with Active Power Decoupling Capability Utilizing Triangular Current Mode for LED Driver Applications  
Hiroki Watanabe, Jun-ichi Itoh  
*Nagaoka University of Technology, Japan*

**18A3-4** Comparative Evaluation of Three-Phase AC-AC Voltage/Current-Source Converter Systems Employing Latest GaN Power Transistor Technology  
Invited Paper  
Neha Nain, Jonas Huber, Johann W. Kolar  
*ETH Zurich, Switzerland*

**18A3-5** Comparative Evaluation of ARCP and Three-Level TCM Soft-Switching Bridge-Legs for High-Frequency SiC Converter Systems  
Invited Paper  
Thomas Langbauer¹, Spasoje Miric², Michael Haider², Jonas Huber², Johann W. Kolar²  
¹ Silicon Austria Labs GmbH, Austria, ² ETH Zurich, Switzerland

---

**Session 18B3  Technical Trend of Magnetic-geared Machines (OS)**

**Chairs:** Kenji Nakamura *(Tohoku University, Japan)*
Kyoei Kiyota *(Tokyo Institute of Technology, Japan)*

**18B3-1** Design of a 15-MW Magnetic-Geared Generator  
Invited Paper  
Noboru Niguchi¹, Katsuhiro Hirata¹, Takuya Ito¹, Haruyuki Kometani², Ryoji Miyatake², Atsushi Yamamoto²  
¹ Osaka University, Japan, ² Mitsubishi Electric Corporation, Japan
18B3-2 A Novel In-Wheel Motor Drive System of Multiple High-Speed Motors Integrated with Magnetic Gear for Electric Vehicle
Kohei Aiso¹, Kan Akatsu², Yasuaki Aoyama³
1) Shibaura Institute of Technology, Japan, 2) Yokohama National University, Japan, 3) Hitachi, Ltd., Japan

18B3-3 Design of a Magnetic Geared Bearingless Slice Motor with Combined Windings
Wolfgang Gruber¹, Tobias Konig², Eva-Maria Miliker³
1) Johannes Kepler University, Austria, 2) Linz Center of Mechatronics GmbH, Austria

18B3-4 Novel Reluctance-type Magnetic Geared Motor with Integrated with High-Speed Bearingless Motor
Akira Kumashiro¹, Akira Chiba¹, Wolfgang Gruber², Wolfgang Amrhein³, Gerald Jungmayr³
1) Tokyo Institute of Technology, Japan, 2) Johannes Kepler University Linz, Austria, 3) Linz Center of Mechatronics GmbH, Austria

Room C

Session 18C3 New Generation Transformers
Chairs: Takaaki Ibuchi (Osaka University, Japan)
Jing Lyu (Shanghai Jiao Tong University, China)

18C3-1 Feasibility Study of High-Frequency Transformer with High-Voltage Insulation Structure for SST Based Medium-Voltage Multi-Level Converter
Yuki Kawaguchi, Kimihisa Furukawa, Takaeh Shimada, Junpei Kusukawa
Hitachi, Ltd., Japan

18C3-2 Analytical Capacitance Calculation for Transformers with Grounded Core
Bastian Korthauer, Jürgen Biela
Laboratory for High Power Electronic Systems (HPE) ETH Zurich, Switzerland

18C3-3 Study the Thermal Performance of the CLLC Transformer in the OBC Designed Using SiC MOSFETs
Haoqi Zhu¹, Naoto Fujishima², Yuichi Onozawa², Sideng Hu¹
1) Zhejiang University, China, 2) Fuji Electric Co., Ltd, Japan

18C3-4 An Integrated Transformer for LLC Resonant Converter Applications of Low Output Voltages and High Currents
Philipp Rehlaender, Shobhit Sharma, Frank Schafmeister, Joachim Böcker
Paderborn University, Germany

18C3-5 Electromagnetic Field and Energy Flux in Wireless Power Transfer System
Itsuki Masuda, Manabu Ishitobi
National Institute of Technology, Nara College, Japan

Room D

Session 18D3 HILS
Chairs: Noriyasu Matsuno (Myway Plus Corporation, Japan)
Ke Ma (Shanghai Jiao Tong University, China)

18D3-1 Virtual Capacitor Concept for Partitioning of Large Converter Systems for RT-HIL Simulations
Philippe Bontemps, Stefan Milovanovic, Drazen Dujic
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

18D3-2 Real-Time Simulation Method Using LPV Model of LLC Current Resonant Converter
Hideaki Funaki¹, Yuichi Noge¹, Masahito Shoyama¹, Yu Yonezawa²
1) Kyushu University, Japan, 2) Nagoya University, Japan

18D3-3 A modular signal processing platform for grid and motor control, HIL and PHIL applications
Benedikt Schmitz-Rode, Lukas Stefanski, Rüdiger Schwendemann, Simon Decker, Stefan Mersche, Philip Kiehnle, Patrick Himmelmann, Andreas Liske, Marc Hiller
Karlsruhe Institute of Technology (KIT), Germany

18D3-4 Mission Profile Emulator for Sub-Modules of Modular Multilevel Converter with Resonant Filter Impedance
Enyi Li, Ke Ma
Shanghai Jiao Tong University, China
18D3-5 Disturbance Suppression for Mission Profile Emulator for Sub-Modules of Modular Multilevel Converter Under Nearest Level Modulation with Feedforward Control
Enyi Li, Ke Ma
Shanghai Jiao Tong University, China

Room E

Session 18E3 Control and Analysis of Dual Active Bridge Converters
Chairs: Koji Orikawa (Hokkaido University, Japan)
Jian Yin (Shenzhen University, China)

18E3-1 Improved Phase-Shift Scheme for Fast Power Reversal in a Bidirectional Dual Active Bridge DC/DC Converter Considering the AC-Link Equivalent Resistance
Xiaochao He, Jian Yin
Shenzhen University, China

18E3-2 Flux Control Modulation for Three-Phase Dual-Active Bridge DC-DC Converters
Niklas Fritz, David Heidenberger, David Bundgen, Rik W. De Doncker
RWTH Aachen University, Germany

18E3-3 A Fast Direct Power Digital Control Strategy for Dual Active Bridge DC-DC Converters
L. James¹, C.A. Teixeira¹, R.W. Wilkinson², B.P. McGrath¹, S.A. Gonzalez³, M. Judewicz⁴, P. Sokolowski¹
1) RMIT University, Australia, 2) Universidad Nacional de Mar del Plata (UNMdP), Argentina

18E3-4 A Transient Characteristics Improvement Method in Dual Active Bridge Converter with Multilevel Inverter Topology
Yasunobu Ueuchi, Nobukazu Hoshi, Takanobu Ohno
Tokyo University of Science, Japan

