Technical Sessions

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

Room A

Oral Session 21A1 Wireless Power Transfer

21A1-1 **Three-Phase Inductive Power Transfer System with 12 Coils for Radiation Noise Reduction**
Invited Paper Keisuke Kusaka, Jun-ichi Itoh
Nagaoka University of Technology, Japan

21A1-2 **Secondary-Side-Only Control for Smooth Voltage Stabilization in Wireless Power Transfer Systems with Constant Power Load**
Invited Paper Giorgio Lovison, Takehiro Imura, Hiroshi Fujimoto, Yoichi Hori
The University of Tokyo, Japan

21A1-3 **Constant Current Charging and the Maximum System Efficiency Tracking for Wireless Charging Systems Employing Dual-Side Control**
Invited Paper Zhenjie Li, Xiaoliang Huang, Kai Song, Jinhai Jiang, Chunbo Zhu, Zhijiang Du
Harbin Institute of Technology, China

21A1-4 **Electric Field Coupling Type High Power Wireless Power Transfer with Leakage Electric Field Strucure**
Invited Paper Mitsuru Masuda
FURUKAWA ELECTRIC CO., LTD., Japan

21A1-5 **Transfer Power Analysis of Capacitively Isolated Outlet and Plug (CapIsOP) Using Series Resonance**
Invited Paper Hirohito Funato, Koki Amano, Takuya Hatsumi, Junnosuke Haruna
Utsunomiya University, Japan

Room B

Oral Session 21B1 LLC Converters

21B1-1 **Wide Voltage Gain Range LLC DC/DC Topologies: State-of-the-Art**
Qi Cao, Zhiqing Li, Haoyu Wang
Shanghai Tech University, China

21B1-2 **Dual Half-Bridge *LLC* Resonant Converter with Hybrid-Secondary-Rectifier (HSR) for Wide-Ouput-Voltage Applications**
Jae-Il Baek[1], Chong-Eun Kim[2], Keon-Woo Kim[1], Min-Su Lee[1], Gun-Woo Moon[1]
1) KAIST, Korea, 2) SoluM, Korea

21B1-3 **A Study on the Analysis and Control of No-Load Characteristics of LLC Resonant Converter for Plasma Process**
Min-Jun Kwon, Woo-Cheol Lee
Hankyong National University, Korea

21B1-4 **Mechanism of Current Imbalance in LLC Resonant Converter with Center Tapped Transformer**
Mitsuru Sato, Shingo Nagaoka, Takeshi Uematsu, Toshiyuki Zaitsu
Omron Corporation, Japan

21B1-5 **Performance Study of High-Power Half-Bridge Interleaved LLC Converter**
Hung-I Hsieh[1], Hui-Lung Chiu[2], Guan-Chyun Hsieh[2]
1) National Chiayi University, Taiwan, 2) Chung Yuan Christian University, Taiwan

Room C

Oral Session 21C1 Packaging Technologies for Power Devices

21C1-1 **Multi-Chip SiC MOSFET Power Modules for Standard Manufacturing, Mounting and Cooling**
Invited Paper Alberto Castellazzi[1], Asad Fayyaz[1], Emre Gurpinar[2], Abdallah Hussein[1], Jianfeng Li[1], Bassem Mouawad[1]
1) University of Nottingham, UK, 2) Oak Ridge National Laboratory, USA

21C1-2 **An Alternative Method to Accurately Determine the Thermal Resistance of SiC MOSFET Structures with Discrete Diodes**
Invited Paper Andras Vass-Varnai[1], Young Joon Cho[1], Gabor Farkas[2], Marta Rencz[2,3]
1) Mentor Graphics, Korea, 2) Mentor Graphics, Hungary, 3) Budapest University of Technology and Economics, Hungary

21C1-3 **Heat-Resistant Packaging Technology for Wide Bandgap Power Devices and Thermal Reliability Testing**
Invited Paper K. Suganuma, H. Zhang, S. Nagao, C. Chen, T. Sugahara, A. Shimoyama, A. Suetake
Osaka University, Japan

21C1-4 **Verification of Identification Accuracy of Loss Calculated by Inverse Thermal Analysis**
Invited Paper Yuki Ikari, Kazushige Nakao
Fukui University of Technology, Japan

21C1-5 **Packaging Architectures for Silicon Carbide Power Electronic Modules**
Invited Paper H. Alan. Mantooth, Simon S. Ang
University of Arkansas, USA

Room D

Oral Session 21D1 High Speed Machines and Drives

21D1-1 **Development of a Homo-Polar Bearingless Motor with Concentrated Winding for High Speed Applications**
Invited Paper Junichi Asama[1], Dai Suzuki[1], Takaaki Oiwa[1], Akira Chiba[2]
1) Shizuoka University, Japan, 2) Tokyo Institute of Technology, Japan

21D1-2 **High-Speed Slotless Permanent Magnet Machines: Modelling and Design Frameworks**
Invited Paper S. Jumayev[1], K.O. Boynov[1], E.A. Lomonova[1], J. Pyrhönen[2]
1) Eindhoven University of Technology, The Netherlands, 2) Lappeenranta University of Technology, Finland

21D1-3 **Development and Performance of High-Speed SPM Synchronous Machine**
Invited Paper Kota Kawanishi[1], Keisuke Matsuo[1], Takayuki Mizuno[1], Koji Yamada[1], Takashi Okitsu[1], Kouki Matsuse[2]
1) Meidensha Corporation, Japan, 2) Meiji University Tokyo, Japan

21D1-4 **1.2kW 100,000rpm High Speed Motor for Aircraft**
Invited Paper Takehiro Jikumaru, Gen Kuwata
IHI Corporation, Japan

21D1-5 **Comparative Evaluation of Y-Inverter against Three-Phase Two-Stage Buck-Boost DC-AC Converter Systems**
Invited Paper Michael Antivachis, Dominik Bortis, David Menzi, Johann W. Kolar
ETH Zurich, Switzerland

Room E

Oral Session 21E1 System Management Technologies

21E1-1 **DC-Powered Office Buildings and Data Centres**
Invited Paper **The First 380 VDC Micro Grid in a Commercial Building in Germany**
Tilo Pueschel
Bachmann GmbH, Germany

21E1-2 **Recent Trend in Power Electronics for ICT Systems**
Invited Paper Hiroshi Nakao[1,2], Yu Yonezawa[1], Yoshiyasu Nakashima[1]
1) Fujitsu Laboratories LTD., Japan, 2) Nagasaki University, Japan

21E1-3 **Green Base Station Using Robust Solar System and High Performance Lithium Ion Battery for Next Generation Wireless Network (5G) and against Mega Disaster**
Invited Paper
M. Nakamura, K. Takeno
NTT DOCOMO, Inc., Japan

21E1-4 **Optimization of Maintenance by Failure Prediction Considering Instantaneous and Cumulative Effects of External Environments**
Invited Paper
Kaisei Kanetani[1], Masahiro Yamazaki[1], Tadatoshi Babasaki[1], Hideaki Kim[2], Tatsushi Matsubayashi[2]
1) NTT Facilities, Inc., Japan, 2) Nippon Telegraph and Telephone Corporation, Japan

21E1-5 **Hybrid Converters with Reduced Inductor Loss for Integratable Power Conversion**
Invited Paper
Gab-Su Seo[1,2], Hanh-Phuc Le[1]
1) University of Colorado, USA, 2) National Renewable Energy Laboratory, USA

Room F

Oral Session 21F1 Recent Motor Drive Technologies for Industrial Applications

21F1-1 **Energy Saving System Trend For Harbor Crane with Lithium Ion Battery**
Invited Paper
Hidemasa Yoshihara
Yaskawa Siemens Automation and Drives Corp., Japan

21F1-2 **Inverter Drive of Dynamometers for Automotive Evaluation System**
Invited Paper
Shizunori Hamada, Toshimichi Takahashi, Nobutaka Kezuka, Masaju Kouketsu, Shingo Ishigaki
Meidensha Corporation, Japan

21F1-3 **Experimental Investigation of Prototype All-SiC Converter for Ultra-High-Speed Elevator**
Invited Paper
Kazuhisa Mori, Kaoru Katoh, Yohei Matsumoto, Tatsushi Yabuuchi, Naoto Ohnuma
Hitachi, Ltd., Japan

21F1-4 **High-Voltage, Large-Capacity Converter Technologies and Their Applications**
Invited Paper
Daisuke Yoshizawa[1], Paul Bixel[2], Masahiko Tsukakoshi[1]
1) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan, 2) TMEIC Corporation, U.S.A

21F1-5 **Higher Radial Suspension Force of Magnetic Bearing on Centrifugal Compressor for HVAC**
Invited Paper
Yuji Nakazawa, Yusuke Irino, Atsushi Sakawaki, Kazunobu Ohyama
Daikin Industries, Ltd., Osaka, Japan

Room G

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

21G1-1 **Novel Switching Control Method for Full-Bridge DC-DC Converters for Improving Light-Load Efficiency Using Reverse Recovery Current**
Fumihiro Sato, Takae Shimada, Takayuki Ouchi
Hitachi, Ltd., Japan

21G1-2 **A 800V/14V Soft-Switched Converter with Low-Voltage Rating of Switch for xEV Applications**
Byeongwoo Kim, Kangsan Kim, Sewan Choi
Seoul National University of Science and Technology, Korea

21G1-3 **High Speed Control Method for Superposing High-Frequency-High-Sinusoidal-Current with DC Current to Analyze Battery AC Impedance**
Jin Xu, Toshihiko Kishimoto, Noboru Shimosato
Myway Plus Corporation, Japan

21G1-4 **EV BMS with Time-Shared Isolated Converters for Active Balancing and Auxiliary Bus Regulation**
Z. Gong[1], B.A.C. van de Ven[1,2], Y. Lu[1], Y. Luo[1], K. Gupta[1], C. da Silva[1], H.J. Bergveld[2], O. Trescases[1]
1) University of Toronto, Canada, 2) Eindhoven University of Technology, The Netherlands

Room H

Oral Session 21H1 Power Electronics and Applied to Home Appliances

21H1-1 **A Driving Circuit with Partial Power Regulation for RGB LED Lamps**
You-Chun Huang[1], Yu-Jen Chen[2]; Yong-Jyun Li[3], Chin-Sien Moo[1]
1) National Sun Yat-Sen University, Taiwan, 2) Industrial Technology Research Institute, Taiwan, 3) Gemtek Technology Co., Ltd, Taiwan

21H1-2 **FPGA-Based Dynamic Duty Cycle and Frequency Controller for a Class-E^2 DC-DC Converter**
Sanghyeon Park, Juan Rivas-Davila
Stanford University, USA

21H1-3 **Design Methodology of 3 kW Induction Heating System for Both Low Resistance and High Resistance Containers in a Single Burner.**
Si-hoon Jeong, Hwa-pyeong Park, Jee-hoon Jung
Ulsan National Institute of Science and Technology, Korea

21H1-4 **Multi-Resonant Inverter Realizing Downsizing and Loss Reduction for All-Metallic IH Cooktop**
Takayuki Hirokawa, Makoto Imai, Atsushi Fujita
Panasonic Corporation, Japan

Room K

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

21K1-1 **Temperature Estimation of Aluminum Electrolytic Capacitor under Actual Circuit Operation**
Invited Paper Kazuki Urata, Toshihisa Shimizu
Tokyo Metropolitan University, Japan

21K1-2 **Design and Evaluation of Current Distribution in Power Module**
Invited Paper Takaaki Ibuchi, Eisuke Masuda, Tsuyoshi Funaki
Osaka University, Japan

21K1-3 **Development of Impedance-Source Inverter Using SiC-MOSFET**
Invited Paper Ryuji Iijima, Thilak Senanayake, Takanori Isobe, Hiroshi Tadano
University of Tsukuba, Japan

21K1-4 **Control Methodology for Realization of 100kW HEECS Chopper with 99.5% Efficiency**
Invited Paper Yukinori Tsuruta, Atsuo Kawamura
Yokohama National University, Japan

21K1-5 **Iron Loss Reduction in the Cores of Induction Heating Coils for Small-Foreign-Metal Particle Detector with a 400-kHz SiC-MOSFETs High-Frequency Inverter**
Invited Paper
Takuya Shijo, Yuki Uchino, Yujiro Noda, Hiroaki Yamada, Toshihiko Tanaka
Yamaguchi University, Japan

Monday, May 21: 15:55-18:00

Room A

Oral Session 21A2 Wireless Power Transfer Systems I

21A2-1 **Frequency Tracking Burst-Mode PDM-Controlled Class-D Zero Voltage Soft-Switching Resonant Converter for Inductive Power Transfer Applications**
Yoichiro Tabata, Tomokazu Mishima, Tatsuya Kido
Kobe University, Japan

21A2-2 **Reduced-Order Dynamical Models of Tuned Wireless Power Transfer Systems**
Hongchang Li, Jingyang Fang, Yi Tang
Nanyang Technological University, Singapore

21A2-3 **Dynamic Modelling and Closed Loop Control of Transmitter Parallel and Receiver Series Compensated IPT Topology for EV Applications**
Suvendu Samanta, Akshay Kumar Rathore
Concordia University, Canada

21A2-4 **Development of Inductive Power Transfer System for Excavator under Large Load Fluctuation -Consideration of Relationship between Load Voltage and Resonance Parameter-**
Jun-ichi Itoh, Kent Inoue, Keisuke Kusaka
Nagaoka University of Technology, Japan

21A2-5 **Wireless Power Transfer System Using Three-Phase to Single-Phase Matrix Converter**
Yuji Hayashi, Hiromasa Motoyama, Takaharu Takeshita
Nagoya Institute of Technology, Japan

Room B

Oral Session 21B2 Dual Active Bridge Converters

21B2-1 **Design of a Reduced-Order Observer for Sensorless Control of Dual-Active-Bridge Converter**
Nguyen Duy Dinh[1,2], Goro Fujita[1]
1) Shibaura Institute of Technology, Japan, 2) Hanoi University of Science and Technology, Vietnam

21B2-2 **Improved Load Transient Response of a Dual-Active-Bridge Converter**
Sheng-Zhi Zhou, Chuan Sun, Song Hu, Guo Chen, Xiaodong Li
Macau University of Science and Technology, China

21B2-3 **Modulation and Active Midpoint Control of a Three-Level Three-Phase Dual-Active Bridge DC-DC Converter under Non-Symmetrical Load**
Philipp Joebges, Anton Gorodnichev, Rik W. De Doncker
RWTH Aachen University, Germany

21B2-4 **A Novel Switching Algorithm to Improve Efficiency at Light Load Conditions for Three- Phase DAB Converter in LVDC Application**
Hyun-jun Choi, Si-hoon Jung, Jee-hoon Jung
Ulsan National Institute of Science and Technology, Korea

21B2-5 **Design of a High-Frequency Dual-Active Bridge Converter with GaN Devices for an Output Power of 3:7kW**
Philipp Schülting, Christian Winter, Rik W. De Doncker
Aachen University, Germany

Room C

Oral Session 21C2 Magnetic Components

21C2-1 **Exploration of the Design and Performance Space of a High Frequency 166 kW / 10 kV SiC Solid-State Air-Core Transformer**
Piotr Czyz, Thomas Guillod, Florian Krismer, Johann W. Kolar
ETH Zürich, Switzerland

21C2-2 **Novel Calculation Method of Iron Loss of Gapped Inductors Using Loss Map**
Yoshihiro Miwa, Toshihisa Shimizu
Tokyo Metropolitan University, Japan

21C2-3 **Verification of the Reduction of the Copper Loss by the Thin Coil Structure for Induction Cookers**
Morimasa Hataya, Koki Kamaeguchi, Eiji Hiraki, Kazuhiro Umetani, Takayuki Hirokawa, Makoto Imai, Hideki Sadakata
1) Okayama University, Japan, 2) Panasonic Corporation, Japan

21C2-4 **Condition Monitoring of Electrolytic Capacitor Based on ESR Estimation and Thermal Impedance Model Using Improved Power Loss Computation**
Sundararajan Prasanth[1], Mohamed Halick Mohamed Sathik[1], Firman Sasongko[1], Tan Chuan Seng[1], Peng Yaxin[1], Rejeki Simanjorang[2]
1) Nanyang Technological University, Singapore, 2) Rolls-Royce Singapore Pte. Ltd., Singapore

21C2-5 **Test Setup for Characterisation of Biased Magnetic Hysteresis Loops in Power Electronic Applications**
Min Luo[1], Drazen Dujic[1], Jost Allmeling[2]
1) École Polytechnique Fédérale de Lausanne, Switzerland, 2) Plexim GmbH, Switzerland

Room D

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

21D2-1 **A Fast Open-Circuit Fault Diagnosis Scheme for Modular Multilevel Converters with Model Predictive Control**
Dehong Zhou, Shunfeng Yang, Yi Tang
Nanyang Technological University, Singapore

21D2-2 **An Online Open-Circuit Fault Diagnosis and Fault Tolerant Scheme for Three-Phase AC-DC Converters with Model Predictive Control**
Dehong Zhou, Yi Tang
Nanyang Technological University, Singapore

21D2-3 **The Lifetime Assessment of a Micro-Inverter for PV Applications**
Tohihiro Shimao[1], Koji Kato[1], Youichi Ito[1], Akio Iwabuchi[1], Yongheng Yang[2], Frede Blaabjerg[2]
1) Sanken Electric Co., Ltd., Japan, 2) Aalborg University, Denmark

21D2-4 **Online Health Monitoring of Multiple MOSFETs in a Grid-Tied PV Inverter Using Spread Spectrum Time Domain Reflectometry (SSTDR)**
Sourov Roy, Faisal Khan
University of Missouri, USA

21D2-5 **An Improved Equivalent Model for a Long PV String under Partial Shading Conditions**
Xiaoyang Wang, Huiqing Wen, Xingshuo Li
Xian Jiaotong-Liverpool University, China

Room E

Oral Session 21E2 IM Drives

21E2-1 **Optimized Flux-Weakening Control of Induction Motor for Torque Enhancement in Voltage Extension Region**
Zhen Dong, Yong Yu, Bo Wang, Qinghua Dong, Dianguo Xu
Harbin Institute of Technology, China

21E2-2 **Improved Performance of CFTC-Based Direct Torque Control of Induction Machines by Increasing Torque Loop Bandwidth**
Ibrahim Mohd Alsofyani, June-Hee Lee, Kyo-Beum Lee
Ajou University, Korea

21E2-3 **μ-Analysis Evaluation of A Novel Combined Current-and-Speed Control for Induction Motors via ILQ Design Method**
Shuto Omori[1], Hiroshi Takami[1], Masashi Nakamura[2]
1) Shibaura Institute of Technology, Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

21E2-4 **Loss Minimization Control of Sensorless Scalar-Controlled Induction Motor Drives Considering Iron Loss**
Nguyen Anh Tan, Dong-Choon Lee
Yeungnam University, Korea

21E2-5 **Tuning of Induction Motor Drive with Torque Sensor**
Hajime Kubo, Yugo Tadano
Meidensha Corporation, Japan