18E3-5 Real-time Power Flow Decoupling of Triple-Active-Bridge Converter for DC Microgrid System Applications
Kwabena Opoku Bempah, Kyung-Wook Heo, Jee-Hoon Jung
Ulsan National Institute of Science and Technology, Korea

Room F

Session 18F3 Railway Vehicles
Chairs: Shingo Makishima (Toyo Denki Seizo K. K., Japan)
Yoshiyasu Hagiwara (Mitsubishi Electric Corporation, Japan)

18F3-1 A Novel Maximum Adhesive Force Control without Vehicle Speed Sensor
Kanta Horikoshi, Kantaro Yoshimoto, Tomoki Yokoyama
Tokyo Denki University, Japan

18F3-2 Power Generation Control Method of Parallel Resonant PMSG System for Series Hybrid Vehicle
Shunsuke Jindo¹, Keiichiro Kondo¹, Minoru Kondo², Toshihide Yokouchi²
1) Waseda University, Japan, 2) Railway Technical Research Institute, Japan

18F3-3 A Method to Design Capacity of Onboard Energy Storage Device for Emergency Operation Based on Effective Balance of Power and Energy
Hiroyasu Kobayashi¹, Keiichiro Kondo¹, Masafumi Miyatake³, Takafumi Koseki⁴
1) Chiba University, Japan, 2) Waseda University, Japan, 3) Sophia University, Japan, 4) The University of Tokyo, Japan

18F3-4 Study on the feeder voltage control with adjusting power factor of train's power converters under multiple trains running in the same feeder section
Hiroshi Moriyama, Ken Kunomura, Kenji Sato, Toshiaki Takami, Toyokazu Hamajima, Toshimasa Shimizu, Takuya Yamagiwa
Central Japan Railway Company, Japan
Session 18G3  Grid Connected Systems related to Home Appliances

Chairs: Kaoru Inoue (Doshisha University, Japan)
Yun Yang (The University of Hong Kong, China)

18G3-1 Efficiency Optimization Method for Parallel Converters in Fault-tolerant Microgrids
Pengwei Li, Ali M. Bazzi
University of Connecticut Storrs, USA

18G3-2 A Power Oscillation Damping Method for Virtual Synchronous Generators Based on Frequency Feedforward in Voltage Reference
Jiazhi Wang, Zeng Liu, Yidong Shi, Jinjun Liu
Xi’an Jiaotong University, China

18G3-3 Dynamic and Steady-State Behavior of Distributed Power Supply in DC Architecture with Minimized DC Bus Capacitor
Pakawadee Wutthiwai¹, Uthen Kamnarn¹, Jedsada Yodwong², Anon Namin¹, Phatiphat Thounthong³, Noureddine Takorabet⁴
1) Rajamangala University of Technology Lanna, Thailand, 2) mu Space and Advanced Technology Company Limited, Thailand, 3) King Mongkut’s University of Technology North Bangkok, Thailand, 4) Université de Lorraine, France

18G3-4 ADALINE Current Control for Single-Phase Active Power Filter
Sarawut Janpong¹, Nanthi Suthikarnnarunui², Somboon Sooksatra¹, Keratiya Janpong³
1) Rangsit University, Thailand, 2) University of the Thai Chamber of Commerce, Thailand, 3) Maejo University, Thailand

Room H

Session 18H3  Battery related technologies for Automobile

Chairs: Hiroaki Matumori (Nagoya Institute of Technology)
Nobuyuki Imai (Honda R&D Co., Ltd., Japan)

18H3-1 Research on High-Power Rapid Charge Approach for EV Based on Clustered Multi-node Learning Gaussian Process
Liguo Wang¹, Zhenteng Tian¹, Yuanqiang Hu², Chunlai Yu², Zongjie Wang³, Feng Gao⁴
1) Harbin Institute of Technology, China, 2) State Grid Heilongjiang Electric Power Co., Ltd, China, 3) University of Connecticut, USA, 4) North Minzu University, China

18H3-2 Remaining Useful Life Prediction Considering Operating Condition Change Based on Regression and Empirical Mode Decomposition
Hyeon Ho Lee, Dong Hwan Kim, Tae-Won Noh, Byoung Kuk Lee
Sungkyunkwan University, Korea

18H3-3 Study on Power Source Properties Suitable for Volume Minimization in Electric Vehicle Hybrid Power-Source System
Shunya Sakamoto¹, Atsushi Okada¹, Kensuke Sasaki¹, Takashi Kato¹, Keiichiro Kondo², Ryo Kimura²
1) Nissan Motor Co., Ltd, Japan, 2) Waseda University, Japan

18H3-4 An RLS Based Battery Modeling Method to Compensate for Recovery Effect in Battery Balancing
Yiqing Lu, Haoyu Wang, Hengzhao Yang, Shaojie Chen, Wei Liu
ShanghaiTech University, China
Session 19A1  Modeling and Simulation Techniques for Power Electronics (OS)
Chairs: Koichi Shigematsu (Nagoya University, Japan)
       Jongwon Shin (Chung-Ang University, Korea)

19A1-1  Practical Modeling and Simulation Techniques for Power Electronics
Invited Paper
Hiroki Ishikawa
Gifu University, Japan

19A1-2  Simulating Wide Bandgap FET Models in LTspice
Invited Paper
Jong-Won Shin, Joonho Shin
Chung-Ang University, Korea

19A1-3  Difficulty and solution in transient thermal resistance measurement for wide band gap power semiconductor device
Invited Paper
Tsuyoshi Funaki1, Shuhei Fukunaga1, Tomoaki Hara2, Takaaki Ibuchi1
1) Osaka University, Japan, 2) Siemens AG, Japan

19A1-4  An Investigation and Proposal for Accurate Leakage Inductance Modeling Based on Dowell Model
Invited Paper
Yu-Hsin Wu1, Koichi Shigematsu1, Yasumichi Omoto2, Jun Imaoka1, Masayoshi Yamamoto1
1) Nagoya University, Japan, 2) NIDEC MOBILITY CORPORATION, Japan

19A1-5  Numerical Methods for the Periodic AC Analysis of DC Power Converters
Invited Paper
Noel Delgado1, Alan Courty2, Datsen Davies Tharakani1
1) Raytheon Missiles & Defense, USA, 2) Synopsys, USA, 3) Synopsys, India

Session 19B1  Technical Trend of Next-generation Application Specific Electric Motors (OS)
Chairs: Yoshinari Asano (Daikin Industries Ltd., Japan)
       Yuting Gao (Nagoya Institute of Technology, Japan)

19B1-1  Technical Trend of Next-generation Application Specific Electric Motors
Invited Paper
Osamu Shimizu1, Yoshiyuki Kato2, Sho Uchihama3, Yoshihiro Miyama4, Hideo Doheki5, Takashi Nakagami6, Tsuyoshi Miyaji7, Kyoei Kitao8
1) The University of Tokyo, Japan, 2) Yasukawa Electric Corporation, Japan, 3) Meidensha Corporation, Japan, 4) Mitsubishi Electric Corporation, Japan, 5) Tokyo City University, Japan, 6) Mitsubishi Heavy Industry, Japan, 7) Asis Corporation, Japan, 8) Tokyo Institute of Technology, Japan

19B1-2  Latest Technical Trend of Miniaturization, Weight Reduction, and High Efficiency of Electric Motors by Increasing the Rotational Speed
Invited Paper
Akio Toba1, Masanori Arata2, Masayuki Sanada3, Yoshiaki Kano4, Tatsuya Tonari5
1) Fuji Electric Co., Ltd., Japan, 2) Chu-o University, Japan, 3) Osaka Prefecture University, Japan, 4) Daido University, Japan, 5) Daidin Industries, Ltd., Japan

19B1-3  Latest Technical Trend of Miniaturization, Weight Reduction and High Efficiency of Electric Motors by Applying New Topology
Invited Paper
Takashi Kosaka1, Yoshihiro Miyama2, Hajime Ukaji3, Kensuke Sasaki4, Yuji Yamamoto5, Yuichi Yokoi6
1) Nagoya Institute of Technology, Japan, 2) Mitsubishi Electric Corporation, Japan, 3) Panasonic Corporation, Japan, 4) Nissan Motor Co., Ltd., Japan, 5) Toshiba Industrial Products and Systems Corporation, Japan, 6) Nagasaki University, Japan

19B1-4  Latest Technical Trend for Miniaturization, Weight Reduction, and High Efficiency by Applying New Materials
Invited Paper
Shoji Shimomura1, Yuji Enomoto2, Masayuki Morimoto3, Yasuhiro Marukawa4, Kiyoshi Wajima5, Takao Yabumi6, Tomoyuki Okubo7, Tatsuya Saito8
1) Shibaura Institute of Technology, Japan, 2) Hitachi, Ltd., Japan, 3) Tokai University, Japan, 4) Hitachi Metals, Ltd, Japan, 5) Nippon Steel Corporation, Japan, 6) Daido Steel, Japan, 7) JFT Steel Corporation, Japan, 8) Sumitomo Electric Industries, Ltd, Japan
Session 19C1 Applications of Solid-State Device for Power System

Chairs: Takanori Isobe (University of Tsukuba, Japan)
       Krishna Raj Potti (Indian Institute of Technology Delhi, India)

19C1-1 Resistive Superconducting Fault Current Limiter - Integrated Bidirectional Hybrid DC Circuit Breaker for HVDC Systems
Siddavatam Ravi Prakash Reddy, Kaushik Rajashekara, Harish Sarma Krishnamoorthy
University of Houston, USA

19C1-2 Generalized Circuit Topology and Classification of Multiline Hybrid HVDC Circuit Breakers
Yushi Koyama¹, Shinnosuke Hamajima¹, Takahiro Ishiguro²
¹) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 2) Toshiba Energy Systems & Solutions Corporation, Japan

19C1-3 DQ Impedance Modeling and Stability Analysis of SVG with Constant Reactive Power Control
Yiming Tu, Tong Wu, Zeng Liu, Jinjun Liu
Xi’an Jiaotong University, China

19C1-4 Consideration of STATCOM for Power Transmission with Dual-Redundant Controllers
Kohei Kobori, Takashi Sugiyama, Ryota Okuyama
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

19C1-5 Comparative Evaluation of MVAC-LVDC SST and Hybrid Transformer Concepts for Future Datacenters
Jonas Huber¹, Peter Wallmeier¹, Ralf Pieper², Frank Schafmeister³, Johann W. Kolar¹
¹) ETH Zurich, Switzerland, 2) Delta Energy Systems GmbH, Germany, 3) University of Paderborn, Germany

Room D

Session 19D1 Multi-level Converters II

Chairs: Junnosuke Haruna (Utsunomiya University, Japan)
        Jianwen Zhang (Shanghai Jiao Tong University, China)

19D1-1 Modulation and Analysis of Current-Fed High Gain Multilevel DC-DC Converter in BESS Charging Mode
Vinay Rathore, Siddavatam Ravi Prakash Reddy, Kaushik Rajashekara
1) University of Houston, USA

19D1-2 An Improved Valve-Side Fault-Riding-Through Control Strategy For Hybrid MMC
Jiawei Zhang, Li Peng, Yuntao Xiao, Zhen Wang
Huazhong University of Science and Technology, China

19D1-3 A DC Fault Ride-Through Control of Half-Bridge MMCs for the HVDC Grid with DC Circuit Breakers
Atsushi Chiba¹, Kenichiro Sano¹, Yushi Koyama², Kei Sekiguchi³, Takahiro Ishiguro¹, Daichi Suzuki¹
¹) Tokyo Institute of Technology, Japan, 2) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 3) Toshiba Energy Systems & Solutions Corporation, Japan

19D1-4 Commissioning test and Operation results of New Hokkaido-Honshu HVDC Link
Daichi Suzuki¹, Noriko Kawakami¹, Masanori Mori², Takanori Uchiumi¹
¹) Toshiba Energy Systems & Solutions Corporation, Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Tokyo, Japan, 3) Hokkaido Electric Power Network inc., Hokkaido, Japan

Room E

Session 19E1 Wireless Power Transfer III

Chairs: Katuhiro Hata (The University of Tokyo, Japan)
        Ming Liu (Shanghai Jiao Tong University, China)

19E1-1 A Consideration on Efficiency Maximization for Inductive Power Transfer System with Dual Converters
Ryohei Okada, Ryosuke Ota, Nobukazu Hoshi
Tokyo University of Science, Japan

19E1-2 An IPT topology with High Misalignment Tolerance and Input Impedance Angle control
Yijie Wang, Xilai Sun, Jianwei Mai, Liang Cai, Dianguo Xu
Harbin Institute of Technology, China
19E1-3 Activation Function Model for Wireless Power Transfer System With an LCC-S Compensated Network
Shuangqing Lv, Wenjie Chen, Xiufang Hu
Xi’an Jiaotong University, China

19E1-4 One Pulse Control of Novel Variable Active Capacitor System for Wireless Power Transfer
Shin-ichi Hamasaki, Keisuke Takashima, Shogo Yamashita, Tetsuji Daido
Nagasaki University, Japan

Room F

Session 19F1 Gate Drive Technology

Chairs: Daiki Yamaguchi (National Institute of Advanced Industrial Science and Technology, Japan)
Ravi Nath Tripathi (Kyoto University of Advanced Science, Japan)

19F1-1 Gate Drive Method Using Wireless Multiplex Transmission of Power and Signal
Kyunghin Sung, Yosuke Ouchi, Sogo Amagai, Kaito Sagara, Yuma Kawasaki, Hiyang Sung
National Institute of Technology, Japan