Room F

Oral Session 21F2 Control and Design Technologies for Industrial Applications

21F2-1 **Quasi-Two-Level Converter for Overvoltage Mitigation in Medium Voltage Drives**
F. Bertoldi[1], M. Pathmanathan[1], R. S. Kanchan[1], K. Spiliotis[2], J. Driesen[2]
1) ABB Corporate Research, Sweden, 2) ESAT-ELECTA, Belgium

21F2-2 **A Medium-Voltage Three-Phase AC-DC Converter Consisting of Cascaded Three-Level Boost-Type Rectifiers and an Open-End Winding Transformer**
Ryoji Tsuruta[1], Hiromitsu Suzuki[2], Ritaka Nakamura[2]
1) Mitsubishi Electric Corp., Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corp. (TMEIC) , Japan

21F2-3 **A Fault Tolerant Control Strategy for the Delta-Connected Cascaded Converter**
Ping-heng Wu, Po-tai Cheng
National Tsing Hua University, Taiwan

21F2-4 **Cooling Performance Improvement of Heat Sink by Oscillating Heat Pipe Addition and Design for Environment of Oscillating Heat Pipe Refrigerant**
Kuan-Chung Tey, Kenichiro Suzuki
Meidensha Corporation, Japan

21F2-5 **Compact Large Capacity Gas Turbine Static Starter**
Hironori Kawaguchi, Shigeyuki Nakabayashi, Akinobu Ando, Hiroshi Ogino, Yasuaki Matsumoto, Ikuto Udagawa, Takahiro Ohta
Toshiba Mitsubishi-Electric Industrial Systems Corporation, TMEIC, Japan

Room G

Oral Session 21G2 Applications of Grid-tied Inverters I

21G2-1 **Voltage Reference Modification Scheme for Resonance Suppression in LCL-Filtered Inverters with Discontinuous PWM Method**
Hyeon-Sik Kim, Seung-Ki Sul
Seoul National University, Korea

21G2-2 **Parametric Robustness Analysis for Parallel Feedforward Compensation Based Active Damping of LCL Grid Connected Inverter**
Muhammad Talib Faiz[1], Muhammad Mansoor Khan[1], Xu Jianming[2], Muhammad Ali[1], Houjun Tang[1]
1) Shanghai Jiaotong University, China., 2) Changzhou Power Supply Company, China

21G2-3 **Open-Loop-Based Island-Mode Voltage Control Method for Single-phase Grid-Tied Inverter with Minimized LC Filter**
Satoshi Nagai, Jun-ichi Itoh
Nagaoka University of Technology, Japan

21G2-4 **Experimental Validation of Adaptive Current Injecting Method for Grid-Synchronization Improvement of Grid-Tied REGS During Short-Circuit Fault**
Shaokang Ma[1], Hua Geng[1], Geng Yang[1], Bo Liu[2]
1) Tsinghua University, China, 2) Zongheng Electro-Mechanical Technology Development Co., China

21G2-5 **Adaptive Control of Grid-Voltage Feedforward for Grid-Connected Inverters based on Real-Time Identifications of Grid Impedance**
Roni Luhtala, Tuomas Mess, Tomi Roinila
Tampere University of Technology, Finland

Room H

Oral Session 21H2 Motion Control Applications

21H2-1 **Model Based Tuning of Proportional Resonant Controllers for Voltage Source Inverters**
Stefan Almér, Thomas Besselmann, Mario Schweizer
ABB Corporate Research, Switzerland

21H2-2 **An SoC-Based Platform for Integrated Multi-Axis Motion Control and Motor Drive**
Yongping Sun, Ming Yang, Yangyang Chen, Wangpin He, Dianguo Xu
Harbin Institute of Technology, China

21H2-3 **Variable Switching Frequency Strategy for Enhanced Settling Performance of Position Control within Inverter Loss Limit**
Choongin Lee, Jung-Ik Ha
Seoul National University, Korea

21H2-4 **Two-Wheel Cane for Walking Assistance**
Phi Van Lam, Yasutaka Fujimoto
Yokohama National University, Japan

21H2-5 **Fall Prevention and Vibration Suppression of Wheelchair Using Rider Motion State**
Isseki Takahashi, Toshiyuki Murakami
Keio University, Japan

Room K

Oral Session 21K2 DC Grids as Future Grid Solutions

21K2-1 **Stabilization Method for Residential DC System Based on Passivity Criterion**
Invited Paper Hiroaki Kakigano
Ritsumeikan University, Japan

21K2-2 **A Novel Control Approach to Multi-Terminal Power Flow Controller for Next-Generation DC Power Network**
Invited Paper Kenji Natori, Yuta Nakao, Yukihiko Sato
Chiba University, Japan

21K2-3 **DC Microgrid for Telecommunications Service and Related Application**
Invited Paper Keiichi Hirose
NTT Facilities, Inc., Japan

21K2-4 **MVDC Distribution Grids for Electric Vehicle Fast-Charging Infrastructure**
Invited Paper Marco Stieneker, Benedict J. Mortimer, Arne Hinz, Adolf Müller-Hellmann, Rik W. De Doncker
RWTH Aachen Univeristy, Germany

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

Room A

Oral Session 22A1 High Frequency Converters

22A1-1 **Review of Resonant Gate Driver in Power Conversion**
Bainan Sun, Zhe Zhang, Michael A. E. Andersen
Technical University of Denmark, Denmark

22A1-2 **A Low Profile High Frequency LED Driving System Based on Aircore Planar Inductor**
Yueshi Guan, Xihong Hu, Shu Zhang, Yijie Wang, Dianguo Xu, Wei Wang
Harbin Institute of Technology, China

22A1-3 **Analysis and Compensation of Dead-Time Effect in SiC-Device-Based High-Switching-Frequency Inverters**
Qingzeng Yan[1,2], Xibo Yuan[1], Xiaojie Wu[2], Yiwen Geng[2]
1) University of Bristol, UK, 2) China University of Mining and Technology, China

22A1-4 **Control and Performance of New Asymmetrical Operation for Switched-Capacitor-Based Resonant Converters**
Hadi Setiadi, Hideaki Fujita
Tokyo Institute of Technology, Japan

22A1-5 **High-Frequency Resonant Converter with Synchronous Rectification for High Conversion Ratio and Variable Load Operation**
Lei Gu, Kawin Surakitbovorn, Juan Rivas-Davila
Stanford University, USA

Room B

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

22B1-1 **Smart PV Inverters for Smart Grid Applications**
Invited Paper Cheng-Jhen Yang[1], Terng-Wei Tsai[1], Yi-Chan Li[1], Cheng-Yu Tang[2], Yaow-Ming Chen[1], Yung-Ruei Chang[3]
1) National Taiwan University, Taiwan, 2) Feng Chia University, Taiwan, 3) Atomic Energy Council, Taiwan

22B1-2 **High-Voltage Bi-Directional Half-Bridge Three-Level Series Resonant Converter with Frequency Modulation Control**
Invited Paper Sih-Yi, Lee[1], Jynu-Jhe, Jhang[1], Jing-Yuan, Lin[1], Yao-Ching, Hsieh[2], Haung-Jen, Chiu[1]
1) National Taiwan University of Science and Technology, Taiwan, 2) National Sun Yat-Sen University, Taiwan

22B1-3 **A Control Strategy for Flying-Start of Shaft Sensorless Permanent Magnet Synchronous Machine Drive**
Invited Paper Zih-Cing You, Sheng-Ming Yang
National Taipei University of Technology, Taiwan

22B1-4 **Contactless EV Power Track System with Segment-Excited Inductively Coupled Structure**
Invited Paper Jia-You Lee, Yu-Chi Wang, Chih-Yi Liao
National Cheng Kung University, Taiwan

Room C

Oral Session 22C1 Motion Control I

22C1-1 **Driving Test Evaluation of Sensorless Vehicle Detection Method for In-Motion Wireless Power Transfer**
Invited Paper Katsuhiro Hata[1], Kensuke Hanajiri[1], Takehiro Imura[1], Hiroshi Fujimoto[1], Yoichi Hori[1], Motoki Sato[2], Daisuke Gunji[3]
1) The University of Tokyo, Japan, 2) Toyo Denki Seizo K. K., Japan, 3) NSK Ltd., Japan

22C1-2 **A System Design Method of High-Frequency Class-D Inverter for Wideband Current Control**
Invited Paper Hiroki Kurumatani, Seiichiro Katsura
Keio University, Japan

22C1-3 **Analysis of Interior Permanent Magnet Two Degrees of Freedom Motor Based on Cross-Coupled Structure**
Invited Paper Yoshiyuki Hatta[1,2], Tomoyuki Shimono[1,2]
1) Yokohama National University, Japan, 2) Kanagawa Institute of Industrial Science and Technology, Japan

22C1-4 **Study Comparison between Firefly Algorithm and Particle Swarm Optimization for SLAM Problems**
Invited Paper Mounia Janah, Yasutaka Fujimoto
Yokohama National University, Japan

22C1-5 **Bandwidth Limitations in Force Control of a Series Elastic Actuator with Backlash and Quantization**
Invited Paper Hanul Jung, Chan Lee, Sehoon Oh
DGIST, Korea

Room D

Oral Session 22D1 PM Machines

22D1-1 **Rotor Shape Optimization of Interior Permanent Magnet Synchronous Motors with Concentrated Windings by Considering End-Leakage Flux**
Katsumi Yamazaki, Hiroki Narushima
Chiba Institute of Technology, Japan

22D1-2 **Loss Analysis of Permanent-Magnet Synchronous Machines Considering In-plane Eddy Current in Electrical Steel Sheets**
Hideki Ohguchi[1], Satoshi Imamori[1], Katsumi Yamazaki[2], Haiyan Yui[2], Masao Shuto[1]
1) Fuji Electric Co., Ltd., Japan, 2) Chiba Institute of Technology, Japan

22D1-3 **Study on Influence of Difference in Structure of Concentrated Winding IPMSMs Obtained by Automatic Design**
A. Ura, M. Sanada, S. Morimoto, Y. Inoue
Osaka Prefecture University, Japan

22D1-4 **Carrier Harmonic Loss Reduction Technique on Dual Three-Phase Permanent-Magnet Synchronous Motors with Phase-Shift PWM**
Yoshihiro Miyama[1,2], Haruyuki Kometani[1], Kan Akatsu[2]
1) Mitsubishi Electric Corporation, Japan, 2) Shibaura Institute of Technology, Japan

22D1-5 **Flux Intensifying PM-Motor with Variable Leakage Magnetic Flux Technique**
Masahiro Aoyama[1], Toshihiko Noguchi[2]
1) Suzuki Motor Corporation, Japan, 2) Shizuoka University, Japan

Room E

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

22E1-1 **Continuous Operation Control of PMSM in the Case of DC Power Supply Loss**
Invited Paper Jongwon Heo, Keiichiro Kondo
Chiba University, Japan

22E1-2 **Model Predictive Control for Multiphase Motor Drives – a Technology Status Review**
Invited Paper A. Tenconi, S. Rubino, R. Bojoi
Politecnico di Torino, Italy

22E1-3 **Influence of Fast Switching Semiconductors on the Winding Insulation System of Electrical Machines**
Invited Paper Kay Hameyer, Andreas Ruf, Florian Pauli
RWTH Aachen University, Germany

22E1-4 **Centralized Control of Modular Multi Rectifier for Motor Drive Applications under Unbalanced Grid**
Invited Paper Yipeng Song, Pooya Davari, Frede Blaabjerg
Aalborg University, Denmark

22E1-5 **Vector Control of Magnetically Modulated Motor for Power Splitting of HEV Application**
Invited Paper Toshihiko Noguchi, Sawanth Krishna Machavolu, Masahiro Aoyama, Yuto Motohashi
Shizuoka University, Japan

Room F

Oral Session 22F1 Grid-tied Converters with Virtual Inertia

22F1-1 **Impedance-Based Stability Evaluation of Virtual Synchronous Machine Implementations in Converter Controllers**
Invited Paper
Eneko Unamuno[1], Atle Rygg[2], Mohammad Amin[3], Marta Molinas[2], Jon Andoni Barrena[1]
1) Mondragon Unibertsitatea, Spain, 2) Norwegian University of Science and Technology, Norway, 3) Illinois Institute of Technology, USA

22F1-2 **Stable Power Supply Method for Household Appliances via Virtual Synchronous Generator in Single-Phase Three-Wire Microgrid**
Invited Paper
Yuko Hirase[1], Hidehiko Nakagawa[1], Eiji Yoshimura[1], Shogo Katsura[1], Kensho Abe[1], Osamu Noro[1], Kazushige Sugimoto[2], Kenichi Sakimoto[2]
1) Kawasaki Technology Co., Ltd., Japan, 2) Kawasaki Heavy Industries, Ltd., Japan

22F1-3 **A Novel Oscillation Damping Method of Virtual Synchronous Generator Control without PLL Using Pole Placement**
Invited Paper
Jia Liu, Yushi Miura, Toshifumi Ise
Osaka University, Japan

22F1-4 **Operation of a Modular Multilevel Converter Controlled as a Virtual Synchronous Machine**
Invited Paper
Salvatore D'Arco[1], Giuseppe Guidi[1], Jon Are Suul[1,2]
1) Energy Research, Norway, 2) Norwegian University of Science and Technology, Norway

22F1-5 **Assessment of Virtual Synchronous Machine Based Control in Grid-Tied Power Converters**
Invited Paper
Chi Li, Igor Cvetkovic, Rolando Burgos, Dushan Boroyevich
Virginia Tech, USA

Room G

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

22G1-1 **Comparison of Optimized Demand of EGs for Minimizing Fuel Consumption and EGs Model with Power Grid Frequency Using a Hpspital Load with PV**
Invited Paper
Yuji Mizuno, Teppei Baba, Fujio Kurokawa, Nobumasa Matsui
Nagasaki Institute of Applied Science, Japan

22G1-2 **Indirect Current Control for Seamless Transfer of Utility Interactive Inverter**
Invited Paper
Kyungbae Lim, Injong Song, Jaeho Choi
Chungbuk National University, Korea

22G1-3 **Study of AC Power Interchange and DC Power Interchange for Micro Grid Systems**
Invited Paper
Kazuto Yukita, Daiki Owaki, Shunsuke Horie, Toshiro Matsumura, Yasuyuki Goto
Aichi Institute of Technology, Japan

22G1-4 **Stability Enhancement Strategy for Islanding Microgrid with Multi-Type Inverters Based on Hybrid Impedance Modelling**
Invited Paper
Meiqin Mao, Yong Ding, Yatao Shen, Liuchen Chang
Hefei University of Technology, China

22G1-5 **DC Powered Data Center with 200 kW PV Panels**
Invited Paper
Keiichi Hirose
NTT Facilities, Inc., Japan

Room H

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

22H1-1 **Influences of Deterioration in Capacitor and Inductor on Current Sensorless Static Model DC-DC Converter**
Fujio Kurokawa[1], Masashi Taguchi[2], Jizhe Wang[2], Hidenori Maruta[2], Nobumasa Matsui[1]
1) Nagasaki Institute of Applied Science, Japan, 2) Nagasaki University, Japan

22H1-2 **Capacitive Divider Based Passive Start-Up Methods for Flying Capacitor Step-Down DC-DC Converter Topologies**
Michael Halamicek, Tom Moiannou, Nenad Vukadinović, Aleksandar Prodić
University of Toronto, Canada

22H1-3 **High Voltage Gain Interleaved Active-Clamp Forward (IACF) Converter Having Reduced Primary Conduction Loss**
Yeonho Jeong[1], Mu-Hyun Park[1], Gun-Woo Kim[1], Byoung-Hee Lee[2], Gun-Woo Moon[1]
1) KAIST, Korea, 2) Han-Bat University, Korea

22H1-4 **Control of Switching-Capacitor Based Buck-Boost Converter**
M. Veerachary, Vasudha Khubchandani
Indian Institute of Technology Delhi, India

22H1-5 **Improvement of Upload Transient Responses for Ultra High Step-Down Converter**
Y. T. Yau[1], K. I. Hwu[2]
1) Asian Power Devices Inc., Taiwan, 2) National Taipei University of Technology, Taiwan

Room K

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

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

22K1-2 **Development of Room Air Conditioner with Twin-Propeller Fans**
Invited Paper Takamasa Uemura, Tomoya Fukui, Kenichi Sakoda
Mitsubishi Electric Corporation Advanced Technology R&D Center, Japan

22K1-3 **Electrolytic Capacitor-Less Single-Phase to Three-Phase Inverter with Harmonics Suppression Control for Air Conditioner**
Invited Paper Nobuo Hayashi, Takuro Ogawa, Tomoisa Taniguchi, Morimitsu Sekimoto
Daikin Industries, Ltd., Japan

22K1-4 **Latest Development of SiC Power Module-Based Single-Stage AC-AC Resonant Converter for High-Frequency Induction Heating Applications**
Invited Paper Tomokazu Mishima
Kobe University, Japan

22K1-5 **An Optimized Control Strategy to Improve the Current Zero-Crossing Distortion in Bidirectional AC/DC Converter Based on V2G Concept**
Invited Paper Lei Jing, Xiaoqing Wang, Bodong Li, Maohang Qiu, Bo Liu, Min Chen
ZheJiang University, China

Tuesday, May 22: 13:10-14:30

Room P

Poster Session 22P1 DC-AC Converters I

22P1-1 **Per-Phase Control Strategy of the Three-Phase Four-Wire Inverter**
Yi-Chan Li[1], Terng-Wei Tsai[1], Cheng-Jhen Yang[1], Yaow-Ming Chen[1], Yung-Ruei Chang[2]
1) National Taiwan University, Taiwan, 2) Institute of Nuclear Energy Research, Atomic Energy Council, Taiwan

22P1-2 **Opportunities for Performance Improvement of Single-Phase Power Converters through Enhanced Automatic-Power-Decoupling Control**
Huawei Yuan[1], Sinan Li[1], Wenlong Qi[1], Siew-Chong Tan[1], S. Y. (Ron)Hui[1,2]
1) The University of Hong Kong, China, 2) Imperial College London, UK

22P1-3 **Zero Voltage Switching Scheme for Flyback Converter to Ensure Compatibility with Active Power Decoupling Capability**
Hiroki Watanabe, Jun-ichi Itoh
Nagaoka University of Technology, Japan

22P1-4 **Model Predictive Fault Tolerant Control of Bidirectional AC/DC Converter with Voltage Balance of Split Capacitor**
Nan Jin, Chongyan Zhao, Leilei Guo
Zhengzhou University of Light Industry, China

Poster Session 22P2 DC-AC Converters II

22P2-1 **PWM Strategy for Parallel Operation of Three Phase Converters Tied to Grid**
Hyun-Sam Jung, Seung-Ki Sul
Seoul National University, Korea