19F1-2 An Investigation of a Power Module for Multiple Series-Connected Si-MOSFETs Realizing Voltage Balance by a Fully Digital Active Gate Control
Hidemine Obara¹, Seiya Abe², Keiji Wada³
1) Yokohama National University, Japan, 2) Kyushu Institute of Technology, Japan, 3) Tokyo Metropolitan University, Japan

19F1-3 A Study on Digital Active Gate Driving of DC-DC Converter for Suppressing Switching Surge Voltage
Shuhei Fukunaga¹, Hajime Takayama², Takashi Hikihara³
1) Osaka University, Japan, 2) Kyoto University, Japan

19F1-4 High Bandwidth Active Gate Driver for Simultaneous Reduction of Switching Surge and Switching Loss of SiC-MOSFET
Yuichi Noge, Masahito Shoyama
Kyushu University, Japan

Room H

Session 19H1 Control method for Automobile

Chairs: Shigeyuki Takagi (Tokyo University of Technology, Japan)
Nobuhisa Yamaguchi (DENSO CORPORATION, Japan)

19H1-1 Design and Control of the Adjustable Turn-ratio LLC Converter for High-Efficiency Operation of Wired/Wireless Integrated EV Charging System
Hyeon-Woo Jo, Dong Hyeon Sim, Ju-A Lee, Won-Jin Son, Byoung Kuk Lee
Sungkyunkwan University, Korea

19H1-2 MPPT operation performance of automotive photovoltaic system during driving
Yosuke Tomita¹, Masanori Saito¹, Yoshiyuki Nagai², Tsutomu Tanimoto³, Takumi Arai⁴, Kimihiro Nishiijima⁵
1) Nissan Motor Co., Ltd. Japan, 2) Sojo University, Japan

19H1-3 A Novel Charging Control for D-EPC with DC Power Sources Connected in Series
Hiromu Akiyama, Hiroki Matsuno, Kantaro Yoshimoto, Tomoki Yokoyama
Tokyo Denki University, Japan

19H1-4 Decentralized Control Using Wireless Signal Communication for Multi-Port EV Charger with Multiple Cells
Keita Ohata, Hiroki Watanabe, Jun-ichi Itoh, Keisuke Kusaka
Nagaoka University of Technology, Japan
Session 19A2  Power Electronics for Future Aircraft (OS)
Chairs: Koji Yamaguchi (IHI Corporation, Japan)
       Tseng King Jet (Singapore Institute of Technology, Singapore)

19A2-1 High-Density Motor Drive Development for Electric Aircraft Propulsion: Cryogenic and non-Cryo Solutions
Invited Paper
Fang Luo, Mustafeez-ul-Hassan, Zhao Yuan, Kushan Choksi
Stony Brook University, USA

19A2-2 Electromagnetic Design of Dual Winding Permanent Magnet Synchronous Motor for Electromechanical
Actuators of Flight Control Systems
Invited Paper
Yutaka Terao¹, Hiroshi Hirayama², Hirotaka Sugawara³, Hitoshi Oyori¹
1) The University of Tokyo, Japan, 2) Akita University, Japan, 3) IHI Corporation, Japan

19A2-3 Construction of an Electric Aircraft System Model with Power Device Losses
Invited Paper
Takamitsu Yamahigashi, Kensuke Shibuya, Koichi Shigematsu, Jun Imaoka, Masayoshi Yamamoto
Nagoya University, Japan

19A2-4 Wireless Charging Technologies and Standardization for Electric Unmanned Crafts
Invited Paper
S. Cao¹, A. Nawawi², Z. Lim², J. Ang², X. Hu³, C.F. Tong², K.J. Tseng¹
1) Singapore Institute of Technology, Singapore, 2) Xnergy Autonomous Power Technologies Pte. Ltd., Singapore

Session 19B2  Design and Control of Flux Modulation Permanent Magnet Machines (OS)
Chairs: Dawei Li (Huazhong University of Science and Technology, China)
       Yuting Gao (Nagoya Institute of Technology, Japan)

19B2-1 Analysis of Double Flux Modulation Flux Reversal Machines with Different Consequent-Pole PM Topologies
Invited Paper
Yuting Zheng, Lijian Wu, Youtong Fang
Zhejiang University of Science and Technology, China

19B2-2 Pole-Slot Combination Design and Investigation of Spoke-Type In-Wheel Motor Considering Flux Modulation
Invited Paper
Zirun Lu, Zixuan Xiang, Xiaoyong Zhu, Min Jiang
Jiangsu University, China

Invited Paper
Yu Zhao, Dawei Li, Xiang Ren, Ronghai Qu
Huazhong University of Science and Technology, China

19B2-4 Investigation of Variable Field Harmonic Principle in Hybrid-Excited Switched-Flux Machine
Invited Paper
Hui Yang¹, Yanding Bi¹, Cheng Qian¹, Dawei Li², Heyun Lin¹, Z. Q. Zhu¹, Shuangxia Niu¹
1) Southeast University, China, 2) The Hong Kong Polytechnic University, China, 3) Huazhong University of Science and Technology, China, 4) The University of Sheffield, UK

Session 19C2  Multi-level converters III
Chairs: Hiroyuki Asahara (Okayama University of Science, Japan)
       Kyo-Beum Lee (Ajou University, Korea)

19C2-1 An Isolated Modular Multi-level DC Transformer with Embedded Multi-port Current Flow Controller for Meshed
DC Distribution Grids
Invited Paper
Yuwen Liu¹, Ximing Fan², Jianqiao Zhou¹, Gang Shi¹, Jiacheng Wang³, Jiajie Zang¹, Xu Cai¹, Jianwen Zhang¹
1) Shanghai Jiao Tong University, China, 2) Foshan Power Supply Bureau of Guangdong Power Grid Co., Ltd., China, 3) Simon Fraser University, Canada
Room D

Session 19D2  PFC Converters
Chairs: Kenichi Nagayoshi (Toyota Industries Corporation, Japan)
        Ryosuke Ota (Tokyo University of Science, Japan)

19D2-1  Individual-Phase Displacement Power Factor Control Strategy of an Active Power-Line Conditioner in Three-Phase Four-Wire Distribution Feeders
Yuka Sabi1, Yuya Kihara1, Hiroaki Yamada1, Toshihiko Tanaka1, Fuka Ikeda2, Masayuki Okamoto2,
Seong Ryong Lee1
1) Yamaguchi University, Japan, 2) National Institute of Technology, Japan, 3) Kunsan National University, Korea

19D2-2  Improvement of Characteristics in CRM-PFC Using a Control Method based on Switching Frequency Limitation
Ryunosuke Araumi1, Ryuji Yamada1, Keiji Wada2
1) Fuji Electric Co., Ltd., Japan, 2) Tokyo Metropolitan University, Japan

19D2-3  Aggregated Modeling for Paralleled PFC Converters in Three-Phase Data Center Power Systems
Tianhua Zhu1, Xiongfei Wang1, Fangzhou Zhao1, Guoqing Gao1, Grover Torrico2
1) Aalborg University, Aalborg, Denmark, 2) Huawei technologies Sweden AB, Sweden

Room E

Session 19E2  Softswitching Converters
Chairs: Tomokazu Mishima (Kobe University, Japan)
        Feng Wang (Xi'an Jiaotong University, China)

19E2-1  An Accurate Backflow Power Calculation Method for the CLLC Resonant Converter Based on FHA and Time-Domain model
Yichen Wang, Feng Wang, Fang Zhuo, Xiaojing Yin, Jiachen Tian, Haoyu Wang
Xi'an Jiaotong University, China

19E2-2  Light Load Efficiency Boost Technique for Switched Tank Converters Based on Hybrid ZVS-ZCS Control
Jiawei Liang, Haoyu Wang
ShanghaiTech University, China

19E2-3  Derivation of Resonant Period for Soft Switching by Linearizing Output Capacitance of Switching Device
Sihoon Choi, Ayato Suzuki, Jun Imaoka, Masayoshi Yamamoto
Nagoya University, Japan

19E2-4  Single-Phase PWM Control of qZSIs for Switching-Loss and Capacitor Reduction Utilizing Accurate DC-Side Current Reference
Tomoyuki Mannen
University of Tsukuba, Japan
Session 19F2  DC-AC Converters

Chairs: Kansuke Fujii (Fuji Electric Co., Ltd., Japan)
        Cheng Huang (University of Tsukuba, Japan)

19F2-1 Experimental Verification of Interleaved Grid-Tied Inverter Using Discontinuous Current Mode with Magnetically Coupled Inductor
Shuntaro Uesugi, Cheng Huang, Tomoyuki Mannen, Takanori Isobe
University of Tsukuba, Japan

19F2-2 Current Ripple Reduction with Enhanced ZVS Operation Based on Off-time Discrete Control for DCM Inverters to Achieve High Efficiency
Cheng Huang, Tomoyuki Mannen, Takanori Isobe
University of Tsukuba, Japan

19F2-3 A More Accurate ZVS Criterion for Resonant Converters
Chanh-Tin Truong, Sung-Jin Choi
University of Ulsan, Korea

19F2-4 Characterization and Switching Strategy Development for SMP SiC Power Modules
Yu Shiogai¹, Alberto Castellazzi², Takashi Hikihara³
1) Kyoto University, Japan, 2) Kyoto University of Advanced Science, Japan

Session 19G2  Motor Drive System and Control I

Chairs: Yukinori Inoue (Osaka Metropolitan University, Japan)
        Shizunori Hamada (Meidensha Corporation, Japan)

19G2-1 High-Speed and Low-Latency Transmission by Millimeter-Wave Digital Wireless System for Si-IGBT/SiC-MOSFET Driver Control
Yukako Tsutsumi¹, Koji Akita¹, Hiroyuki Kitagawa¹, Kentaro Suzuki², Ryosuke Saito², Yoshihiro Tawada³
1) Toshiba Corporation, Japan, 2) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 3) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

19G2-2 Motor Current Reconstruction Method Using Single Shunt Resistance by High-Frequency Voltage Injection
Takuji Mitsui, Yoshitaka Iwaji
Ibaraki University, Japan

19G2-3 Hexagonal Voltage Modification Scheme to Improve Torque Capability of Low-Cost Drives
Hyung-June Cho¹, Yong-Cheol Kwon², Seung-Ki Sul³
1) Seoul National University, Korea, 2) PLECKO Co., Ltd., Korea

19G2-4 Design of Predictive Controllers and Input Filters for Matrix Converter PMSM Drive Systems
Tian-Hua Liu, Jia-Han Li
National Taiwan University of Science and Technology, Taiwan

Session 19H2  Converter topologies for Automobiles

Chairs: Sakahisa Nagai (The University of Tokyo, Japan)
        Nobuhisa Yamaguchi (DENSO CORPORATION, Japan)

19H2-1 Static and Dynamic Cryogenic Characterizations of Commercial High Performance GaN HEMTs for More Electric Aircraft
Yuqi Wei, Md Maksudul Hossain, H. Alan Mantooth
University of Arkansas, USA

19H2-2 A New Family of Non-Isolated Single-Inductor Three-Port Converter Based on A Storage Port Switch-Commutated Unit
Chengdong Yin, Hong Li, Yamin Li, Wenzhe Su, Trillion Q. Zheng
Beijing Jiaotong University, China
19H2-3  Analysis and Theoretical Comparison of 1-to-1.5 Resonant Switched Capacitor Converters for High-Voltage EV Batteries
Masatoshi Uno, Toko Sanada, Yuto Fujii
Ibaraki University, Japan

19H2-4  Analysis and Conceptualization of a 800V 100 kVA Full-GaN Three-Level Flying Capacitor Inverter for Next-Generation Electric Vehicle Drives
Davide Cittanti, Enrico Vico, Eric Armando, Radu Bojoi
Politecnico di Torino, Italy

Thursday, May 19: 14:05-15:45
Room A

Session 19A3  Power Electronics for Renewable Energy Interconnected Grid (OS)
Chairs: Naomitsu Urasaki (University of the Ryukyus, Japan)
Sjur Føyen (Norwegian University of Science and Technology, Norway)

19A3-1  Analysis of Power Electronics-Dominated Hybrid AC/DC Grid for Data-Driven Oscillation Diagnosis
Invited Paper
Haoxiang Zong1, Chen Zhang1, Xu Cai1, Marta Molinas2
1) Shanghai Jiao Tong University, China, 2) Norwegian University of Science and Technology, Norway

19A3-2  Modeling and Calculation of Grid Frequency Support Effect and Transient Energy Demand of a Virtual Synchronous Generator
Invited Paper
Jia Liu, Jinjun Liu
Xi’an Jiaotong University, China

19A3-3  A High Side Voltage Fluctuation Suppression Control of Bidirectional Chopper to Reduce Capacitance of DC Bus
Invited Paper
Hiroaki Kakigano
Ritsumeikan University, Japan

19A3-4  Application of Reinforcement Learning Algorithm to Parameter Identification for MPPT Control of PMSG Wind Energy Conversion Systems
Invited Paper
Ryo Miyara1, Jargalsaikhan Nyam1, Takeyoshi Kato2, Natarajan Prabaharan1, Hitoshi Takahashi4, Tomonobu Senjyu1
1) University of the Ryukyus, Japan, 2) Nagoya University, Japan, 3) SASTRA Deemed University, India, 4) Fuji Electric Co., Ltd., Japan