22P2-2 **Practical Issues and Implementation Circuits of the Digital-Analog Hybrid Full Feed-Forward Method with Unipolar and Bipolar Modulations**
Xin Zhang[1], Henry S. H. Chung[2], ZhiXun Ma[1]
1) Nanyang Technological University, Singapore, 2) City University of Hong Kong, Hong Kong

22P2-3 **An AC-DC Power Converter for Electrolytic Capacitor-less LED Driver with High Luminous Efficacy**
Kwon-Sik Park, Byuong-Jun Seo, Kyoung-Suk Kang, Eui-Cheol Nho
Pukyong National University, Korea

Poster Session 22P3 DC-DC Converters I

22P3-1 **An Improved Cascaded Dual-Buck Inverter**
Usman Ali Khan[1], Honnyong Cha[1], Ashraf Ali Khan[2], Heung-Geun Kim[3], Wilson Eberle[1], Liwei Wang[2]
1) Kyoungpook National University, Korea, 2) The University of British Columbia, Canada

22P3-2 **A Single-Switch Integrated-Stage LED Driver Based on Cuk and Class-E Converter**
Shu Zhang, Yijie Wang, Xiaosheng Liu, Yan Zhou, Dianguo Xu
Harbin Institute of Technology, China

Poster Session 22P4 Grid-tied Converters I

22P4-1 **A Fault-Tolerant Parallel Inverter Applied to Micro-Grid**
Yan Li, Xiangyue Shi, Jinjie Peng, Zhifeng Qiu, Wei Xiong
Central South University, China

22P4-2 **Stability Analysis of Grid-Connected Converters with Add-on Voltage Support Functionality Using Repetitive Control**
Y. Zhang, M. G. L. Roes, M. A. M. Hendrix, J. L. Duarte
Eindhoven University of Technology, The Netherlands

22P4-3 **Adaptive Series Stabilizer Module for the Grid Connected Inverter under Variable Grid Conditions**
Xin Zhang
Nanyang Technological University, Singapore

22P4-4 **An Improved Droop Control Based Smooth Transfer Control Strategy**
Xin Meng, Jinjun Liu, Zeng Liu, Ronghui An
Xi'an Jiaotong University, China

22P4-5 **Frequency Response Analysis of Load Effect on Dynamics of Grid-Forming Inverter**
Matias Berg, Tuomas Messo, Teuvo Suntio
Tampere University of Technology, Finland

Poster Session 22P5 Isolated DC-DC Converters I

22P5-1 **A New Control Method for Triple-Active Bridge Converter with Feed Forward Control**
Takanobu Ohno, Nobukazu Hoshi
Tokyo University of Science, Japan

22P5-2 **Analysis of PFM Operation Model for Capacitor Charger Resonant Topology with Energy Dosage**
Pengyu Jia, Yiqin Yuan, Shengwen Fan, Zhenyu Shan
North China University of Technology, China

22P5-3 **An Active-Clamped Current-Fed Half-bridge DC-DC Converter With Three Switches**
Truong-Duy Duong[1], Minh-Khai Nguyen[2], Young-Cheol Lim[1], Joon-Ho Choi[1]
1) Chonnam National University, Korea, 2) Chosun University, Korea

Poster Session 22P6 Isolated DC-DC Converters II

22P6-1 **A High Gain Quasi Single Stage LLC Resonant DC/DC Converter with Coupled Inductor and Partial Active Clamp**
Chongcan Huo, Xiaogao Xie, Shuai Jiang, Hanjing Dong
Hangzhou Dianzi University, China

22P6-2 **Suppression of Ripple Current in High Step-Up DC-DC Converter Utilizing Cockcroft-Walton Circuit with Inductor**
Takumi Yasuda, Masataka Minami, Shin-ichi Motegi, Masakazu Michihira
Kobe City College of Technology, Japan

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

Poster Session 22P7 Multi-level Converters and MMC I

22P7-1 **Comparison of Harmonic Linearization and Harmonic State Space Methods for Impedance Modeling of Modular Multilevel Converter**
Jing Lyu[1], Xin Zhang[2], JingJing Huang[2], Jianwen Zhang[1], Xu Cai[1]
1) Shanghai Jiao Tong University, China, 2) Nanyang Technological University, Singapore

22P7-2 **An Improved Phase-Shifted PWM for a Five-level Hybrid-Clamped Converter**
Kui Wang[1], Nianzhou Liu[2], Zedong Zheng[1], Yongdong Li[1]
1) Tsinghua University, China, 2) Wuhan Institute of Marine Electric Propulsion, China

22P7-3 **Integrated Control Methods for Asymmetrical Cascaded H-bridge Rectifier**
Wenjing Dai, Jie Chen, Xin Chen, Chunying Gong
Nanjing University of Aeronautics and Astronautics, China

22P7-4 **Transient Voltage Stress Modeling for Submodules of Modular Multilevel Converters under Grid Voltage Sags**
Zhijian Yin, Yongheng Yang, Huai Wang
Aalborg University, Denmark

22P7-5 **SVPWM Strategy Based on Multilevel 3LNPC-CR**
Xiaoqiong He[1,2], Pengcheng Han[1], Xiaolan Lin[1], Yi Wang[1], Xu Peng[1]
1) Southwest Jiaotong University, China, 2) National Rail Transit Electrification and Automation Engineering Technique Research Center, China

Poster Session 22P8 Multi-level Converters and MMC II

22P8-1 **The Multiple Degree of Freedom Based Neutral Point Potential Control of Three Level Neutral Point Clamped Converters**
Bo Guan, Shinji Doki
Nagoya University, Japan

22P8-2 **A Modified Phase-Shifted PWM Technique for the Grid-Connected Hybrid Cascaded Converter**
Yu-chen Su, Po-tai Cheng
National Tsing Hua University, Taiwan

22P8-3 **Novel T-type Dual-Buck Inverter with Minimum Number of Inductors**
Tien-The Nguyen[1], Honnyong Cha[1], Bang Le-Huy Nguyen[1], Heung-Geun Kim[2]
1) Kyungpook National University, Korea, 2) Kyungpook National University, Korea

22P8-4 **Control of Direct AC/AC Modular Multilevel Converter in Railway Power Supply System**
Shuguang Song, Jinjun Liu, Shaodi Ouyang, Xingxing Chen, Baojin Liu
Xi'an Jiaotong University, China

Poster Session 22P9 Other Converters

22P9-1 **Research on Low Input Current Ripple Two-Stage Converter for Low Frequency Pulsed Power Applications**
Yu Gu, Donglai Zhang, Xiaorui Zhu
Harbin Institute of Technology, China

22P9-2 **Wireless Power Transfer: Critical Review of Related Standards**
Mohamad Abou Houran, Xu Yang, Wenjie Chen, Mehdi Samizadeh
Xi'an Jiaotong University, China

22P9-3 **Comparative Study of Single-Phase Fundamental Component Frequency Estimation Schemes under Time-varying Harmonic Distortion Operation**
E. B. Kapisch[1,2], J. L. Duarte[1], C. A. Duque[2]
1) Eindhoven University of Technology, The Netherlands, 2) Federal University of Juiz de Fora, Brazil

22P9-4 **A Comprehensive Dead-Time Compensation Method for a Three-Phase Dual-Active Bridge Converter with Hybrid Modulation Schemes**
Jingxin Hu, Zhiqing Yang, Rik W. De Doncker
RWTH Aachen University, Germany

Poster Session 22P10 Passive Components

22P10-1 **Evaluation of a High-Frequency Reactor with a New Wire Guide for a Toroidal Core**
Hideki Ayano, Akira Fujimura, Yoshihiro Matsui
National Institute of Technology, Tokyo College, Japan

22P10-2 **Core Loss Evaluation in Powder Cores: A Comparative Comparison between Electrical and Calorimetric Methods**
Yuki Ishikura[1], Jun Imaoka[2], Mostafa Noah[1], Masayoshi Yamamoto[1]
1) Nagoya University, Japan, 2) Kyushu University, Japan

22P10-4 **Modeling, Magnetic Design, and Simulation Methods Considering DC Superimposition Characteristic of Powder Cores Used in Power Converters**
Jun Imaoka[1], Kenkichiro Okamoto[1], Masahito Shoyama[1], Yuki Ishikura[2], Mostafa Noah[2], Masayoshi Yamamoto[2]
1) Kyushu University, Japan, 2) Nagoya University, Japan

22P10-5 **Modelling and Design of a Medium Frequency Transformer for High Power DC-DC Converters**
Miloš Stojadinović, Jürgen Biela
ETH Zürich, Switzerland

22P10-6 **Evaluation of Inductor Losses on Z-source Inverter Considering AC and DC Components**
Ryuji Iijima, Naoki Kamoshida, Rene Alexander Barrera Cardenas, Takanori Isobe, Hiroshi Tadano
University of Tsukuba, Japan

22P10-7 **An Integrating Structure of Output Filter for Grid Connected Inverter Based on FMLF Technique**
Jie Ma, Yenan Chen, PingPing Chen, Wenxing Zhong, Dehong Xu
Zhejiang University, China

Poster Session 22P11 Wide Band Gap Devices I

22P11-1 **New Screening Method for Improving Transient Current Sharing of Paralleled SiC MOSFETs**
Junji Ke, Zhibin Zhao, Peng Sun, Huazhen Huang, James Abuogo, Xiang Cui
North China Electric Power University, China

22P11-2 **PSpice Modeling and Application for SiC Power MOSFET to Evaluate the Power Loss in Full-Bridge Converter**
Juan Wei[1], Fei Lin[1], Zhongping Yang[1], Xianjin Huang[1], Chanjuan Xiao[2], Hao Zhang[2], Wencai Liang[2]
1) Beijing Jiaotong University, China, 2) CRRC Qingdao Sifang Co., Ltd, China

22P11-3 **All-SiC Module Packaging Technology**
Kento Shirata, Norihiro Nashida, Hideyo Nakamura, Yoshitaka Nishimura
Fuji Electric Co., Ltd., Japan

Poster Session 22P12 Packaging and Circuit Integration I

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

22P12-2 Design and Enhancement of ESD Reliability in Circular UHV 300-V nLDMOS Power Components
Shen-Li Chen[1], Yi-Hao Chao[1], Chih-Ying Yen[1], Jen-Hao Lo[2], Chun-Ting Kuo[2], Yu-Lin Lin[1], Yi-Hao Chiu[1], Pei-Lin Wu[1], Yu-Lin[1] Jhou
1) National United University, Taiwan, 2) Peking University, China

22P12-3 A Technology Analysis of Voltage Sharing in Series Connected Power Devices
Z Davletzhanova, O Alatise, R Bonyadi, J Ortiz-Gonzalez, T Dai, M Jennings, L Ran, P Mawby
University of Warwick, UK

22P12-4 Failure Mechanism Analysis and Physics-of- Failure Lifetime Prediction Method for Press- Pack Thyristor of Converter Valve
Ning Liang[1], Zhigang Zhang[2], Yating Gou[2], Cuicui Liu[2], Zebin Yang[2], Jiangnan Chen[2], Fang Zhuo[2], Feng Wang[2]
1) M&T Center of EHV Power Transmission Company, China, 2) Xi'an Jiaotong University, China

22P12-5 Surge Voltage Absorption by a Silicon Carbide Avalanche-Diode with P-N Structure
K. Koseki, Y. Tanaka
National Institute of Advanced Industrial Science and Technology (AIST) , Japan

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

22P13-1 Calculation of Thyristor Reliability Parameter of UHVDC Converter Valve in HEMP Environment
Zhigang Zhang[1], Yating Gou[1], Cuicui Liu[1], Zebin Yang[1], Xiaotong Du[1], Jiangnan Chen[1], Fang Zhuo[1], Feng Wang[1], Yuanliang Lan[2], Caiwang Sheng[2]
1) Xi'an Jiaotong University, China, 2) Global Energy Interconnection Research Institute Co. Ltd, China

22P13-2 Generalized Stackelberg Game-theoretic Approach for Jointed Energy and Reserve Coordination of Electric Vehicles
Tianyang Zhao[1], Xuewei Pan[2], Lei Li[2], Fei Zhao[2], Can Wang[2]
1) Nanyang Technology University, Singapore, 2) Harbin Institute of Technology, China

22P13-3 Impedance Influence Analysis of Phase-Locked Loops on Three-Phase Grid-Connected Inverters
Yuncheng Wang, Xin Chen, Yang Zhang, Jie Chen, Chunying Gong
Nanjing University of Aeronautics and Astronautics, China

Poster Session 22P14 Motor Control and Drives I

22P14-1 Pulse-Injection-Based Sensorless Control Method with Improved Dynamic Current Response for PMSM
Hechao Wang, Kaiyuan Lu, Dong Wang, Frede Blaabjerg
Aalborg University, Denmark

22P14-2 Influence of Parameter Variations on Operating Characteristics of MTPF Control for DTC-Based PMSM Drive System
Keisuke Fujii, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada
Osaka Prefecture University, Japan

22P14-3 A Quiet Position Sensorless Control for an IPMSM Based on Extended EMF and Voltage Injection Synchronized with PWM Carrier
Yuki Ishii, Hiroki Yamashita, Hisao Kubota
Meiji University, Japan

22P14-4 Study of Torque Ripple Reduction and Torque boost by Modified Trapezoidal Modulation
Satoshi Joryo, Kazuto Tatsumi, Toshimitsu Morizane, Katsunori Taniguchi, Noriyuki Kimura, Hideki Omori
Osaka Institute of Technology, Japan

22P14-5 Fault Diagnosis Method of Current Sensor for Permanent Magnet Synchronous Motor Drives
Guoqiang Zhang[1], Guoxin Wang[1], Gaolin Wang[1], Junya Huo[1,2], Lianghong Zhu[2], Dianguo Xu[1]
1) Harbin Institute of Technology, China, 2) GD Midea Air-Conditioning Equipment Co., Ltd., China

22P14-6 Sensorless Speed Control of Diesel-Generator Systems Based on Multiple SOGI-FLLs
Ngoc Dat Dao[1], Dong-Choon Lee[1], Dae-Sik Lim[2]
1) Yeungnam University, Korea, 2) Bokuk Electric Industrial Company, Korea

22P14-7 Robustness of Simplified Speed-Sensorless Vector Control for Induction Motor
Naoki Akao, Mineo Tsuji, Shin-ichi Hamasaki
Nagasaki University, Japan

22P14-8 Maximum Torque Control Reference Frame Based on a Torque Map for IPMSMs with Large Inductance Variation
Kazuki Ohta[1], Takumi Ohnuma[1], Shinji Doki[2]
1) National Inst. of Tech., Japan, 2) Nagoya University, Japan

Poster Session 22P15 Motor Control and Drives II

22P15-1 PMSM Model Discretization in Consideration of Park Transformation for Current Control System
Masamichi Inoue, Shinji Doki
Nagoya University, Japan

22P15-2 Pseudo-Random High-Frequency Sinusoidal Voltage Injection Based Sensorless Control for IPMSM Drives
Guoqiang Zhang[1], Huiying Wang[1], Gaolin Wang[1], Junya Huo[1,2], Lianghong Zhu[2], Dianguo Xu[1]
1) Harbin Institute of Technology, China, 2) GD Midea Air-Conditioning Equipment Co., Ltd., China

22P15-3 AT-NPC 3-Level Inverter-Fed Induction Motor Vector Control with Neutral Point Voltage Control
K. Sudo[1], M. Tsuji[1], S. Hamasaki[1], T. Fukuoka[1], H. Ichinose[2]
1) Nagasaki University, Japan, 2) Mitsubishi Electric Engineering Co.,Ltd, Japan

22P15-4 Investigation of Various Position Estimation Accuracy Issues in Pulse-Injection-Based Sensorless Drives
Hechao Wang, Kaiyuan Lu, Dong Wang, Frede Blaabjerg
Aalborg University, Denmark

22P15-5 Position Sensorless Control of Switched Reluctance Motor Using Estimated PWM Phase Voltage
Y. Nakazawa[1], K. Ohyama[2], H. Fujii[3], H. Uehara[3], Y. Hyakutake[3]
1) National Institute of Technology, Akita College, Japan, 2) Fukuoka Institute of Technology, Japan, 3) Meiwa Manufacturing Co., Ltd, Japan

22P15-6 Experimental Confirmation of Thrust and Attractive Force Control of Linear Induction Motor by Two Different Frequency Components
Kenta Sannomiya, Toshimitsu Morizane, Noriyuki Kimura, Hideki Omori
Osaka Institute of Technology, Japan

22P15-7 GA Based Optimized Trajectories of Rotating Speed and *d-q* Axis Currents for an IPMSM
Shuta Kumagai, Kaoru Inoue, Toshiji Kato
Doshisha University, Japan

22P15-8 2-Degree-of-Freedom Deadbeat Control with Disturbance Compensation for PMSM Drive System Using FPGA
Arata Takahashi, Shotaro Takakura, Tomoki Yokoyama
Tokyo Denki University, Japan

Poster Session 22P16 Motor Control and Drives III

22P16-1 Extended EMF-Based Simple IPMSM Sensorless Vector Control Using Compensated Current Controller
Takatoshi Inoue, Yasumasa Hamabe, Mineo Tsuji, Shin-ichi Hamasaki
Nagasaki University, Japan

22P16-2 Full-Band Output Impedance Model of Virtual Synchronous Generator in *dq* Framework
Li Wenbing[1], Wang Jianhua[1], Song Jingyu[2], Luo Fangfang[1], Gao Shang[1], Wu Zaijun[1]
1) Southeast University, China, 2) China State Shipbuilding Co., Ltd., China

22P16-3 An MTPA Control Method of a PMSM and a SynRM Based on a DTC in the Stator Flux Linkage Synchronous Frame
Gimpei Itoh, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada
Osaka Prefecture University, Japan

22P16-4 EEMFs Excited by Signal Injection for Position Sensorless Control of PMSMs and Their Performance Comparison by Using Imaginary Electromotive Force
Takumi Nimura[1], Shota Kondo[1], Shinji Doki[1], Mutuwo Tomita[2]
1) Nagoya University, Japan, 2) National Institute of Technology, Gifu College, Japan

22P16-5 Harmonic Current Cancellation Method for PMSM Drive System Using Resonant Controllers
Dongsheng Li[1], Yoshitaka Iwaji[1], Yasuo Notohara[1], Ken Kishita[2]
1) Hitachi, Ltd., Japan, 2) Hitachi-Johnson Controls Air Conditioning, Inc., Japan

22P16-6 Estimation Error Analysis of Stator Flux Observer for DTC-Based PMSM Drives
Atsushi Shinohara, Kichiro Yamamoto
Kagoshima University, Japan

22P16-7 Application of Fictitious Reference Iterative Tuning to Controller Design for Various Machines
Hidehiro Ikeda[1], Kazuya Goto[1], Feili Zhang[1], Kazuya Kayashima[1], Tsuyoshi Hanamoto[2]
1) Nishi-Nippon Institute of Technology, Japan, 2) Kyushu Institute of Technology, Japan