Room B

Session 19B3  Energy Storage Systems
Chairs: Yushi Miura (Nagaoka University of Technology, Japan)
Giuseppe Guidi (Sintef Energy Research, Norway)

19B3-1  Autonomous Control for Cooperative Operation between Energy Storage Systems
Invited Paper
Tomohiro Yamaguchi, Takayuki Matsumoto
CS Yuasa Infrastructure Systems Co., Ltd., Japan

19B3-2  Design of Integral Droop Control for Hybrid Energy Storage System Considering Ramp Rate Characteristic
Invited Paper
Seung-Hyun Choi1, Jae-Sang Kim1, Jeong-Eon Park2,2, Donghyeon Yu1, Gun-Woo Moon1
1) Korea Advanced Institute of Science and Technology (KAIST), Korea, 2) Korea Aerospace Research Institute (KARI), Korea

19B3-3  New Circuit Structure Applying MMC and Its Control for Quick Charger System
Invited Paper
Shin-ichi Hamasaki, Konosuke Takahashi, Yuga Fujita, Tetsuji Daido
Nagasaki University, Japan

19B3-4  Efficiency Characteristic of a High-Power Reconfigurable Battery with Series-Connected Topology
Invited Paper
Jan Engelhardt, Jan Martin Zepiter, Tatiana Gabderakhmanova, Mattia Marinelli
Technical University of Denmark, Denmark
Session 19C3  Multi-level Converters IV

**Chairs:** Kazuto Takagi (GS Yuasa Infrastructure Systems Co., Ltd., Japan)
Jianqiao Zhou (Shanghai Jiao Tong University, China)

19C3-1  **Design Considerations for the Intermediate Circuit of a Multimegawatt Medium-Voltage Neutral-Point-Clamped Inverter**
Aleksi Mattsson¹, Juhamatti Korhonen¹, Pasi Nuutinen¹, Pasi Peltoniemi¹, Olli Pyrhönen¹, Pertti Silventoinen¹,
Riku Pöllänen²
1) LUT University, Finland, 2) The Switch Drive Systems Oy, Finland

19C3-2  **A Fast Neutral-Point Potential Balance Modulation Method for T-type Three-Level Inverter**
Sizheng Wang, Hui Wang
Central South University, China

19C3-3  **Simplified Finite Set Model Predictive Control for T-type Three-Level Battery Energy Storage Power Conversion System**
Huaiyu Fan, Ning Gao, Weimin Wu
Shanghai Maritime University, China

19C3-4  **Passivity-Based Design for High-Order Harmonic Voltage Emulation of Grid Emulators**
Zejie Li, Fangzhou Zhao, Xiongfei Wang
Aalborg University, Denmark

Room D

Session 19D3  Control and Analysis of Converters III

**Chairs:** Hiroki Ishikawa (Gifu University, Japan)
Younghoon Cho (Konkuk University, Korea)

19D3-1  **Current Balancing of Interleaved Boost PFC Converter with Auxiliary Winding Coupled Inductor**
Dongkwan Yoon, Sungmin Lee, Jaehyeon Bang, Younghoon Cho
Konkuk University, Korea

19D3-2  **Online Optimization of Zero-Sequence Voltage Injection of PWM Strategy for 3L-NPC converters**
Mateja Novak, Ariya Sangwongwanich, Frede Blaabjerg
Aalborg University, Denmark

19D3-3  **Submodule Capacitor Sizing for Cascaded H-Bridge STATCOM with Sum of Squares Formulation**
Hengyi Wang¹, Fei Wang¹, Fei Gao², Jianqiang Cheng³
1) University of Shanghai, China, 2) Ministry of Education, China, 3) The University of Arizona, USA

19D3-4  **Voltage Balancing Control for Y-Connected Modular Converter in MV Drive Application**
DongUk Kim¹, Sungmin Kim¹
Hanyang University, Korea

Room E

Session 19E3  Simulation of Power Electronics Systems

**Chairs:** Kazuhiro Umetani (Okayama University, Japan)
Jinjun Liu (Xi’an Jiaotong University, China)

19E3-1  **Frequency-dependent Equivalent Circuit Parameter Calculation of Gapped Multiwinding Inductors**
Thomas Ewald, Richard Schlesinger, Jan P. Agner, Jürgen Biela
ETH Zurich, Switzerland

19E3-2  **Model Extraction for Power Electronics Systems Using Vector Fitting Based on Sampling Optimized Method**
Zipeng Liu, Jinjun Liu, Zeng Liu
Xi’an Jiaotong University, China

19E3-3  **Unification of SISO Open-loop Gain Based Stability Analysis Methods for Three-phase Cascaded System**
Tong Wu¹, Jinjun Liu¹, Yiming Tu¹, Zeng Liu¹, Teng Liu²
1) Xi’an Jiaotong University, China, 2) Aalborg University, Denmark
Session 19F3  Control and Analysis of DC-DC Converters

Chairs: Kazunori Hasegawa (Kyushu Institute of Technology, Japan)
Jaydeep Saha (National University of Singapore, Singapore)

19F3-1  Effect of Parasitic Components on Dynamic Response in Buck Converters
Hanhim Sung, Donghan Seo, Dongwook Kim, Jong-Won Shin
Chung-Ang University, Korea

19F3-2  Transient Performance Improvement of Digital Average Current Controlled Multiphase Interleaved Buck Converter
Guihua Mao¹, Guohua Zhou¹, Klaus Moth², Yashank Bansal¹, Yuan Gao¹, Stig Munk-Nielsen¹
1) Southwest Jiaotong University, China, 2) LivingPower company, Denmark, 3) Aalborg University, Denmark

19F3-3  Burst Control Incorporated in Switching Period for Bidirectional Series Resonant Converter Achieving Small Voltage Ripple and Fully Soft Switching
Zhijian Fang¹,²,³, Yangeng Xia¹,²,³, Fei Xie¹,²,³, Hanlin Dong¹,²,³, Zhiguo Wei¹,²,³
1) China University of Geosciences, China, 2) Hubei Key Laboratory of Advanced Control and Intelligent Automation for Complex Systems, China, 3) Ministry of Education, China

19F3-4  Comparative Overview of Power Balance Control for Two-stage and Single-stage Isolated MVAC-LVDC Cascaded Converters
Jaydeep Saha¹, Naga Brahmendra Yadav Gorla², Sanjib Kumar Panda²
1) National University of Singapore, Singapore, 2) Nanyang Technological University, Singapore

Room G

Session 19G3  Motor Drive System and Control II

Chairs: Masahiro Aoyama (Shizuoka University, Japan)
Yuichi Yokoi (Nagasaki University, Japan)

19G3-1  Decoupling Control Method in an M- and T-axis Current Vector Control System of a Permanent Magnet Synchronous Motor
Daiki Sekiguchi¹, Yukinori Inoue², Shigeo Morimoto², Masayuki Sanada²
1) Osaka Prefecture University, Japan, 2) Osaka Metropolitan University, Japan