22P16-8 High Efficiency Control for Permanent Magnet Motor Drive System with Fuel Cells Connected in Series with Electric Double-Layer Capacitors
Kichiro Yamamoto, Fumiya Ohdera, Atsushi Shinohara
Kagoshima University, Japan

22P16-9 Comparative Study of Speed Ripple Reduction by Various Control Methods in PMSM Drive Systems with Pulsating Load
Yuma Komaru, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada
Osaka Prefecture University, Japan

22P16-10 Estimation of the Parameters of the Servo Drive System Using Particle Swarm Optimization Algorithm
Helin Zhu[1], Jae Hyuk Choi[1], Sang Uk Park[1], Jusuk Lee[2], Hyong Gun Lee[3], Hyung Soo Mok
1) Konkuk University, Korea, 2) Gyeonggi College of Science and Technology, Korea, 3) LC-TEK Co. Ltd., Korea

Poster Session 22P17 Battery Energy Storage and Renewable Energy Systems

22P17-1 A Programmable Battery Test System with Energy Recycling Feature Based on Sinusoidal Loading Technique
Chang-Hua Lin[1], Guan-Jung Chen[1], Hwa-Dong Liu[1], Kun-Feng Chen[2]
1) National Taiwan University of Science & Technology, Taiwan, 2) Chung-Shan Institute of Science and Technology, Taiwan

22P17-2 Development of Large-Capacity Converter for Battery Energy Storage Systems
Hiroyoshi Komatsu, Tatsuji Katayama, Noriko Kawakami
Toshiba Mitsubishi-Electric Industrial Systems Corporation (TMEIC) , Japan

22P17-3 Analysis and Comparison of dc/dc Topologies in Partial Power Processing Configuration for Energy Storage Systems
Maria C. Mira, Zhe Zhang, Michael A. E. Andersen
Technical University of Denmark, Denmark

22P17-4 Two-Stage Protection for Multi-Channel Power Electronic Converters Fed Large Asynchronous Hydro-Generating Unit
R.R.Semwal, Anto Joseph, Thanga Raj Chelliah
Indian Institute of Technology, India

22P17-5 Current Sharing Control for Series-Parallel Changeover Using Battery and Electric Double-Layer Capacitor Bank
Taisei Nishino, Keisaku Isozaki, Naoki Kogai, Kyungmin Sung
National Institute of Technology, Ibaraki College, Japan

22P17-6 Control Method of Energy Storage System to Improve Output Power of PCS
Mikiya Ishibashi[1], Hitoshi Haga[1], Kenji Arimatsu[2], Koji Kato[3]
1) Nagaoka University of Technology, Japan, 2) Tohoku Electric Power Co., Inc, Japan, 3) Sanken Electric Co., Ltd., Japan

22P17-7 A Control Strategy of MMC Battery Energy Storage System Based on Arm Current Control
Liu Danqing, Wang Guangzhu, Ou Zhujian, Liu Jiaxing
Shandong University, China

22P17-8 Equivalent Resistance Control for Maximum Power Transfer Method of Piezoelectric Element in Vibration Power Generation
Kenya Takamura[1], Hiroaki Yamada[1], Toshihiko Tanaka[1], Tomoharu Yada[2], Hajime Fujiwara[2]
1) Yamaguchi University, Japan, 2) New Japan Radio Company, Limited., Japan

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

Poster Session 22P18 PV Systems I

22P18-1 Common Mode Current Reduction of Three-Phase Cascaded Multilevel Transformerless Inverter for PV System
Wenjie Wang[1], Ke Chen[1], Lijun Hang[1], Anping Tong[2], Yiliang Gan[3]
1) Hangzhou Dianzi University, China, 2) Shanghai Jiao Tong University, China, 3) General Office of People's Government of Shuangliu District, China

22P18-2 Current Sharing/Voltage Sharing Control Strategy for Cascaded DC/DC Converter in Photovoltaic DC Collection System
Bo Chen, Yi Wang, Yanjun Tian, Shilei Wei
North China Electric Power University, China

22P18-3 PCC Voltage Compensation of PV Inverter with Active Power Decoupling Circuit
Duck-Hwan Hwang, Jung-Yong Lee, Younghoon Cho
Konkuk University, Korea

22P18-4 A Novel Partial Shading Detection Algorithm Utilizing Power Level Monitoring of Photovoltaic Panels
Thusitha Randima Wellawatta, Sung-Jin Choi
University of Ulsan, Korea

22P18-5 Boost Integrated Three-Phase Solar Inverter Using Current Unfolding and Active Damping Methods
Ha Pham N.[1], Tomoyuki Mannen[2], Keiji Wada[2]
1) University of Technology Sydney, Australia, 2) Tokyo Metropolitan University, Japan

22P18-6 Linear Active Disturbance Rejection Control for Isolated Three-Port Converter
Jiang You, Mengyan Liao, Weiyan Fan
Harbin Engineering University, China

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

22P19-1 Stability Constrained Gain Optimization of Droop Controlled Converters in DC Nanogrids
Soumya Bandyopadhyay, Laura Ramirez-Elizondo, Pavol Bauer
TU Delft, The Netherlands

22P19-2 SiC Based SSPC for High Voltage Space Applications
D. Marroquí, A. Garrigós, José M. Blanes, R. Gutiérrez
Miguel Hernández University of Elche, Spain

22P19-3 An Improved Voltage-Type Grid-Connected Control Strategy for Compensating Unbalanced Voltage
Liu Hongpeng, Zhou Jiajie, Wang Wei
Harbin Institute of Technology, China

22P19-4 Dual Two-Stage Isolated Bidirectional DC-DC Converter for DC Grid Storage
Gabriel Tibola, Jorge L. Duarte
Eindhoven University of Technology, The Netherlands

22P19-5 Modular Multilevel Converter with Capacitor Voltage Self-Balancing Using Reduced Number of Voltage Sensors
Taiyuan Yin[1], Yue Wang[1], Xiaolei Wang[2], Shiyuan Yin[1], Shumin Sun[3], Guanglei Li[3]
1) Xi'an Jiaotong University, China, 2) Zhongyuan University of Technology, China, 3) State Grid Shandong Electric Power Research Institute, China

22P19-6 Plug and Outlet in Household DC Low Voltage Micro-grid Power Distribution
Worapong Pairindra[1], Surin Khomfoi[2]
1) Valaya Alongkorn Rajabhat University, Thailand, 2) King Mongkut's Institute of Technology, Thailand

22P19-7 Performance Programming Technique for Multi-Stage Dc Power Distribution Systems
Syam Kumar Pidaparthy, Hansang Kim, Yeonjung Kim, Byungcho Choi
Kyungpook National University, Korea

22P19-8 Coordination Control for Paralleled Inverters Based on VSG for PV/Battery Microgrid
Meiqin Mao, Cheng Qian, Liuchen Chang, Yan Du
Hefei University of Technology, China

22P19-9 Adaptive Voltage Control Scheme for DAB Based Modular Cascaded SST in PV Application
Tao Liu[1,2], Yang Xuan[1], Xu Yang[1], Peng Xu[1], Yang Li[1], Lang Huang[1,2], Xiang Hao[2]
1) Xian Jiaotong University, China, 2) TBEA Xinjiang Sunoasis Co., LTD, China

22P19-10 Six-Step MMC-Based High Power DC-DC Converter
Stefan Milovanović, Dražen Dujić
École Polytechnique Fédérale de Lausanne – EPFL, Switzerland

22P19-11 Combined DC Power Flow Controller for DC Grid
Xu Zhong[1], Miao Zhu[1], Yongning Chi[2], Xizhou Du[3], Siqi Liu[1], Xu Cai[1]
1) Shanghai Jiao Tong University, China, 2) China Electric Power Research Institute, China, 3) State Grid Shanghai Municipal Electric Power Company, China

22P19-12 An Approach for the Emulation of DC Grid Admittances: Implementation on a Buck Converter
Enrique Rodriguez-Diaz[1], Fracisco D. Freijedo[2], Drazen Dujic[2], Juan C. Vasquez[1], Josep M. Guerrero[1]
1) Aalborg University, Denmark, 2) Ecole Polytechnique Federale de Lausanne, Switzerland

22P19-13 A Compound Controller for Power Flow and Short-Circuit Fault in DC Grid
Han Ye, Wu Chen, Pengpeng Pan, Xiaokun He
Southeast University, China

22P19-14 Design Procedure and Control of a Hybrid Circuit Breaker with Adaptable Pulse Current Injection
Andreas Jehle, Jürgen Biela
ETH Zürich, Switzerland

22P19-15 A Pragmatic SOH and SOC Co-Estimator for Lithium-Ion Batteries in Smart Grid Applications
Kaiyuan Li[1], King Jet Tseng[2], Feng Wei[2], Boon-Hee Soong[1]
1) Nanyang Technological University, Singapore, 2) Singapore Institute of Technology, Singapore

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

22P20-1 Direct Wireless Battery Charging System
Woo-Seok Lee, Jin-Hak Kim, Shin-Young Cho, Il-Oun Lee
Myongji University, Korea

22P20-2 An Improved PWM Scheme to Achieve Zero-Voltage Switching for All Devices in Three-Phase Isolated Matrix Rectifier
Xuerui Lin[1], Yunwei (Ryan)Li[1], Jahangir Afsharian[2], Dewei (David)Xu[2]
1) University of Alberta, Canada, 2) Ryerson University, Canada

22P20-3 Fixed-Frequency HF Gate Driver by a Push-Pull Self-Excitation LC Oscillator Having a Capacitance Transistor
Naoyuki Ishibashi[1], Takuya Mizushima[1], Masahiko Hirokawa[2], Akihiko Katsuki[1]
1) Nagasaki University, Japan, 2) TDK Corporation, Japan

Poster Session 22P21 Industrial Applications I

22P21-1 A Flexible Reduced Capacitor Voltages Strategy for Variable-Speed Drives with Modular Multilevel Converter
Fangzhou Zhao, Guochun Xiao, Daoshu Yang, Zhiqian Wu, Xin Meng
Xi'an Jiaotong University, China

22P21-2 A Leakage Flux Cancellation Technique for Series- Parallel Combined Resonant Circuits with Asymmetric Rotary Transformers Used for Ultrasonic Spindle Drive
Jun Imaoka, Masahito Shoyama
Kyushu University, Japan

22P21-3 **A Novel Structural Health Monitoring System with Wireless Power and Bi-Directional Data Transfer**
Yujin Jang, Keon-Woo Kim, Moo-Hyun Park, Nayoung Lee, Gun-Woo Moon
KAIST, Korea

22P21-4 **Control Strategy for Starter Generator in UAV with Micro Jet Engine**
Jun-ichi Itoh[1], Kazuki Kawamura[1], Hiroyuki Koshikizawa[2], Kazuyuki Abe[2]
1) Nagaoka University of Technology, Japan, 2) YSEC Co., Ltd, Japan

Poster Session 22P22 Power Converters and Systems I

22P22-1 **Study on the Influence of Voltage Variations for Non-Intrusive Load Identifications**
Yu-Hsiu Lin[1], Shun-Kang Hung[2], Men-Shen Tsai[3]
1) Providence University, Taiwan, 2) Avnet, Inc., Taiwan, 3) National Taipei University of Technology, Taiwan

22P22-2 **Basic Experiment of a Maglev System for a Flexible Steel Plate with Curvature: Fundamental Consideration on Levitation Stability under Disturbance**
Makoto Tada, Kazuki Ogawa, Takayoshi Narita, Hideaki Kato, Hiroyuki Moriyama
Tokai University, Japan

22P22-3 **Performance of Hybrid Magnetic Levitation Control System for Thin Steel Plate by EMs and PMs: Experimental Evaluation of Applying Optimal Gap and Arrangement of PMs**
Yasuaki Ito, Yoshiho Oda, Kengo Okuno, Toshiki Suzuki, Masahiro Kida, Takayoshi Narita, Hideaki Kato, Hiroyuki Moriyama
Tokai University, Japan

22P22-4 **A Practical Lithium-Ion Battery Model Based on the Butler-Volmer Equation**
Kaiyuan Li[1], King Jet Tseng[2], Feng Wei[2], Boon-Hee Soong[1]
1) Nanyang Technological University, Singapore, 2) Singapore Institute of Technology, Singapore

22P22-5 **Bonding Technology Using Cold-Rolled Ag Sheet in Die-Attachment Applications**
Seungjun Noh, Chanyang Choe, Chuantong Chen, Hao Zhang, Katsuaki Suganuma
Osaka University, Japan

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

Room A

Oral Session 22A2 High Frequency Power Conversion

22A2-1 **High-Frequency Self-Driven Synchronous Rectifier Controller for WPT Systems**
Akihiro Konishi, Kazuhiro Umetani, Eiji Hiraki
Okayama University, Japan

22A2-2 **Automatic Resonance Frequency Tuning Method for Repeater in Resonant Inductive Coupling Wireless Power Transfer Systems**
Masataka Ishihara, Kazuhiro Umetani, Eiji Hiraki
Okayama University, Japan

22A2-3 **Inductive Power Transfer for T5 Fluorescent Lamp Lighting System**
Chung-Chuan Hou, Tang-Jung Chen, Ching-Chen Chen, Chen-Wei Chang, Po-Wei Wang
Chung Hua University, Taiwan

22A2-4 **An Implement 1.5 MHz of Induction Heating for Aluminum Based on Vacuum Tube Oscillator Circuit**
A. Bilsalam, P. Chanmontree, S. Supanyapong, V. Chunkag
King Mongkut's University of Technology North Bangkok, Thailand

22A2-5 **Single-Inductor Multiple-Outputs Dimmable LED Driver with Buck Converter**
Ta-Wei Huang, Tsorng-Juu Liang, Wei-Jing Tseng, Jun-Xian Huang
National Cheng Kung University, Taiwan

Room B

Oral Session 22B2 Multi-level Inverters I

22B2-1 **A Soft-Switched Three-Level T-Type Inverter with Auxiliary Commutated Poles**
Apollo Charalambous, Xibo Yuan
University of Bristol, UK

22B2-2 **Carrier-Based Realization of Arbitrary Space-Vector PWM Methods for Three-Level Inverters**
Somboon Sangwongwanich, Supakorn Paiboon
Chulalongkorn University, Thailand

22B2-3 **Multi-Level Topology Based Linear Amplifier Family for Realization of Noise-Less Inverters**
Hidemine Obara, Tatsuki Ohno, Atsuo Kawamura
Yokohama National University, Japan

22B2-4 **A New Zero-Voltage Switching Three-Level Converter with Reduced Rectifier Voltage Stress**
Keon-Woo Kim, Cheon-Yong Lim, Dong-Kwan Kim, Yu-Jin Jang, Gun-Woo Moon
KAIST, Korea

22B2-5 **Model Predictive Control of a Three-Level NPC Rectifier with a Sliding Manifold Term**
Xiaonan Gao[1], Wei Tian[1], Xicai Liu[1], Zhenbin Zhang[2], Ralph Kennel[1]
1) Technical University of Munich, Germany, 2) Shandong University, China

Room C

Oral Session 22C2 Motion Control II

22C2-1 **H_∞ Control-Based Vibration Suppression in Robot Arm with Strain Wave Gearing**
Invited Paper Tran Vu Trung, Makoto Iwasaki
Nagoya Institute of Technology, Japan

22C2-2 **Fine Force Sensorless Force Control Based on Friction-Free Disturbance Observer**
Invited Paper Kiyoshi Ohishi, Naoki Kamiya, Toshimasa Miyazaki, Yuki Yokokura
Nagaoka University of Technology, Japan

22C2-3 **Kinematics and Tracking Control of a Four Axis Antenna for Satcom on the Move**
Invited Paper Oguz Kaan Hancioglu[1,2], Mustafa Celik[1,3], Ugur Tumerdem[4]
1) PROFEN Communication Technologies & Services, Inc., Turkey, 2) Istanbul Technical University, Turkey, 3) Ankara University, Turkey, 4) Marmara University, Turkey

22C2-4 **Position Sensorless Position Control for Dual Solenoid Actuator**
Invited Paper Sakahisa Nagai, Atsuo Kawamura
Yokohama National University, Japan

Room D

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

22D2-1 **CAE Technology Application Trend for Large-Capacity Power Electronics Development**
Teruo Yoshino, Kuniaki Nagasaka, Shigeaki Nakabayashi, Ikuto Udagawa, Isamu Tominaga, Junya Konno
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

22D2-2 **Xilinx System Generator Based Modelling of Finite State MPC**
Vijay Kumar Singh, Ravi Nath Tripathi, Tsuyoshi Hanamoto
Kyushu Institute of Technology, Japan

22D2-3 **Power Hardware-in-the-Loop Setup for Stability Studies of Grid-Connected Power Converters**
Tommi Reinikka, Henrik Alenius, Tomi Roinila, Tuomas Messo
Tampere University of Technology, Finland

22D2-4 **Passivity-Based LCL Filter Design of Grid-Connected VSCs with Converter Side Current Feedback**
Shih-Feng Chou, Xiongfei Wang, Frede Blaabjerg
Aalborg University, Denmark

22D2-5 **Adaptive Control of DC Power Distribution Systems: Applying Pseudo-Random Sequences and Fourier Techniques**
Tomi Roinila[1], Hessamaldin Abdollahi[2], Silvia Arrua[2], Enrico Santi[2]
1) Tampere University of Technology, Finland, 2) University of South Carolina, USA

Room E

Oral Session 22E2 Predictive Control for Machine Drives

22E2-1 **An Improved Finite-Set Model Predictive Torque Control for Interior Permanent Magnet Synchronous Motor Drives**
Xinan Zhang[1], Gilbert Foo[2], Tung Ngo[2]
1) Nanyang Technological University, Singapore, 2) Auckland University of Technology, New Zealand

22E2-2 **Predictive Torque Control for Five Phase Induction Motor Drive with Common Mode Voltage Reduction**
Apekshit Bhowate[1], Mohan Aware[1], Sohit Sharma[1], Yogesh Tatte[2]
1) Visvesvaraya National Institute of Technology, India, 2) SBJITMR, India

22E2-3 **Indirect Matrix Converter for Permanent-Magnet-Synchronous-Motor Drives by Improved Torque Predictive Control**
Yun Jang, Yeongsu Bak, Kyo-Beum Lee
Ajou University, Korea

22E2-4 **Predictive DC-Link Current Control Based on IPMSM Discrete State Equation for Inverter without Inductor or Electrolytic Capacitor**
Yousuke Akama, Kodai Abe, Kiyoshi Ohishi, Yuki Yokokura, Koji Kobayashi, Tatsuki Kashihara
Nagaoka University of Technology, Japan

22E2-5 **New Search Algorithm of Model Predictive Control to Reducing Calculation Amount for Improving Steady Current Control Performance**
Masahiro Shimaoka, Shinji Doki
Nagoya University, Japan

Room F

Oral Session 22F2 AC Microgrids

22F2-1 **Distributed Power Sharing Strategy for Islanded Microgrids without Frequency and Voltage Deviations**
Tuan V. Hoang, Hong-Hee Lee
University of Ulsan, Korea

22F2-2 **Lifetime-Oriented Droop Control Strategy for AC Islanded Microgrids**
Yanbo Wang[1], Dong Liu[1], Fujin Deng[2], Dao Zhou[1], Zhe Chen[1]
1) Aalborg University, Denmark, 2) Southeast University, China

22F2-3 **Experiment on Hierarchical Control Based Power Quality Enhancement for Standalone Microgrid**
Darith Leng[1], Sompob Polmai[2], Kittichot Soontorntaweesub[3]
King Mongkut's Institute of Technology Ladkrabang, Thailand

22F2-4 **Modeling and Stability Analysis of Parallel Droop- Controlled and Current-Controlled Inverters**
Shike Wang, Zeng Liu, Jinjun Liu, Ronghui An
Xi'an Jiaotong University, China

22F2-5 **A Distributed Predictive Control Strategy Based on State Estimator for Islanded Microgrid**
Mi Dong, Li Li, Xiaoyu Tian
Central South University, China

Room G

Oral Session 22G2 Trends in PV Systems Applications I

22G2-1 **Maximum Power Point Tracking Method for PV Module under Wide Range Varying Irradiance Levels**
Hwa-Dong Liu, Chang-Hua Lin
National Taiwan University of Science and Technology, Taiwan

22G2-2 **Dual MPPT Control and Field Testing for Switched Capacitor-Based Cell-Level Power Balancing Utilizing Diffusion Capacitance of Photovoltaic Cells**
Masatoshi Uno[1], Yota Saito[1], Masaya Yamamoto[1], Shinichi Urabe[2]
1) Ibaraki University, Japan, 2) Toyota Motor Corporation, Japan

22G2-3 **Series Resonant DC-DC Converter with Dual-Mode Rectifier for PV Microinverters**
Yanfeng Shen, Huai Wang, Zhan Shen, Yongheng Yang, Frede Blaabjerg
Aalborg University, Denmark

22G2-4 **Voltage-Reference Active Power Decoupling Based on Boost Converter for Single-Phase Bridge Inverter**
Shuang Xu[1], Meiqin Mao[2], Riming Shao[1], Liuchen Chang[1]
1) University of New Brunswick, Canada, 2) Hefei University of Technology, China

22G2-5 **A Single-Phase Common Ground Boost Inverter for Photovoltaic Applications**
Tan-Tai Tran[1], Minh-Khai Nguyen[2], Young-Cheol Lim[1], Joon-Ho Choi[1]
1) Chonnam National University, Korea, 2) Chosun University, Korea

Room H

Oral Session 22H2 Railway Power Supply Systems

22H2-1 **Study for Further Introduction of the Electronic Frequency Converters to the Tokaido Shinkansen**
Toshimasa Shimizu[1], Ken Kunomura[1], Masahiko Kai[1], Hiroki Miyajima[2], Teruhisa Matsui[3]
1) Central Japan Railway Company, Japan, 2) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 3) Toshiba Corporation, Japan

22H2-2 **Countermeasure for Partial Turn-Off of Thyristor Changeover Switch Introduced to Tohoku Shinkansen Shin-Yono Sectioning Post**
Yuki Mizumoto, Nobuhito Kurosawa
East Japan Railway Company, Japan

22H2-3 **Hardware-in-the-Loop Real-Time Simulation Experiment Platform for Traction Power Supply System Based on dSPACE-Xsim**
Runze Zhang[1], Fei Lin[1], Zhongping Yang[1], Hu Cao[2], Yuping Liu[2]
1) Beijing Jiaotong University, China, 2) CCRC Qingdao Sifang Rolling Stock Reseaarch Institute Co. Ltd., China

22H2-4 **Evaluating the Non-Sinusoidal and Non-Symmetric Regimes from a Railway Supplying Substation**
Ileana-Diana Nicolae, Petre-Marian Nicolae, Radu-Florin Marinescu
University of Craiova, Romania

22H2-5 **A Fundamental Train Running Experiment for a Basic Performance Verification of a Train Power Demand Control System by Decentralized Control Algorithm**
Yusuke Oki[1], Tomoyuki Ogawa[2], Yoko Takeuchi[2], Tatsuhito Saito[2], Jun'ichiro Kawaguchi[3]
1) The University of Tokyo, Japan, 2) Railway Technical Research Institute, Japan, 3) Japan Aerospace Exploration Agency, Japan

Room K

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

22K2-1 **Verification of SiC Based Modular Multilevel Cascade Converter (MMCC) for HVDC Transmission Systems**
Invited Paper Y. Ishii, T. Jimichi
Mitsubishi Electric Corporation, Japan

22K2-2 **Control of a 6.6-kV Transformerless STATCOM Based on the MMCC-SDBC Using SiC MOSFETs**
Invited Paper Laxman Maharjan, Toshihisa Tajyuta, Hiroshi Shinohara, Akio Suzuki, Akio Toba
Fuji Electric Co., Ltd., Japan

22K2-3 **Isolated Three-Phase AC/DC Converter Using a Soft-Switching Technique for Battery Charger**
Invited Paper Yuto Matsui, Kazuma Suzuki, Takaharu Takeshita, Wataru Kitagawa
Nagoya Institute of Technology, Japan

22K2-4 **Implementation of a Miniaturized SiC Inverter**
Invited Paper Hideaki Fujita, Cristian Andres Garces Guajardo
Tokyo Institute of Technology, Japan

22K2-5 **Design Consideration of Flying Capacitor Multilevel Inverters Using SiC MOSFETs**
Invited Paper Yukihiko Sato, Kenji Natori
Chiba University, Japan

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

Room A

Oral Session 22A3 Control Techniques for Converters/Inverters

22A3-1 **A Control Method of Overvoltage Suppression Across the DC Capacitor in a Grid-Connection Converter Using Leg Short-Circuit of Power MOSFETs during the Initial Charge**
Tomoyuki Mannen, Keiji Wada
Tokyo Metropolitan University, Japan

22A3-2 **The Essential Relationship between Deadbeat Predictive Control and Continuous-Control-Set Model Predictive Control for PWM Converters**
Bi Liu[1], Tao Chen[2], Wensheng Song[1]
1) Southwest Jiaotong University, China, 2) CRRC Zhuzhou Institute Co., Ltd, China

22A3-3 **Deadbeat Control for Multi-level Inverter Using 1MHz Multisampling Method for Utility Interactive System**
Ryosuke Kikuchi, Ryunosuke Araumi, Tomoki Yokoyama
Tokyo Denki University, Japan

22A3-4 **1MHz Multisampling Deadbeat Control with Disturbance Compensation Method for Three Phase PWM Inverter**
Hiroaki Ueta, Tomoki Yokoyama
Tokyo Denki University, Japan

Room B

Oral Session 22B3 Modular Multi-level Converters I

22B3-1 **Modular Multilevel Converter Replaced One Module with High Voltage IGBT**
Kazunobu Oi, Kenta Takasho, Yugo Tadano
Meidensha Corporation, Japan

22B3-2 **Increased Efficiency and Reduced Realization Effort of DSBC and DSCC Modular Multilevel Converters (MMCs)**
A. Hillers, J. Biela
ETH Zürich, Switzerland

22B3-3 **Common-Mode Voltage Injection Techniques for Quasi Two-Level PWM-Operated Modular Multilevel Converters**
Jakub Kucka, Axel Mertens
Leibniz Universität Hannover, Germany

22B3-4 **Current Tracking and Cell-Voltage Limitations of Modular Multilevel Converters with Direct Digital Control**
T.-F. Wu, T.-C. Chou, K.-E. Lin, T.-Y. Li
National Tsing Hua University, Taiwan

Room C

Oral Session 22C3 Passive Components in Power Electronics Applications

22C3-1 **Switching Loss Analysis of SiC-MOSFET Based on Stray Inductance Scaling**
Invited Paper Keiji Wada, Masato Ando
Tokyo Metropolitan University, Japan

22C3-2 **Modeling and Optimization of Displacement Windings for Transformers in Dual Active Bridge Converters**
Invited Paper Zhan Shen[1], Yanfeng Shen[1], Zian Qiny[2], Huai Wang[1]
1) Aalborg University, Denmark, 2) Delft University of Technology, The Netherlands

22C3-3 **Optimized Selection and Utilization of DC-Link Capacitor in a Single-Phase PV Grid Inverter System**
Invited Paper Caspar Collins, Li Ran
University of Warwick, UK

22C3-4 **An Evaluation Circuit for DC-Link Capacitors Used in a High-Power Three-Phase Inverter with Condition Monitoring**
Invited Paper
Kazunori Hasegawa[1], Ichiro Omura[1], Shin-ichi Nishizawa[2]
1) Kyushu Institute of Technology, Japan, 2) Kyushu University, Japan

Room D

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

22D3-1 **Recent Market and Technical Trends in Copper Rotors for High-Efficiency Induction Motors**
Invited Paper Daniel Liang, Victor Zhou
International Copper Association, China

22D3-2 **Overview of the Latest Research and Development for Copper Die-Cast Squirrel-Cage Rotors**
Invited Paper Shu Yamamoto
Polytechnic University, Japan

22D3-3 **A Novel Heat-Resistant Insulation-Processing Agent Applicable to Copper Die-Cast Squirrel-Cage Rotors**
Invited Paper Junichi Uchida, Yuki Sueuchi, Naosumi Kamiyama
Nihon Parkerizing Co., Ltd, Japan

22D3-4 **Experimental Verification on the Effects of Insulation-Processing of Copper Die-Cast Squirrel-Cage Rotor on Motor Efficiency in High-Speed Operation over 10,000 r/min**
Invited Paper
Hideaki Hirahara, Akira Tanaka, Shu Yamamoto
Polytechnic University, Japan

Room E

Oral Session 22E3 High Speed and High Power Drives

22E3-1 **High-Precision Rotor Position Estimation for High-Speed SPMSM Drive Based on State Observer and Harmonic Elimination**
Peng Yang[1], Xi Xiao[1], Meng Zhang[2], Shkodyrev Vyacheslav[3]
1) Tsinghua University, China, 2) Beijing Institute of Control Engineering, China, 3) Saint-Petersburg Polytechnic University, Russia

22E3-2 **Harmonic Loss Reduction in High Speed Motor Drive Systems by Flying Capacitor Multilevel Inverter**
Anudari Tumurbaatar[1], Sae Mochidate[1], Koji Yamaguchi[2], Tomohiro Matsuda[2], Yukihiko Sato[1]
1) Chiba University, Japan, 2) IHI Corporation, Japan

22E3-3 **Current Source Type PMSG Wind Turbine System with Three-Phase Three-Switch Buck-Type Rectifier for Machine-Side Converter**
Beomseok Chae[1], Tahyun Kang[2], Yongsug Suh[1]
1) Chonbuk National University, Korea, 2) Milimsyscon Co, Korea

22E3-4 **A Study of 10MW Load Commutated Inverter for Gas-Turbine Start-Up**
Hyunsung An, Hanju Cha
Chungnam National University, Korea

Room F

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

22F3-1 **Prototyping of 500 kVA Medium Frequency Transformer for Offshore Direct-Current Collection Grid**
Invited Paper Tomoyuki Hatakeyama, Naoyuki Kurita, Mamoru Kimura
Hitachi, Ltd., Japan

22F3-2 **PSCAD/EMTDC and RTDS Simulation Analysis of Multivendor Multi-Terminal HVDC System Connected to Offshore Windfarms**
Invited Paper Hiroshi Suwa[1], Takuro Arai[2], Takahiro Ishiguro[3], Tohru Yoshihara[4], Mamoru Kimura[4], Tsuneshisa Wachi[5], Takahiro Horikoshi[5], Tatsuhito Nakajima[6]
1) Tokyo Electric Power Company Holdings, Incorporated, Japan, 2) Toshiba Corporation, Japan, 3) Toshiba Energy Systems and Solutions Corporation, Japan, 4) Hitachi, Ltd., Japan, 5) JP Business Service Corporation, Japan, 6) Tokyo City University, Japan

22F3-3 **Interoperability of Modular Multilevel Converters and 2-Level Voltage Source Converters in a Laboratory-Scale Multi-Terminal DC Grid**
Invited Paper Salvatore D'Arco, Atsede G. Endegnanew, Giuseppe Guidi, Jon Are Suu
SINTEF Energy Research, Norway

22F3-4 **Principle Experiment of Current Commutated Hybrid DCCB for HVDC Transmission Systems**
Invited Paper Ryuta Hasegawa[1], Kazuhisa Kanaya[2], Yushi Koyama[2], Toshiaki Matsumoto[2], Takahiro Ishiguro[3]
1) Toshiba Infrastructure Systems & Solutions Corporation, Japan, 2) Toshiba Corporation, Japan, 3) Toshiba Energy Systems & Solutions Corporation, Japan

Room G

Oral Session 22G3 Trends in PV Systems Applications II

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

22G3-2 **Series/Parallel Switching Circuits Using Power MOSFETs for Photovoltaic Modules**
Masamichi Tanemo, Koki Matsudate, Shinichi Nomura
Meiji University, Japan

22G3-3 **Modularized Equalization Architecture Based on Switched Capacitor Converter to Virtually Unify Mismatched Photovoltaic Panel Characteristics**
Masatoshi Uno, Masaya Yamamoto
Ibaraki University, Japan

22G3-4 **Buck-Boost Type MPPT Circuit Suitable for Photovoltaic Generation of Vehicle Installation**
Fumihisa Kano[1,2], Yuji Kasai[3], Hideki Kimura[4], Kouhei Sagawa[4], Junnosuke Haruna[1], Hirohito Funato[1]
1) Utsunomiya University, Japan, 2) Nattional Institute of Techchnology, Oyama College, Japan, 3) National Institute of Advanced Industrial Science and Technology, Japan, 4) Tokai University, Japan

Room H

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

22H3-1 **Verification Test of Energy-Efficient Operations and Scheduling Utilizing Automatic Train Operation System**
Invited Paper Shoichiro Watanabe[1], Yasuhiro Sato[1], Takafumi Koseki[2], Eisuke Isobe[3], Jun Kawashita[4]
1) National Traffic Safety and Environment Laboratory, Japan, 2) The University of Tokyo, Japan, 3) Japan Subway Association, Japan, 4) Osaka Municipal Transportation Bureau, Japan

22H3-2 **The Direct Benefit of SiC Power Semiconductor Devices for Railway Vehicle Traction Inverters**
Invited Paper Shingo Makishima[1], Kazuki Fujimoto[1], Keiichiro Kondo[2]
1) Toyo Electric Mfg. Co., Ltd, Japan, 2) Waseda University, Japan

22H3-3 **The Loss Characteristics of PSFB ZVS DC-DC Converter Applied to the Auxiliary Power System**
Invited Paper Xianjin Huang, Juan Zhao, Fei Lin
Beijing Jiaotong University, China

22H3-4 **Survey on Electromagnetic Interference Analysis for Traction Converters in Railway Vehicles**
Invited Paper Zhichang Yang, Hong Li, Chao Feng, Yanfeng Jiang, Fei Lin, Zhongping Yang
Beijing Jiaotong University, China

Room K

Oral Session 22K3 Power Electronics and Motor Drives for Automobiles

22K3-1 **Development of Traction Motor for New Zero-Emission Vehicle**
Invited Paper Akinobu Iwai, Satoshi Honjo, Toshio Okazawa, Hirofumi Suzumori
Honda R&D Co., Ltd., Japan

22K3-2 **EMC Design and Development Methodology for Traction Power Inverters of Electric Vehicles**
Invited Paper Isao Hoda[1], Jia Li[2], Hiroki Funato[1]
1) Hitachi, Ltd., Japan, 2) Hitachi America, Ltd., USA

22K3-3 **Simulation-Driven Design Optimization of a Multilayer EMC Input Filter**
Invited Paper Fatou Diouf[1], Nadim Sakr[1], Anna Gheonjian[2]
1) RENAULT, France 2) EMCoS, Georgia

22K3-4 **EV Traction Inverter Employing Double-Sided Direct-Cooling Technology with SiC Power Device**
Invited Paper Takashi Hirao, Masami Onishi, Yusuke Yasuda, Akihiro Namba, Kinya Nakatsu
Hitachi, Ltd., Japan

Wednesday, May 23: 8:35-10:40

Room A

Oral Session 23A1 High Performance Power Converters

23A1-1 **An Overview of Stability Improvement Methods for Wide-Operation-Range Flyback Converter with Variable Frequency Peak-Current-Mode Control**
Invited Paper Ching-Hsiang Cheng[1], Ching-Jan Chen[1], Shinn-Shyong Wang[2]
1) National Taiwan University, Taiwan, 2) Richtek Technology Corporation, Taiwan

23A1-2 **Design and Implementation of a High Power Density Active-Clamped Flyback Converter**
Invited Paper Yu-Chen Liu[1], Bing-Siang Huang[2], Cheng-Hung Lin[2], Katherine A. Kim[3], Huang-Jen Chiu[2]
1) National Ilan University, Taiwan, 2) National Taiwan University of Science and Technology, Taiwan, 3) Ulsan National Institute of Science and Technology Ulsan, Korea

23A1-3 **Optimized Variable On-Time Control for LED Lighting Driver**
Invited Paper Jizhe Wang[1], Haruhi Eto[1], Fujio Kurokawa[2]
1) Nagasaki University, Japan, 2) Nagasaki Institute of Applied Science, Japan

23A1-4 **Design of Multimode Battery Charger with Dynamic Voltage Tracking Control**
Invited Paper Pang-Jung Liu, Lin-Hao Chien, Song-Kai Lee, Ang-Tung Chen
National Taipei University of Technology, Taiwan

23A1-5 **Dual-Slot Power-Pickup Structure for Contactless Strip Inductive Power Track System**
Invited Paper Jia-You Lee, I-Lin Chen, Chien-Tzu Ko
National Cheng Kung University, Taiwan

Room B

Oral Session 23B1 Three-phase Inverters

23B1-1 **Discontinuous SVM Technique for Three-Leg VSI Fed Balanced/Unbalanced Two-Phase Loads**
Supanut Charoensuksirikul, Yuttana Kumsuwan
Chiang Mai University, Thailand

23B1-2 **Reduction of Power Losses Based on Generalized Two-Level PWM Algorithm for a Nine-Switch VSI**
Neerakorn Jarutus, Yuttana Kumsuwan
Chiang Mai University, Thailand

23B1-3 **SiC-Based Three-Phase Quasi-Z-Source Inverter Versus the Two-Stage Topology - a Comparison**
Kornel Wolski, Mariusz Zdanowski, Jacek Rabkowski
Warsaw University of Technology, Poland

23B1-4 **DC-Side Circuit Implementation of a Three-Phase Inverter for Balancing Phase-Leg Capacitor Currents**
Takashi Hirao, Keiji Wada, Toshihisa Shimizu
Tokyo Metropolitan University, Japan