19G3-2  Online Deadbeat Predictive Direct Torque and Active Flux Control for IPMSM Drive
S M Showybul Islam Shakib, Dan Xiao, Rukmi Dutta, Muhammed Fazlur Rahman
University of New South Wales, Australia

19G3-3  Voltage Compensation Performance of the Voltage Unbalance Compensator Using the Method of Symmetrical Components
Tomoya Katsuki, Iori Yamakawa, Akihiro Imakiire, Satoshi Matsumoto
Kyushu Institute of Technology, Japan

19G3-4  Voltage-Integral-based Reference Tracking Modulation Method for High-Efficiency Motor Drive
Yuto Kobayashi¹, Kiyoshi Ohishi¹, Yuki Yokokura¹, Tenjiro Hiwatari², Akira Satake²
1) Nagaoka University of Technology, Japan, 2) Mitsubishi Electric Corporation, Japan

Room H

Session 19H3  Detection, estimation, and diagnosis in rotating machines

Chairs: Kenji Nakamura (Tohoku University, Japan)
Lew Andrew R. Tria (University of the Philippines Diliman, Philippines)

19H3-1  Torque Estimation of a Variable Speed Induction Motor without Torque and Rotational Speed Meters
Shu Yamamoto¹, Hideaki Hirahara¹, Masayuki Motosugi¹,²
1) Polytechnic University, Tokyo, Japan, 2) Polytechnic Center Kochi, Japan
19H3-2 Real-time Dynamic Eccentricity Detection by Analyzing Harmonic Components of No-load Line-line Voltages on Multi-three-phase PMSMs
Kodai Okazaki¹, Kan Yang², Kan Akatsu²
1) Mitsubishi Electric Corporation, Japan, 2) Yokohama National University, Japan

19H3-3 TFFC-RNN: A New RNN Based Approach for Bearing and Misalignment Compound Fault
Ziran Guo, Ming Yang
Harbin Institute of Technology, China

19H3-4 Light-Weight and Compact Magnetic Rotation Angle Sensor with Partial Arc Stator Using Three Hall-Effect Sensors
Tatsuo Nishimura, Koji Nishizawa, Yoshihiro Miyama, Hideaki Arita
Mitsubishi Electric Corporation, Japan

Thursday, May 19: 16:05-18:10
Room A

Session 19A4 Electromagnetic Compatibility (OS)
Chairs: Hideki Ayano (National institute of Technology, Japan)
Wilmar Martinez (KU Leuven, Belgium)

19A4-1 EMC implications of implementing WBG devices in battery charger modules for electric vehicles
Invited Paper
Wilmar Martinez, WeiRen Lin, Camilo Suarez
KU Leuven-EnergyVille, Belgium

19A4-2 Impedance Analysis of Single-Phase PFC Converter in the Frequency Range of 0-150 kHz
Invited Paper
Pooya Davari, Frede Blaabjerg
Aalborg University, Denmark

19A4-3 Reduction of Input- and Output-Side Common-Mode Currents Based on a Coupled Common-Mode Inductor in DC-Fed Three-Phase Motor Drive Systems
Invited Paper
Shotaro Takahashi, Sari Maekawa
Seikei University, Japan

19A4-4 EMI model of Air-conditioning Outdoor Machines
Invited Paper
Fan Peng, Changsheng Hu, Dehong Xu, Hui Wang, Wenxing Zhong
Zhejiang University, China

19A4-5 Prediction of Disturbance Current from Railway Traction Inverters at Train’s Maximum Design Speed
Invited Paper
Satoru Hatukade
Railway Technical Research Institute, Japan

Room B

Session 19B4 Reliability and Diagnostics of Power Converters II
Chairs: Ryota Kondo (Mitsubishi Electric Corporation, Japan)
Spasoje Miric (ETH Zurich, Switzerland)

19B4-1 Reliability Modeling and Assessment of De-rated Redundant Power Converters
Saeed Peyghami¹, Mostafa Abarzadeh², Frede Blaabjerg¹
1) Aalborg University, Denmark, 2) SmartD Technologies Inc., Canada

19B4-2 A Stress Emulation Method for Concurrent Testing of AC and DC Capacitors
Bo Yao, Xing Wei, Haoran Wang, Huai Wang
Aalborg University, Denmark

19B4-3 Condition Monitoring of a DC-Link Capacitor Used in a PWM Inverter With a Six-Pulse Diode Rectifier Without Current Sensors
Kazunori Hasegawa, Tsukasa Kubo, Yuto Hirose
Kyushu Institute of Technology, Japan
19B4-4 Local Heat Generation Analysis Method of Ferrite Cores for Wireless Power Transfer Coil Considering Compressive Stress
Norihito Kimura, Hiroaki Yuasa
1) SOKEN, INC., Japan, 2) TOYOTA MOTOR CORPORATION, Japan

Session 19C4 Advanced magnetics
Chairs: Tsuyoshi Funaki (Osaka University, Japan)
Alberto Castellazzi (Kyoto University of Advanced Science, Japan)

19C4-1 Basic Characteristics of Thin-Film Single-Layer Coreless Micro-Transformers for Digital Isolators
Motochika Inohara, Satoshi Sugahara
Fukuyama University, Japan

19C4-2 An Adaptive Active Inductor for the AC Filter of Grid-connected Drive
Feng Liu, Guorong Zhu, Zhe Kong, Haoran Wang, Huai Wang
1) Wuhan University of Technology, China, 2) Three Gorges Intelligent Industrial Control Technology Co.Ltd, China, 3) Aalborg University, Denmark

19C4-3 Iron Loss Properties of Amorphous Ring under High-Frequency SiC Inverter Excitation with Different Dead-times Using High Sampling Rate
Nguyen Gia Minh Thao, Keisuke Fujisaki, Duc-Kien Ngo, Kenya Naruse
1) Toyota Technological Institute, Japan, 2) The University of Danang–University of Technology and Education, Vietnam

19C4-4 An Integrated Matrix Magnetics for Isolated Single-stage DC/DC Converter
Fei Li, Laili Wang, Longyang Yu
Xi'an Jiaotong University, China

19C4-5 A Load Test Method Using Two Power Supplies for High-Frequency Transformers
Koji Orikawa, Shogo Nishikawa, Satoshi Ogasawara
Hokkaido University, Japan

Session 19D4 SiC Device Applications
Chairs: Takeshi Horiguchi (Mitsubishi Electric Corporation, Japan)
Yanbo Wang (Aalborg University, Denmark)

19D4-1 Verification and Application of an Analytical Switching Loss Model for a SiC MOSFET and Schottky Diode Half-Bridge
Anliang Hu, Jürgen Biela
ETH Zurich, Switzerland