23B1-5 **A Three-Phase Hybrid Switched-Boost Inverter**
Minh-Khai Nguyen[1], Tan-Tai Tran[2], Hoan-Tien Luong[3], Kyoung-Won Lee[1], Youn-Ok Choi[1], Geum-Bae Cho[1]
1) Chosun University, Korea, 2) Chonnam National University, Korea, 3) HCMC University of Technology and Education, Vietnam

Room C

Oral Session 23C1 Passive Components and Design

23C1-1 **The Effect of Built-in CR Snubber Capacitor into the Power Module**
Ryotaro Hata, Shigeki Nishiyama
Murata Manufacturing Co., Ltd., Japan

23C1-2 **Evaluation of Novel Hybrid Protection Based on Pyroswitch and Fuse Technologies**
Tomokazu Sakuraba[1], Rémy Ouaida[2], Song Chen[3], Thibaut Chailloux[2]
1) MERSEN Japan K. K., Japan, 2) MERSEN France SB, France, 3) MERSEN Shanghai, China

23C1-3 **Optimal Design of a Magnetically Coupled Filter for High Efficiency, Low Cost and Low Volume Dc-Dc Battery Storage Converter**
Timothé Delaforge[1], Robert Pasterczyk[2], Mickaël Robert[2], Hervé Chazal[3], Jean-Luc Schanen[3], Sébastien Mariethoz[1]
1) Bern University of Applied Sciences, Switzerland, 2) Schneider Electric ITB, France, 3) Grenoble Electrical Engineering Laboratory G2ELab, France

23C1-4 **High Power/Current Inductor Loss Measurement with Shunt Resistor Current-sensing Method**
Pin Yu Huang, Toshihisa Shimizu
Tokyo Metropolitan University, Japan

23C1-5 **Sensitivity Analysis of Medium Frequency Transformer Design**
Marko Mogorovic, Drazen Dujic
École Polytechnique Fédérale de Lausanne – EPFL, Switzerland

Room D

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

23D1-1 **Standard Models for Power Electronic System Simulation**
Invited Paper Koichi Shigematsu[1], Hiroki Ishikawa[2], Taku Noda[3], Kentarou Fukushima[3], Yoichi Sekiba[4], Yusuke Kouno[5], Takashi Abe[6], Takayuki Sekisue[7], Shinji Katoh[8]
1) CYBERNETSYSTEMS Co. Ltd., Japan, 2) Gifu University, Japan, 3) Central Research Institute of Electric Power Industry, Japan, 4) Denryoku Computing Center, Japan, 5) Toshiba Co., Ltd., Japan, 6) Nagasaki University, Japan, 7) ANSYS Japan, Japan, 8) Kobe City College of Technology, Japan

23D1-2 **Modeling and Model Parameter Extraction of Wide Bandgap Power Semiconductor Device, Package, and Circuit for Simulating Fast Switching Behavior**
Invited Paper
Tsuyoshi Funaki
Osaka University, Japan

23D1-3 **Stability Analysis Methods of a Grid-Connected Inverter in Time and Frequency Domains**
Invited Paper
Toshiji Kato, Kaoru Inoue, Taiki Sakiyama
Doshisha University, Japan

23D1-4 **Finite Element Methods for Multi-Objective Optimization of a High Step-Up Interleaved Boost Converter**
Invited Paper
Wilmar Martinez[1,2], Camilo Cortes[2], Ahmad Bilal[3], Jorma Kyyra[3]
1) KU Leuven, Campus Diepenbeek, Belgium, 2) Universidad Nacional de Colombia, Colombia, 3) Aalto University, Finland

23D1-5 **High Fidelity Real-Time Simulation of Multi-Level Converters**
Invited Paper
Jost Allmeling, Niklaus Felderer, Min Luo
Plexim GmbH, Switzerland

Room E

Oral Session 23E1 Sensorless PM Drives

23E1-1 **An Enhanced High Frequency Pulsating Voltage Injection Method Based on Immune Algorithm for Sensorless IPMSM Drives**
Yanping Zhang[1], Zhonggang Yin[1], Chao Du[1], Youyun Wang[2], Xiangdong Sun[1]
Xi'an University of Technology, China, 2) Tianshui Electric Drive Research Institute, China

23E1-2 **Position Estimation Accuracy Improvement for Magnetic Saliency Based Sensorless Control Including Cross-Coupling Factor**
Keita Shimamoto, Shinya Morimoto
Yaskawa Electric Corporation, Japan

23E1-3 **Sensorless Drive in the Low Speed Region and Auto-Tuning Method for Permanent Magnet Synchronous Motors**
Naofumi Nomura, Shinichi Higuchi
Fuji Electric Co.,Ltd., Japan

23E1-4 **High Stability V/f Control of PMSM Using State Feedback Control Based on n-t Coordinate System**
Yosuke Matsuki[1], Shinji Doki[2]
1) DENSO CORPRATION, Japan, 2) Nagoya University, Japan

23E1-5 **Stabilization Method Using Equivalent Resistance Gain Based on V/f Control for IPMSM with Long Electrical Time Constant**
Jun-Ichi Itoh, Takato Toi, Koroku Nishizawa
Nagaoka University of Technology, Japan

Room F

Oral Session 23F1 Solid-state Transformers (SST)

23F1-1 **Single-Phase Solid-State Transformer Using Multi-Cell with Automatic Capacitor Voltage Balance Capability**
Jun-ichi Itoh, Kazuki Aoyagi, Keisuke Kusaka, Masakazu Adachi
Nagaoka University of Technology, Japan

23F1-2 **A Developed Dual MMC Isolated DC Solid State Transformer and Its Modulation Strategy**
Yang Chen[1], Yan Li[2], Miao Zhu[1], Chao Liu[2], Xu Cai[1]
1) Shanghai Jiao Tong University, China, 2) China Electric Power Research Institute, China

23F1-3 **DC Fault Ride-Through of a Three-Phase Dual-Active Bridge Converter for DC Grids**
Jingxin Hu, Shenghui Cui, Rik W. De Doncker
RWTH Aachen University, Germany

23F1-4 **High-Power High-Step-Up Ratio DC Solid-State Transformer Based on Medium-Frequency Inversion**
Fang Liu, Jie Zhang, Zhe Zhang, Xing Zhang, Shuying Yang
Hefei University of Technology, China

23F1-5 **A Compound 10kV DVR System Based on Solid State Transformer Structure**
Yaqian Zhang, Jianzhong Zhang, Xing Hu, Zakiud Din
Southeast University, China

Room G

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

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

23G1-2 **Influence of Wind Power Forecasts on Equitable Distribution Method of Wind Power Curtailment**
Invited Paper Daisuke Iioka, Hiroumi Saitoh
Tohoku University, Japan

23G1-3 **Research on the Blockchain-Based Integrated Demand Response Resources Transaction Scheme**
Invited Paper Shengnan Zhao[1], Yang Li[1], Beibei Wang[1], Huiling Su[2]
1) Southeast University, China, 2) Jiangsu Electric Power Research Institute, China

23G1-4 **Coordinated DFIG Wind Turbines and Solar PV Generators for Inter-area Oscillation Damping**
Invited Paper Tossaporn Surinkaew, Issarachai Ngamroo
King Mongkut's Institute of Technology Ladkrabang, Thailand

23G1-5 **Energy Management Using a Quick Charger with Storage Batteries for Electric Vehicles**
Invited Paper Taku Ishibashi, Toyonari Shimakage, Norikazu Takeuchi, Takaaki Kikuchi, Midori Nonogaki
NTT Facilities, Inc., Japan

Room H

Oral Session 23H1 Various Related Topics to Power Electronic Converters

23H1-1 **A Method for Junction Temperature Estimation Utilizing Turn-on Saturation Current for SiC MOSFET**
Hui-Chen Yang[1], Rejeki Simanjorang[2], Kye Yak See[1]
1) Nanyang Technological University, Singapore, 2) Rolls-Royce Singapore Pte. Ltd., Singapore

23H1-2 **Field Bus for Data Exchange and Control of Modular Power Electronic Systems with High Synchronisation Accuracy**
Stefan Rietmann, Simon Fuchs, André Hillers, Jürgen Biela
ETH Zürich, Switzerland

23H1-3 **Analytical Investigation on Asymmetric LCC Compensation Circuit for Trade-off between High Efficiency and Power**
Kodai Takeda, Takafumi Koseki
The University of Tokyo, Japan

23H1-4 **Probabilistic PCA-Support Vector Machine Based Fault Diagnosis of Single Phase 5-Level Cascaded H-Bridge MLI**
Nagendra Vara Prasad.Kuraku, Yigang He, Murad Ali
Hefei University of Technology, China

23H1-5 **A Study on Edge Supported Electromagnetic Levitation System: Fundamental Consideration on Levitation Performance of Thin Steel Plate**
Yoshiho Oda, Yasuaki Ito, Kengo Okuno, Masahiro Kida, Toshiki Suzuki, Takayoshi Narita, Hideaki Kato, Hiroyuki Moriyama
Tokai University, Japan

Room K

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

23K1-1 **Application of FACTS Devices for a Dynamic Power System within the USA**
Invited Paper Dan Sullivan[1], Bryan Buterbaugh[1], Jan Paramalingam[1], Fuminori Nakamura[2], Akihiro Matsuda[2], Daisuke Yamanaka[2], Taichiro Tsuchiya[3]
1) Mitsubishi Electric Power Products Inc., USA, 2) Mitsubishi Electric Corporation, Japan, 3) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

23K1-2 **Capacitor Voltage Balancing in Semi-Full-Bridge Submodule with Differential-Mode Choke**
Invited Paper Kalle Ilves, Yuhei Okazaki, Nan Chen, Muhammad Nawaz, Antonios Antonopoulos
ABB Coporate Research, Sweden

23K1-3 **Research on Key Technology and Equipment for Zhangbei 500kV DC Grid**
Invited Paper Guangfu Tang, Hui Pang, Zhiyuan He, Xiaoguang Wei
Global Energy Interconnection Research Institute, China

23K1-4 **What Led to Success in Academic Research on the Family of Modular Multilevel Cascade Converters?**
Invited Paper Hirofumi Akagi
Tokyo Institute of Technology, Japan

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

Room A

Oral Session 23A2 Resonant Convers for Information and Communication Systems

23A2-1 **Operating Principle of Current Resonant Converter Using Air Core Transformer for Isolated Power Supply on Chip**
Seiya Abe, Hikaru Kaishakuji, Satoshi Matsumoto
Kyushu Institute of Technology, Japan

23A2-2 **Analysis for High-Frequency LLC Resonant Converter with Planar Transformer at Light-Load Condition**
Keon-Woo Kim[1], Jae-Il Baek[1], Yeonho Jeong[1], Ki-Mok Kim[1,2], Gun-Woo Moon[1]
1) KAIST, Korea, 2) Gumi Campus of Korea Polytechnic College, Korea

23A2-3 **A Novel Full Digital Control H-Bridge DC-DC Converter for Power Supply on Chip Applications**
Shigeki Nakano, Toshiomi Oka, Seiya Abe, Satoshi Matsumoto
Kyushu Institute of Technology, Japan

23A2-4 **A High-Efficiency Power Supply from Magnetic Energy Harvesters**
Cheon-Yong Lim[1], Yeonho Jeong[1], Keon-Woo Kim[1], Feel-Soon Kang[2], Gun-Woo Moon[1]
1) Korea Advanced Institute of Science and Technology, Korea, 2) Hanbat National University, Korea

Room B

Oral Session 23B2 Modular Multi-level Converters II

23B2-1 **Opportunities for Leveraging Low-Voltage GaN Devices in Modular Multi-Level Converters for Electric-Vehicle Charging Applications**
Mojtaba Ashourloo, Mohammad Shawkat Zaman, Miad Nasr, Olivier Trescases
University of Toronto, Canada

23B2-2 **A New Control Strategy for Modular Multilevel Converter Operating in Quasi Two-Level PWM Mode**
Chao Wang, Kui Wang, Zedong Zheng, Yongdong Li
Tsinghua University, China

23B2-3 **A Current-Source Type MMC with Delta-Connected Arms for SMES**
Yushi Miura, Toshifumi Ise
Osaka University, Japan

23B2-4 **New Module with Isolated Half Bridge or Isolated Full Bridge for Modular Medium Voltage Converter**
Yunpeng Si, Yifu Liu, Qin Lei
Arizona State University, USA

Room C

Oral Session 23C2 Power Module Design

23C2-1 **Development of a 700-V-Class Reverse-Blocking IGBT for Advanced T-Type Neutral Point-Clamped Power Conversion System**
Hiroki Wakimoto[1], Haruo Nakazawa[1], David H. Lu[1], Takashi Matsumoto[2], Yoichi Nabetani[2]
1) Fuji Electric Co., Ltd. Japan, 2) University of Yamanashi, Japan

23C2-2 **Ceramic Embedding as Packaging Solution for Future Power Electronic Applications**
Hoang Linh Bach[1], Tobias Maximilian Endres[1], Daniel Dirksen[1], Sigrid Zischler[1], Christoph Friedrich Bayer[1], Andreas Schletz[1], Martin März[1,2]
1) Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany, 2) Friedrich-Alexander University Erlangen-Nürnberg, Germany

23C2-3 **Microelectromechanical System (MEMS) Resonator: A New Element in Power Converter Circuits Featuring Reduced EMI**
A. N. M. Wasekul Azad[1], Sourov Roy[1], Abu Saleh Imtiaz[2], Faisal Khan[1]
1) University of Missouri-Kansas City, USA, 2) Globalfoundries, USA

23C2-4 **A Lumped Thermal Model Including Thermal Coupling Effects and Boundary Conditions for Capacitor Banks**
Haoran Wang[1], Qiusheng Wang[2], Huai Wang[1]
1) Aalborg University, Denmark, 2) Anyang Vibrator Co., Ltd (Group) , China

Room D

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

23D2-1 **Hysteresis Modeling of Magnetic Devices Based on Reluctance Network Analysis**
Yoshiki Hane, Kenji Nakamura
Tohoku University, Japan

23D2-2 **Optimal Sizing and Placement of Solar Powered Charging Station under EV Loads Penetration Using Artificial Bee Colony Technique**
Yuttana Kongjeen[1], Kulsomsup Yenchamchalit[2], Krischonme Bhumkittipich[1]
1) Rajamangala University of Technology Thanyaburi, Thailand, 2) Thepsatri Rajabhat University, Thailand

23D2-3 **A Comparison of Average Model, Sampled-Data Model and Multi-Frequency Model Based on DC/DC Converters**
Xiangpeng Cheng, Jinjun Liu, Zeng Liu, Yiming Tu, Danhong Xue
Xi'an Jiaotong University, China

23D2-4 **Small-Signal Discrete-Time Modeling and Digital Control of the Bi-Directional DC/DC Converters**
Jia Yaoqin, Xu Yingchun, Hou Yijie
Xi'an Jiaotong University, China

Room E

Oral Session 23E2 Energy Management Systems and Modelling of Batteries

23E2-1 **Energy Management of Hydrogen-Storage Photovoltaic Generation System with a Function of Suppressing Short-Period Components**
Yuuki Machida, Akihisa Goto, Akiko Takahashi, Shigeyuki Funabiki
Okayama University, Japan

23E2-2 **A Dynamic Battery Charging Approach for Energy Trading in the Smart Grid**
Avinash Sharma[1], Akshay Kumar Rathore[1], Rajesh Kumar[2]
1) Concordia University, Canada, 2) MNIT, India

23E2-3 **TBD**

23E2-4 **Online Internal Impedance Measurements of Li-Ion Battery Using PRBS Broadband Excitation and Fourier Techniques: Methods and Injection Design**
Jussi Sihvo, Tuomas Messo, Tomi Roinila, Roni Luhtala
Tampere University of Technology, Finland

Room F

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

23F2-1 **A DC Current Flow Controller for Meshed HVDC Grids**
Viktor Hofmann, Mark-M. Bakran
University of Bayreuth, Center of Energy Technology, Germany

23F2-2 **An Isolated Soft-Switching Hybrid-Source DC-DC Converter for DC Offshore Wind Farms**
Shenghui Cui, Jingxin Hu, Marco Stieneker, Rik W. De Doncker
RWTH Aachen University, Germany

23F2-3 **A Transformerless Multi-Cell Solid-State Fault Current Limiter for Medium Voltage Power System**
Pantarote Techama, Sompob Polmai, Chanin Bunlaksananusorn
King Mongkut's Institute of Technology Ladkrabang, Thailand

23F2-4 **A Novel DC Power Flow Controller for HVDC Grids with Different Voltage Levels**
Ya'nan Wu[1], Han Ye[2], Wu Chen[2], Xiaokun He[2]
1) State Key Laboratory of Advanced Power Transmission Technology (Global Energy Interconnection Research Institute) , China, 2) Southeast University, China

Room G

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

23G2-1 ***Invited Paper*** **Design and Control of Single-Phase Grid-Connected Photovoltaic Microinverter with Reactive Power Support Capability**
Geon-Hong Min[1], Kyung-Hwan Lee[1], Jung-Ik Ha[1], Myong Hwan Kim[2]
1) Seoul National University, Korea, 2) LG Electronics, Korea

23G2-2 ***Invited Paper*** **Optimal Size and Multi-Objective Control of Battery Energy Storages in Distribution System with High Penetration of Distributed PV Generators**
Meiqin Mao[1], Lei Zhou[1], Yangyang Wang[1], Liuchen Chang[2]
1) Hefei University of Technology, China, 2) University of New Brunswick, Canada

23G2-3 ***Invited Paper*** **Mission Profile-Oriented Control for Reliability and Lifetime of Photovoltaic Inverters**
Ariya Sangwongwanich, Yongheng Yang, Dezso Sera, Frede Blaabjerg
Aalborg University, Denmark

23G2-4 **Discontinuous Current Mode Control for Minimization of Three-Phase Grid-Tied Inverter in Photovoltaic System**
Invited Paper
Hoai Nam Le, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Room H

Oral Session 23H2 Advanced Electrified Railway Systems

23H2-1 **A Theoretical Analysis on Static Characteristics of Voltage Based Control Method and Current Based Control Method for the Wayside Energy Storage System in DC-Electrified Railway**
Invited Paper
Hiroyasu Kobayashi[1], Keiichiro Kondo[1], Diego Iannuzzi[2]
1) Chiba University, Japan, 2) University Federico II of Naples, Italy

23H2-2 **Improvement of a DC Electrical Railway Simulator Using Artificial Intelligence**
Invited Paper
Alvaro J. Lopez-Lopez, Ramon R. Pecharroman, Antonio Fernandez-Cardador, Asuncion P. Cucala
Comillas Pontifical University, Spain

23H2-3 **Feeding-Loss Reduction by Higher-Voltage DC Railway Feeding System with DC-to-DC Converter**
Invited Paper
Hidenori Shigeeda[1], Hiroaki Morimoto[1], Kazuhiko Ito[1], Toshiyuki Fujii[2], Naoki Morishima[3]
1) Railway Technical Research Institute, Japan, 2) Mitsubishi Electric Corporation, Japan, 3) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

23H2-4 **Modeling and Simulation of Novel Railway Power Supply System Based on Power Conversion Technology**
Invited Paper
Minwu Chen[1], Ruofei Liu[1], Shaofeng Xie[1], Xiaofang Zhang[2], Yimin Zhou[2]
1) Southwest Jiaotong University, China, 2) Wenzhou Mass Transit Railway Investment Group Co., Ltd, China

Room K

Oral Session 23K2 Static Wireless EV Charging

23K2-1 **Comparative Study on Front-End Parameter Identification Methods for Wireless Power Transfer Without Wireless Communication Systems**
Invited Paper
Sinan Li[1], S. Y. (Ron)Hui[1,2]
1) The University of Hong Kong, China, 2) Imperial College, UK.

23K2-2 **A New Type of Wireless V2X System with a Dual-Active Bidirectional Single-Ended Converter and Optimized SiC-MOSFET**
Invited Paper
Hideki Omori[1], Aoto Yamamoto[1], Naoki Mukaiyama[1], Masahito Tsuno[2], Kenji Fukuda[3], Hisato Michikoshi[3], Noriyuki Kimura[1], Toshimitsu Morizane[1]
1) Osaka Institute of Technology, Japan, 2) Nichicon Corporation, Japan, 3) National Institute of Advanced Industrial Science and Technology, Japan

23K2-3 **Metal Object Detection System with Parallel-Mistuned Resonant Circuits and Nullifying Induced Voltage for Wireless EV Chargers**
Invited Paper
Seog Y. Jeong, Van X. Thai, Jun H. Park, Chun T. Rim
GIST, Korea

23K2-4 **Wireless EV Charging System without Air-Gap and Misalignment**
Invited Paper
Wenxing Zhong, Dehong Xu
Zhejiang University, China

Room P

Poster Session 23P1 Matrix Converters

23P1-1 **Fixed Slope Carrier PWM for Indirect Matrix Converter**
Tzung-Lin Lee, Chun-Yao Hung, Yen-Wen Chen, Wen-Mei Huang
National Sun Yat-sen University, Taiwan

23P1-2 **Carrier-Based Overmodulation Strategy for Matrix Converters**
Paiboon Kiatsookkanatorn[1], Somboon Sangwongwanich[2]
1) Rajamangala University of Technology, Thailand, 2) Chulalongkorn University, Thailand

23P1-3 **Three-Phase to High-Frequency Single-Phase Matrix Converter -A Frequency Control Suitable for Soft Switching-**
Wataru Kodaka[1], Satoshi Ogasawara[1], Koji Orikawa[1], Masatsugu Takemoto[1], Takashi Hyodo[2], Hiroyuki Tokusaki[2]
1) Hokkaido University, Japan, 2) Omron Corporation, Japan

23P1-4 **Two-Step Commutation for Isolated DC-AC Converter with Matrix Converter**
Shunsuke Takuma, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Poster Session 23P2 Multi-level Converters and MMC III

23P2-1 **A DC-Link Capacitor Voltage Oscillation Reduction Method for a Modular Multilevel Cascade Converter with Single Delta Bridge Cells (MMCC-SDBC)**
Takaaki Tanaka[1], Huai Wang[2], Frede Blaabjerg[2]
1) Fuji Electric Co., Ltd, Japan, 2) Aalborg University, Denmark

23P2-2 **Optimized Decoupling Control of Flying Capacitor in ANPC Five-Level Inverter**
Fusheng Wang, Deyou Zheng, Jianing Wang, Fei Li, Fang Liu, Shuying Yang, Zhen Xie
Hefei University of Technology, China

23P2-3 **Cascaded Dual-Buck AC-AC Converter Using Coupled Inductors**
Sanghun Kim[1], Duekjin Jang[1], Heung-Geun Kim[1], Honnyong Cha[2]
1) Kyungpook National University, Korea, 2) Kyungpook National University, Korea

23P2-4 **Instantaneous Power Loss Calculation for MMC Based on Virtual Arm Mathematical Model**
Yin Shiyuan, Wang Yue, Yin Taiyuan, Nie Cheng, Duan Guozhao, Wang Zhang
Xi'an Jiaotong University, China

23P2-5 **Comparison of Current Control Strategies in Modular Multilevel Converter**
Jianzhao Wei[1], Anirudh Budnar Acharya[1], Lars Norum[1], Pavol Bauer[2]
1) IME, NTNU, Norway, 2) EEMCS Faculty, TUD, The Netherlands

23P2-6 **Model Predictive Control of a Modular Multilevel Converter with an Improved Capacitor Balancing Method**
Shichong Zhang, Baodong Bai, Dezhi Chen
Shenyang University of Technology, China

Poster Session 23P3 DC-DC Converters II

23P3-2 **High Step-Up DC-DC Converter Based on Multi-Cell Coupled Inductor Diode-Capacitor Network**
Xinying Li, Yan Zhang, Jinjun Liu, Pengxiang Zeng
Xi'an Jiaotong University, China

23P3-3 **Novel Active Clamping Step-Down DC-DC Converter with Lower Voltage Stress**
Chi-Hsuan Hsu, Jun-Min Jian, Jiann-Fuh Chen, Hsuan Liao
National Cheng Kung University, Taiwan

23P3-4 **Design and Evaluation of a Magnetically-Loosely-Coupled Inductor for a Four-Phase Interleaved Boost Chopper**
Hiroki Kowatari, Toshinori Kitamura, Nobukazu Hoshi
Tokyo University of Science, Japan

Poster Session 23P4 Grid-tied Converters II

23P4-1 **A Synchronous-Reference-Frame I-V Droop Control Method for Parallel-Connected Inverters**
Mingshen Li, Yonghao Gui, Zheming Jin, Yajuan Guan, Josep M. Guerrero
Aalborg University, Denmark

23P4-2 **Transient Stability Impact of the Phase-Locked Loop on Grid-Connected Voltage Source Converters**
Heng Wu, Xiongfei Wang
Aalborg University, Denmark

23P4-3 **Comprehensive Analysis of Virtual Impedance-Based Active Damping for *LCL* Resonance in Grid-Connected Inverters**
Teng Liu, Zeng Liu, Jinjun Liu, Yiming Tu, Zipeng Liu
Xi'an Jiaotong University, China

23P4-4 **A Comparative Study of the Traditional FS-MPC and the Proposed CSF-PCC for the Three-Phase Grid-Connected Inverters**
ZhiXun Ma[1,2], Xin Zhang[1], Jingjing Huang[1,3]
1) Nanyang Technological University, Singapore, 2) Tongji University, Shanghai, 3) Xi'an University of Technology, China

23P4-5 **Constant Switching-Frequency Predictive- Current-Control Method with a Dichotomy Solution for the Grid-Tied Inverters**
ZhiXun Ma[l,2], Xin Zhang[l], Jingjing Huang[l,3], Zhao Binl, Lyu Jing[4]
l) Nanyang Technological University, Singapore, 2) Tongji University, China, 3) Xi'an University of Technology, China, 4) Shanghai Jiao Tong University, China

23P4-6 **Observer-Based Active Damping for Grid-Connected Converters with LCL Filter**
Y. Zhang, M. G. L. Roes, M. A. M. Hendrix, J. L. Duarte
Eindhoven University of Technology, The Netherlands

Poster Session 23P5 Isolated DC-DC Converters III

23P5-1 **Conduction Loss Analysis and Optimization Design of Full Bridge LLC Resonant Converter**
Yugang Yang, Lifei Zhang, Tianshu Ma
Liaoning Technical University, China

23P5-2 **Full-Bridge T-type Isolated DC/DC Converter with Wide Input Voltage Range**
Dong Liu[1], Yanbo Wang[1], Fujin Deng[2], Zhe Chen[1]
1) Aalborg University, Denmark, 2) Southeast University, China

23P5-3 **Research on High Efficiency LLC DC-DC Converter Based on SiC MosFet**
Pengcheng Han[1], Xiaoqiong He[1,2], Haijun Ren[1], Zhiqing Zhao[1], Xu Peng[1]
1) Southwest Jiaotong University, China, 2) National Rail Transit Electrification and Automation Engineering Technique Research Center, China

23P5-4 **An Improved Dual Phase Shift Control Strategy for Dual Active Bridge DC-DC Converter with Soft Switching**
Miao Hong, Gao Xuanjie, Zeng Chengbiand, Duan Shujiang
Sichuan University, China

Poster Session 23P6 Wide Band Gap Devices II

23P6-1 **Development of an SiC High-Frequency PWM Inverter Using a Thick Multilayer PCB to Minimize Stray Inductance**
Kohsuke Ishikawa, Satoshi Ogasawara, Masatsugu Takemoto, Koji Orikawa
Hokkaido University, Japan

23P6-2 **Fast Switching Planar Power Module with SiC MOSFETs and Ultra-Low Parasitic Inductance**
Arash Edvin Risseh[1], Hans-Peter Nee[1], Konstantin Kostov[2]
1) KTH Royal Institute of Technology, Sweden, 2) The Mads Clausen Institute, SDU Electrical Engineering, Denmark

23P6-3 **Experimental Evaluation of Inverter System Consisting of 4-Parallel GaN Devices Unit**
Yoshiya Ohnuma[1], Satoshi Miyawaki[1], Fumiya Hattori[2], Masayoshi Yamamoto[2]
1) Nagaoka Power Electronics, Japan, 2) Nagoya University, Japan

Poster Session 23P7 Si Devices

23P7-1 **Impact of the Thermal-Interface-Material Thickness on IGBT Module Reliability in the Modular Multilevel Converter**
Yi Zhang, Huai Wang, Zhongxu Wang, Yongheng Yang, Frede Blaabjerg
Aalborg University, Denmark

23P7-2 **Nanoscale Investigation of the Power MOSFET by the AFM/KFM/SCFM**
Mizuki Nakajima[1], Yuuki Uchida[1], Nobuo Satoh[1], Hidekazu Yamamoto[2]
Chiba Institute of Technology, Japan

23P7-3 **Simulation Analysis of Optimum Gate Driving Conditions of IGBTs**
Satoshi Sugahara, Masaki Kawakami, Kousuke Kamakura
Fukuyama University, Japan

23P7-4 **Improvement of the I^2t Capability for xEV Active Short Circuit Protection by Combination of RC-IGBT and Leadframe Technologies**
Keiichi Higuchi, Hayato Nakano, Akihiro Osawa, Akio Kitamura, Shunji Takenoiri, Daisuke Inoue, Souichi Yoshida, Hiromichi Gohara, Masahito Otsuki
Fuji Electric Co., Ltd, Japan

23P7-5 **Investigation of Switching Behavior of an IGBT under Soft Turn-off in Application for Dual-Active Bridge Converters**
Eri Ogawa[1], Yuichi Onozawa[1], Rik W. De Doncker[2]
1) Fuji Electric Co., Ltd., Japan, 2) RWTH Aachen University, Germany

Poster Session 23P8 Packaging and Circuit Integration II

23P8-1 **600V High Voltage Gate Driver IC (HVIC) with 1.0 MHz High Frequency Operation for LLC Current Resonant Power Supply**
Masaharu Yamaji, Masashi Akahane, Takahide Tanaka, Akihiro Jonishi, Hidetomo Ohashi, Masahiro Sasaki, Hitoshi Sumida
Fuji Electric Co. Ltd., Japan

23P8-2 **An Integrated Voltage and Current Balancing Strategy of Series-Parallel Connected IGBTs**
Xiaotong Du, Fang Zhuo, Haotian Sun, Hao Yi, Yanlin Zhu
Xi'an Jiaotong University, China

23P8-3 **Thermal Design and Analysis of a Cable Charger Used for Portable Electronics**
Mofan Tian, Xu Yang, Naizeng Wang, Yang Chen, Laili Wang
Xi'an Jiaotong University, China

23P8-4 **Parasitic Inductance Design Considerations to Suppress Gate Voltage Oscillation of Fast Switching Power Semiconductor Devices**
Yusuke Sugihara[1], Kimihiro Nanamori[1], Masayoshi Yamamoto[2], Yasuki Kanazawa[2]
1) Shimane University, Matsue, Japan, 2) Nagoya University, Japan

Poster Session 23P9 Electric Machines, Actuators and Sensors

23P9-1 **The Examination of Increasing Operation Speed of Consequent Pole Type Axial Gap Motor for Higher Output Power Density**
Toru Ogawa[1,2], Tomohira Takahashi[3], Masatsugu Takemoto[2], Satoshi Ogasawara[2], Hideaki Arita[3], Akihiro Daikoku[1]
1) Mitsubishi Electric Corp., Japan, 2) Hokkaido Univ., Japan, 3) Mitsubishi Electric Corp., Japan

23P9-2 **Basic Study of PMASynRM with Bonded Magnets for Traction Applications**
Marika Kobayashi, Shigeo Morimoto, Masayuki Sanada, Yukinori Inoue
Osaka Prefecture University, Japan

23P9-3 **Study on Rotor Structure Suitable for Improving Power Density and Efficiency in IPMSMs for Automotive Applications**
R. Imoto, M. Sanada, S. Morimoto, Y. Inoue
Osaka Prefecture University, Japan

23P9-4 **Examination of the Demagnetization Suppression Effect of Placing Flux Barriers in an IPMSM Using Rare-Earth Bonded Magnets**
Takashi Umeda, Masayuki Sanada, Shigeo Morimoto, Yukinori Inoue
Osaka Prefecture University, Japan

23P9-5 **A Novel Pole-Changing Method with a Multiple Three-Phase Inverter**
Yuki Hidaka[1], Taiga Komatsu[1], Hideaki Arita[2]
1) Mitsubishi Electric Corporation, Japan, 2) Mitsubishi Electric Corporation, Japan

23P9-6 **Starting Characteristics of an Ultra-Lightweight Motor Using Magnetic Resonance Coupling**
Kenta Takishima, Kazuto Sakai
Toyo University, Japan

23P9-7 **Design and Basic Characteristics Analysis of Toroidal Winding Axial Gap Induction Motor**
Ryosuke Sakai, Yukihiro Yoshida, Katsubumi Tajima
Akita University, Japan

23P9-8 **Magnet Arrangement suitable for Large Air Gap Length in Linear PM Vernier Motor**
Tatsuya Ninomiya, Abdulaziz Gasim, Shoji Shimomura
Shibaura Institute of Technology, Japan

23P9-9 **Micro Electromagnetic Vibration Energy Harvester with Mechanical Spring and Iron Frame for Low Frequency Operation**
Yecheng Shen, Kaiyuan Lu, Yongming Xia
Aalborg University, Denmark

23P9-11 **Measurement of Two-Level Inverter Induced Current Slopes at High Switching Frequencies for Control and Identification Algorithms of Electrical Machines**
Simon Decker[1], Andreas Liske[1], Daniel Schweiker[1], Johannes Kolb[2], Michael Braun[1]
1) Karlsruhe Institute of Technology, Germany, 2) Schaeffler Technologies AG & Co. KG, Germany

Poster Session 23P10 PV Systems II

23P10-1 **A New Topology of Switched-Capacitor Multilevel Inverter for Single-Phase Grid-Connected with Eliminating Leakage Current**
Mehdi Samizadeh[1], Xu Yang[1], Bagher Karami[2], Wenjie Chen[1], Mohamad Abou Houran[1], Adib Abrishamifar[2], Abdolreza Rahmati[2]
1) Xi'an Jiaotong University, China, 2) Iran University of Science & Technology, Iran

23P10-2 **An Interleaved Buck-Cascaded Buck-Boost Inverter for PV Grid-Connection Applications**
Chien-Hsuan Chang, Chun-An Cheng, Hung-Liang Cheng
I-Shou University, Taiwan

23P10-3 **A Novel PV Array Connection Strategy with PV-Buck Module to Improve System Efficiency**
Chi Shao[1], Wenjie Wang[1], Lijun Hang[1], Anping Tong[2], Shitao Wang[3]
1) Hangzhou Dianzi University, China 2) Shanghai Jiao Tong University, China, 3) State Grid of China Technology College, China

23P10-4 **A Common-Mode Voltage Reduction for Two-Stage Three-Phase Transformerless PV Inverters**
Adisak Promyoo, Surapong Suwankawin
Chulalongkorn University, Thailand

23P10-5 **A Grid-Connected PV-Energy Storage System with Synchronous Generator Characteristics**
Huadian Xu, Jianhui Su, Ning Liu, Yong Shi, Yan Du
Hefei University of Technology, China

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

23P11-1 A Transformerless Bidirectional DC-DC Converter Based on Power Units with Unipolar and Bipolar structure for MVDC Interconnection
Lejia Sun[1], Fang Zhuo[1], Feng Wang[1], Hao Yi[1], Baohui Ma[2]
1) Xi'an Jiaotong University, China, 2) State Key Laboratory of Large Electric Drive System and Equipment Technology, China

23P11-2 New Modulation Control of Converter System Applied for Offshore Wind Farms
Naoki Kawabata, Noriyuki Kimura, Toshimitsu Morizane, Hideki Omori
Osaka Institute of Technology, Japan

23P11-3 Sphere Decoding Based Long-Horizon Predictive Control of Three-Level NPC Back-to-Back PMSG Wind Turbine Systems
Ferdinand Grimm[1,2], Zhenbin Zhang[1], Ralph Kennel[2]
1) Shandong University, China, 2) Technische Universitat Munchen, Germany

23P11-4 Based on PCHD and HPSO Sliding Mode Control of D-PMSG Wind Power System
Lijun Hou, Xuemei Zheng, Chao Wang, Yangman Li, Haoyu Li
Harbin Institute of Technology, China

23P11-5 Establishment and Dynamic Control of Wind Induction Generator
M. Z. Lu, V. K. Ganisetti, C. M. Liaw
National Tsing Hua University, Taiwan

23P11-6 Middle Frequency Solid State Transformer for HVDC Transmission from Offshore Windfarm
Noriyuki Kimura[1], Toshimitsu Morizane[1], Isao Iyoda[2], Kazushige Nakao[3], Tomoki Yokoyama[4]
1) Osaka Institute of Technology, Japan, 2) Osaka Electro-Communication University, Japan, 3) Fukui Institute of Technology, Japan, 4) Tokyo Denki University, Japan

23P11-7 Simulation of Wind Power Generation System Using Switched Reluctance Generator and Capacitor-less AC-AC Converter
Guyuan Ji, Kazuhiro Ohyama
Fukuoka Institute of Technology, Japan

23P11-8 A Multi-Phase Series-Connected Modular Converter for Offshore Wind Energy Conversion System
Baiyan Sun[1], Congzhe Gao[1], Xiangdong Liu[1], A. Haddad[2], Jun Liang[2], Zhen Chen[1], Tong Zheng[1]
1) Beijing Institute of Technology, China, 2) Cardiff University, UK

23P11-9 Variable Frequency Control and Filter Design for Optimum Energy Extraction from a SiC Wind Inverter
Abdallah Hussein, Alberto Castellazzi
The University of Nottingham, UK