19D4-2 Experimental Verification of a Gate-Drive Circuit Using Distributed Signal Processing for Fast-Switching Operation of SiC MOSFETs
Daiki Yamaguchi, Shinji Sato, Atsushi Yao, Hiroshi Sato
National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan

19D4-3 Real-time FPGA Simulation of Dual Active Bridge Converter with SiC MOSFET Device Model
Gard Lyng Rodal, Dimosthenis Peftitsis
Norwegian University of Science and Technology, Norway

19D4-4 Low Inductive Platform for Long- and Short-term Dynamic Characterization of SiC MOSFETs
Daniel A. Philipps, Tobias N. Ubostad, Dimosthenis Peftitsis
Norwegian University of Science and Technology, Norway
Session 19E4  DC-DC Converters IV

Chairs: Yoshiya Ohnuma (Nagaoka Power Electronics co., Ltd., Japan)
Qinglei Bu (Xian Jiaotong-Liverpool University, China)

19E4-1  99%, 15 W/cm² capacitively coupled modular DCPET for low-voltage dc power supply system
Keigo Arita, Yusuke Hayashi, Kazuto Takao
Toshiba Corporation, Japan

19E4-2  A Hybrid Step-up DC-DC Converter based on Ladder Switched-capacitor and High-frequency Transformer
Qinqin Dong¹, Yu Fu¹, Shanwei Liu¹, Shouxiang Li¹, Guoju Zhang¹
1) Beijing Institute of Technology, China, 2) Chinese Academy of Sciences, China

19E4-3  A Family of High Step-up Isolated DC-DC Converters based on Fibonacci Switched-capacitor Cell
Shanwei Liu¹, Qinqin Dong¹, Yu Fu¹, Shouxiang Li¹, Guoju Zhang¹
1) Beijing Institute of Technology, China, 2) Chinese Academy of Sciences, China

19E4-4  Transient Bias Suppression Optimization for Bidirectional 2/3-Level DC-DC Converters
Qinglei Bu¹,², Huiqing Wen¹, Yinxiao Zhu¹,², Haochen Shi¹, Guanying Chu¹
1) Xi’an Jiaotong-Liverpool University, China, 2) University of Liverpool, UK, 3) Huazhong University of Science and Technology, China

19E4-5  Analysis and Improvement of Harmonic Content in Multi-level Three-phase DAB Converters with Different Transformer Windings Connections
Babak Khanzadeh, Torbjorn Thiringer, Yuriy Serdyuk
Chalmers University of Technology, Sweden

Session 19F4  Multi-level Converters V

Chairs: Hiroaki Yamada (Yamaguchi University, Japan)
Kenichiro Sano (Tokyo Institute of Technology, Japan)

19F4-1  A Multiple-AC-Ports Power Electronic Transformer
Xinyi Kong¹, Ximing Fan¹, Jianqiao Zhou¹, Gang Shi¹, Jiajie Zang¹, Jiacheng Wang¹, Xu Cai¹, Jianwen Zhang¹
1) Shanghai Jiaotong University, China, 2) Foshan Power Supply Bureau of Guangdong Power Grid Co., Ltd., China

19F4-2  A 1200V DC-link Hybrid Si/SiC Four-level ANPC Inverter with Balanced Loss Distribution, dv/dt and Cost
Jun Wang, Lihong Xie, Xibo Yuan, Wenzhi Zhou, Ian Laird
University of Bristol, UK

19F4-3  Efficiency Improvement of Flying-Capacitor Linear Amplifier by Unequal Capacitor Voltage Ratio
Hidemine Obara, Keichi Matsushima
Yokohama National University, Japan

19F4-4  DC Power Filter Design for a Neutral-Point Clamped Hybrid Multilevel Converter
Caspar T. Collins, Tim C. Green
Imperial College London, UK

Session 19G4  Reluctance Motor Drives

Chairs: Kohei Aiso (Shibaura Institute of Technology, Japan)
Tetsuya Kojima (Mitsubishi Electric, Japan)

19G4-1  Effect of Inductance Model on Sensorless Control Performance of SynRM with Magnetic Saturation
Yuma Tsuji², Shigeo Morimoto², Yukinori Inoue², Masayuki Sanada²
1) Osaka Prefecture University, Japan, 2) Osaka Metropolitan University, Japan

19G4-2  Standstill Sensorless Self-Commissioning Strategy of Synchronous Machine Considering Rotor Rotation Reduction Technique
Hyun-Jun Lee, Je-Eok Joo, Young-Doo Yoon
Hanyang University, Korea
19G4-3 Improved Parameter Estimation Method for Flux Saturation Model of Synchronous Reluctance Machines
Tae-Gyeom Woo, Hyun-Jun Lee, Young-Doo Yoon
Hanyang University, Korea

19G4-4 Proposal of Optimal Design Method for Capacitance in Operating Area Expandable SR Motor Drive Circuit
Taisei Kurishima, Ryuya Sugai, Hiroki Goto, Hirohito Funato, Junnosuke Haruna
Utsunomiya University, Japan

19G4-5 An Open-Loop Control for the Determination of the MITP-V-Trajectory of a SynRM
Vasken Ketchedian, André Haspel, Jörig Haarer, Jörig Roth-Stielow
University of Stuttgart, Germany

Session 19H4 Motor analysis
Chairs: Masafumi Fujita (Toshiba Energy Systems & Solutions Corporation, Japan)
Masatsugu Nakano (Mitsubishi Electric Corporation, Japan)

19H4-1 Analytical Approach to Estimate Torque Characterization of Synchronous Motors Assisted by FEA
Zheng-Feng Li, Ming-Shi Huang, Lin-Wei Huang
National Taipei University of Technology, Taiwan

19H4-2 Cost-efficient Analysis of Core and PM Eddy Current Loss Considering Current Harmonics
Jun-Yeol Ryu, Jun-Woo Chin, Myung-Seop Lim
Hanyang University, Korea

19H4-3 Efficient Frequency-domain Evaluation of Transient Voltage Effects in Electric Machines
Bianca Wex¹, Siegfried Silber¹, Petra Miletic², Wolfgang Gruber³
1) Linz Center of Mechatronics, Austria, 2) University of Rijeka, Croatia, 3) Johannes Kepler University, Austria

19H4-4 Analysis of Winding AC Loss in a Permanent Magnet Synchronous Machine With High Slot Fill Aluminum Winding
Hiroya Sugimoto¹, Yuto Yamada¹, Kazuhito Imade²
1) Tokyo Denki University, Japan, 2) Aster Co., Ltd., Japan

19H4-5 Learning Thermal Properties and Temperature Models of Electric Motors with Neural Ordinary Differential Equations
Wilhelm Kirchgässner, Oliver Wallscheid, Joachim Böcker
Paderborn University, Germany