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

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

23P12-2 A Control Method for Two Types of Three-Phase Transformerless Unified Power Quality Conditioner
Fujian Li, Guochun Xiao, Fangzhou Zhao, Shuai Zhang, Baojin Liu
Xi'an Jiaotong University, China

23P12-3 Design of Customer-End Converter Systems for Low Voltage DC Distribution from a Life Cycle Cost Perspective
A. Mattsson, P. Nuutinen, T. Kaipia, P. Peltoniemi, J. Karppanen, V. Tikka, A. Lana, P. Pinomaa, P. Silventoinen, J. Partanen
Lappeenranta University of Technology, Finland

23P12-4 A Control Method of DC Capacitor Voltage in MMC for HVDC System Using Negative Sequence Current
Hanis Afiqah binti Jaffar, Ahmad Arif bin Abd Rahman, Hiroaki Kakigano
Ristumeikan University, Japan

23P12-5 A Coordinate and Distributed Control Scheme for Multilevel and Multi-Stage Medium Voltage Solid State Transformer
Jintong Nie, Liqiang Yuan, Qing Gu, Jianning Sun, Zhengming Zhao
Tsinghua University, China

23P12-6 An Improved Harmonic Power Sharing Scheme of Paralleled Inverter System
Liu Hongpeng, Liu Xiaoxi, Zhang Wei, Wang Wei
Harbin Institute of Technology, China

23P12-7 The Grid Impedance Adaptation Dual Mode Control Strategy in Weak Grid
Ming Li, Xing Zhang, Ying Yang, Pengpeng Cao
Hefei University of Technology, China

23P12-8 Transmission Power Analysis and Control of the DC Transformer in Hybrid AC/DC Microgrid
Jingjin Huang[1,2], Xin Zhang[2], Tengfei Zhang[2]
1) Xi'an University of Technology, China, 2) Nanyang Technological University, Singapore

23P12-9 A Novel Flexible Interconnection Scheme for Microgrid to Optimize the Capacity of Energy Storage System (ESS)
Jianqiao Zhou, Jianwen Zhang, Xu Cai, Zhuyong Li
Shanghai Jiaotong University, China

23P12-10 VSC Control and Parameters Design Based on Virtual Synchronous Generator
Fang Liu, Meng Wang, Zhen Xie, Fusheng Wang, Jinxin Deng, Xing Zhang
Hefei University of Technology, China

23P12-11 Multi-Target Virtual Resistance Control Strategy in a 400 Hz Low Voltage Microgrid
Yuze Li, Xuejun Pei, Zhi Chen, Hanyu Wang, Yong Kang
Huazhong University of Science and Technology, China

23P12-12 An Adaptive Power Compensation Strategy for the Voltage Stabilization of LCL-VSC Based Microgrids
Sheng Xu[1], Wu Cao[2], Dongchen Fan[2], Jianfeng Zhao[2], Shunyu Wang[2]
1) Taizhou University, China, 2) Southeast University, China

23P12-13 Resonance Detection Strategy for Multiple Grid-Connected Inverters-Based System Using Cascaded Second-Order Generalized Integrator
Wu Cao[1], Dongchen Fan[1], Kangli Liu[1], Jianfeng Zhao[1], Liheng ruan[2], Xiaojun Wu[2]
1) Southeast University, China, 2) Jiangsu Haihang Electric Technology Co. Ltd, China

23P12-14 Harmonic Stability Assessment Based on Global Admittance for Multi-Paralleled Grid-Connected VSIs Using Modified Nyquist Criterion
Wu Cao[1], Dongchen Fan[1], Kangli Liu[1], Jianfeng Zhao[1], Liheng ruan[2], Xiaojun Wu[2]
1) Southeast University, China, 2) Jiangsu Haihang Electric Technology Co. Ltd, China

23P12-15 The AC Traction Power Supply System for Urban Rail Transit Based on Negative Sequence Current Compensator
Tianshu Zhao[1], Xu Peng[2]
1) Chengdu NO. 7 High School, China, 2) Southwest Jiaotong University, China

Poster Session 23P13 Power Electronics for Automobiles

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

23P13-2 An Isolated PFC Converter with Harmonic Modulation Technique for EV Chargers
Jun Young Lee
Myongji University, Korea

Poster Session 23P14 Industrial Applications II

23P14-1 Highly Dynamic Switching Frequency-Based Calculation of Power Quantities, Fundamental Waveforms, and RMS Values of Inverter-Fed Electrical Machines
Alexander Stock, Johannes Teigelkötter, Johannes Büdel
University of Aschaffenburg, Germany

23P14-2 Design and Analysis of High Voltage Power Supply for Industrial Electrostatic Precipitators
Shengwen Fan[1], Yiqin Yuan[2], Pengyu Jia[2], Zhigang Chen[1], Haisi Li[2]
1) University of Science and Technology Beijing, China, 2) North China University of Technology, China

23P14-3 Load Sharing Operation in N+1 UPS System by Using Harmonic Sharing Control Method
Prashant Patel[1], Sagar Naina[2], Utsav Patel[2], Premal Patwa[2]
1) Hitachi India Pvt. Ltd., India, 2) HHPE Pvt. Ltd., India

Poster Session 23P15 Power Converters and Systems II

23P15-1 Research on Capacity Optimization of PV-Wind-Diesel-Battery Hybrid Generation System
Cailing Zhu[1], Furong Liu[1], Sheng Hu[1], Shu Liu[2]
1) Wuhan University of Technology, China, 2) Sinomach Intelligence Technology Research Institute, China

23P15-2 A Numerical Analysis and Improvement of Output Characteristics in Different Passive Rectifiers Based on Vibration Generators
Tomoki Sakabe, Masataka Minami, Shin-ichi Motegi, Masakazu Michihira
Kobe City College of Technology, Japan

23P15-3 Circuit Modeling Approach for Analyzing Triboelectric Nanogenerators for Energy Harvesting
Bo-Kyung Yoon, Jeong Min Baik, Katherine A. Kim
Ulsan National Institute of Science and Technology, Korea

Poster Session 23P16 Power Converters and Systems III

23P16-1 General Power Electric Converter Model
Jingwen Xie
Schneider Electric, China

23P16-2 A Modular Converter- and Signal-Processing-Platform for Academic Research in the Field of Power Electronics
Rüdiger Schwendemann, Simon Decker, Marc Hiller, Michael Braun
Karlsruhe Institute of Technology, Germany

23P16-3 A Forced Commutation Method of the Solid-State Transfer Switch in the Uninterrupted Power Supply Applications
Meng-jiang Tsai, Jiuyang Zhou, Po-tai Cheng
National Hsing-hua University, Taiwan

23P16-4 Control IC for Boost-Flyback Converter for Energy Harvesting Applications
Jhih-Sian Li, Tsorng-Juu Liang, Kai-Hui Chen, Jui-Hung Lai, Jun-Xian Huang
National Cheng Kung University, Taiwan

Wednesday, May 23: 14:20-16:00

Room A

Oral Session 23A3 Application of DC-DC Converters

23A3-1 New Concept of the DC-DC Converter Circuit Applied for the Small Capacity Uninterruptible Power Supply
Dang Minh Huynh, Yoichi Ito, Shinji Aso, Koji Kato, Kenji Teraoka
Sanken Electric Co., Japan

23A3-2 Comparative Study on the Performance of Dual-Phase Tapped-Inductor Boost Converter and Interleaved Boost Parallel-Input Series-Output Converter in 40 to 400V Applications
Niño Christopher Ramos[1,2], Tsuyoshi Funaki[2]
1) University of the Philippines-Diliman, Philippines, 2) Osaka University, Japan

23A3-3 **A New Standby Structure Integrated with Boost PFC Converter for Server Power Supply**
Jae-Il Baek[1], Jae-Kuk Kim[2], Jae-Bum Lee[3], Moo-Hyun Park[1], Gun-Woo Moon[1]
1) KAIST, Korea, 2) In-ha University, Korea, 3) KRRI, Korea

23A3-4 **Nonisolated Two-Channel LED Driver with Simple Snubber**
Jong-Woo Kim[1], Jung-Kyu Han[2], Jih-Sheng Lai[1]
1) Virginia Tech, USA, 2) Electrical Engineering, KAIST, Korea

Room B

Oral Session 23B3 Modular Multi-level Converters III

23B3-1 **Design and Implementation of Single-Phase Asymmetric Multilevel STATCOM**
Hao Chen[1], Yang Han[1], Ping Yang[1], Congling Wang[1], Josep M. Guerrero[2]
1) University of Electronic Science and Technology of China, China, 2) Aalborg University, Denmark

23B3-2 **Submodule Voltage Balancing and Loss Equalisation in Alternate Arm Converters Based on Virtual Voltages**
Georgios Konstantinou[1], Harith R. Wickramasinghe[1], Salvador Ceballos[2], Josep Pou[3]
1) The University of New South Wales, Australia, 2) Tecnalia Research and Innovation, Spain, 3) Nanyang Technological University, Singapore

23B3-3 **Balanced Conduction Loss Distribution among SMs in Modular Multilevel Converters**
Zhongxu Wang, Huai Wang, Yi Zhang, Frede Blaabjerg
Aalborg University, Denmark

23B3-4 **Simplification of Model Predictive Control for Modular Multilevel Converter through Direct Voltage Level Selection**
Xingxing Chen, Jinjun Liu, Shaodi Ouyang, Shuguang Song, Rui Luo
The University of Xi'an Jiaotong, China

Room C

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

23C3-1 **Family of Integrated Multi-Input Multi-Output DC-DC Power Converters**
Bang Le-Huy Nguyen[1], Honnyong Cha[1], Tien-The Nguyen[1], Heung-Geun Kim[2]
1) Kyungpook National University, Korea, 2) Kyungpook National University, Korea

23C3-2 **Low-Complexity State-Space Based System Identification and Controller Auto-Tuning Method for Multi-Phase DC-DC Converters**
Marc Kanzian[1], Harald Gietler[2], Christoph Unterrieder[1], Matteo Agostinelli[1], Michael Lunglmayr[3], Mario Huemer[3]
1) Infineon Technologies Austria AG, Austria, 2) Alpen-Adria Universität Klagenfurt, Austria, 3) Johannes Kepler University Linz, Austria

23C3-3 **A Phase-Shift Double Full-Bridge (PSDB) Converter with Three Shared Leading-Legs**
Junjie Zhu, Qinsong Qian, Shengli Lu, Weifeng Sun, Le Zhang
Southeast University, China

23C3-4 **Dual Active Bridge Synchronous Rectified Step-Down Converter**
Chien-Chun Huang[1], Chang-Lin Tsai[1], Tsung-Lin Tsai[1], Yao-Ching Hsieh[2], Huang-Jen Chiu[1], Jing-Yuan Lin[1]
1) National Taiwan University of Science and Technology, Taiwan, 2) National Sun Yat-Sen University, Taiwan

Room D

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

23D3-1 **Accurate Impedance Model of Grid-Connected Inverter for Small-Signal Stability Assessment in High-Impedance Grids**
Tuomas Messo, Roni Luhtala, Aapo Aapro, Tomi Roinila
Tampere University of Technology, Finland

23D3-2 **Modeling of Unbalanced Three-Phase Grid-Connected Converters with Decoupled Transfer Functions**
Wei Liu, Xiongfei Wang, Frede Blaabjerg
Aalborg University, Denmark

23D3-3 **Predicting Voltage Characteristic of Charging Model for Li-Ion Battery with ANN for Real Time Diagnosis**
Minella Bezha, Naoto Nagaoka
Doshisha University, Japan

23D3-4 **Impedance Modeling and Stability Analysis of the Cascaded Three-Phase Symmetric Systems Using Complex Transfer Functions**
Teng Liu, Zeng Liu, Jinjun Liu, Yiming Tu, Zipeng Liu
Xi'an Jiaotong University, China

Room E

Oral Session 23E3 Reluctance Machines

23E3-1 **Acoustic Noise Reduction of 12/8 Poles SRM without Efficiency Drop Using Simple Current Waveforms**
Kyohei Kiyota[1], Kenji Amei[1], Takahisa Ohji[1], Jun Jisaki[2], Masanobu Nakai[2]
1) University of Toyama, Japan, 2) Nachi-Fujikoshi Corp., Japan

23E3-2 **Study of Switched Reluctance Motor Directly Driven by Commercial Three-Phase Power Supply**
Masaki Takahashi, Kohei Aiso, Kan Akatsu
Shibaura Institute of Technology, Japan

23E3-3 **Double Stator Axial-Flux Switched Reluctance Motor for Electric City Commuters**
Hiroki Goto
Utsunomiya University, Japan

23E3-4 **Torque Ripple Reduction Using Asymmetric Flux Barriers in Synchronous Reluctance Motor**
Yuuto Yamamoto, Shigeo Morimoto, Masayuki Sanada, Yukinori Inoue
Osaka Prefecture University, Japan

Room F

Oral Session 23F3 Chargers for Transportation Systems

23F3-1 **On-board Single-Phase Electric Vehicle Charger with Active Front End**
Theodore Soong, Peter W. Lehn
University of Toronto, Canada

23F3-2 **A Bidirectional Buffered Charging Unit for EV's (BBCU)**
Alfred Rufer, Gabriel Fernandez
Ecole Polytechnique Fédérale de Lausanne, Switzerland

23F3-3 **Reconfigurable Converter with Multiple-Voltage Multiple-Power for E-Mobility Charging**
Mohamed S A Dahidah[1], He Liu[1], Vassilios G. Agelidis[2]
1) Newcastle University, UK, 2) Technical University of Denmark, Denmark

23F3-4 **Development of a Series Hybrid Electric Vehicle Laboratory Test Bench with Hardware-in-the-Loop Capabilities**
Poria Fajri[1], Nima Lotfi[2], Mehdi Ferdowsi[3]
1) University of Nevada Reno, USA, 2) Southern Illinois University, USA, 3) Missouri University of Science and Technology, USA

Room G

Oral Session 23G3 Smart Grids and Distributed Power Sources

23G3-1 **New Three-Phase Static Transfer Switch Using AC SSCB**
Seung-Min Song, Jin-Young Kim, In-Dong Kim
Pukyong National University, Korea

23G3-2 **Harmonics Compensation in High Frequency Range of Active Power Filter with SiC-MOSFET Inverter in Digital Control System**
Shin-ichi Hamasaki, Kengo Nakahara, Mineo Tuji
Nagasaki University, Japan

23G3-3 **Control of Buck-Boost Direct Matrix Converter with Low Voltage Ride-Through Capability**
Nico Remus, Martin Leubner, Wilfried Hofmann
Technical University Dresden, Germany

23G3-4 **An Improved PLL Based Seamless Transfer Control Strategy**
Xin Meng, Jinjun Liu, Zeng Liu, Ronghui An
Xi'an Jiaotong University, China

Room H

Oral Session 23H3 Energy Storage System for Railway Systems

23H3-1 **Efficient Urban Railway Design integrating Train Scheduling, Onboard Energy Storage, and Traction Power Management**
Warayut Kampeerawar[1], Takafumi Koseki[1], Fulin Zhou[2]
1) The University of Tokyo, Japan, 2) Southwest Jiaotong University, China

23H3-2 **Optimal Control Method of an Energy Storage System for Energy Saving**
Yoko Takeuchi, Tomoyuki Ogawa, Keisuke Sato, Hiroaki Morimoto, Tatsuhito Saito
Railway Technical Research Institute, Japan

23H3-3 **Start-Up and Transient Operation of a Bidirectional Chopper with an Auxiliary Converter**
Hamzeh J. Ahmad, Haruna Ohnishi, Makoto Hagiwara
Tokyo Institute of Technology, Japan

23H3-4 **Experimental Results of Quasi-Optimal Charging Current Patterns to Reduce the Internal Heat Generation of the Lithium-Ion Battery**
Yoshiaki Taguchi, Gaku Yoshikawa
Traction Control, Railway Technical Research Institute, Japan

Room K

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

23K3-1 **Development of Test Methods and Evaluation Results for 500kV HVDC Converter**
Keisuke Hattori[1], Asuka Ohtake[1], Takayoshi Kamejima[2], Haruhisa Wada[3]
1) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan, 2) Toshiba Energy Systems & Solutions Corporation, Japan, 3) Toshiba Corporation, Japan

23K3-2 **Dissipation Loop for Shoot-Through Faults in HVDC Converter Cells**
Keijo Jacobs, Staffan Norrga, Hans-Peter Nee
KTH Royal Institute of Technology, Sweden

23K3-3 **A Suppression Method of Harmonic Instability in Line-Commutated Converters Applying Active Harmonic Filters**
Kenichiro Sano[1], Toshiaki Kikuma[1], Tatsuhito Nakajima[2], Junya Kanno[3]
1) CRIEPI, Japan, 2) Tokyo City University, Japan, 3) TEPCO Holdings, Japan

23K3-4 **Experiment of Semiconductor Breaker Using Series-Connected IEGTs for Hybrid DCCB**
Kazuyasu Takimoto[1], Hiroshi Takenaka[1], Toshiaki Matsumoto[1], Takahiro Ishiguro[2]
1) Toshiba Corporation, Japan, 2) Toshiba Energy Systems & Solutions Corporation, Japan

Room A

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

23A4-1 **Study of EMI Caused by Buck Converter on Controller Area Network**
Ryo Shirai, Toshihisa Shimizu
Tokyo Metropolitan University, Japan

23A4-2 **A Study on Reduction Techniques of a Wideband Common-Mode Voltage Produced by a PWM Inverter**
Shotaro Takahashi[1], Satoshi Ogasawara[1], Masatsugu Takemoto[1], Koji Orikawa[1], Michio Tamate[2]
1) Hokkaido University, Japan, 2) Fuji Electric Co., Ltd., Japan

23A4-3 **A Modified Discontinuous PWM for Commonmode Voltage Elimination in 3-Level 4-Leg PWM Converter System**
Seon-Ik Hwang[1], Jun-Hyung Jung[1], In-Ho Cho[2], Jang-Mok Kim[1], Yung-Deug Son[3]
1) Pusan National University, Korea, 2) Hyundai Heavy Industries, Korea, 3) Korea University of Technology and Education, Korea

23A4-4 **EMI Analysis of Full-SiC Integrated Power Module**
Xiliang Chen, Wenjie Chen, Yu Ren, Liang Qiao, Yilin Sha, Xu Yang
Xi'an Jiaotong University, China

Room B

Oral Session 23B4 Wireless Power Transfer Systems II

23B4-1 **Experimental Verification of Coupling Effect and Power Transfer Capability of Dynamic Wireless Power Transfer**
Chan Anyapo[1], Nithiphat Teerakawanich[1], Chowarit Mitsantisuk[1], Kiyoshi Ohishi[2]
1) Kasetsart University, Thailand, 2) Nagaoka University of Technology, Japan

23B4-2 **Neighboring Effects on the Deactivated Inverter in a Segmented Dynamic Wireless EV Charging System**
Qingwei Zhu[1], Yanjie Guo[2], Lifang Wang[2], Shufan Li[2], Chenglin Liao[2]
1) University of Manchester, UK, 2) Chinese Academy of Sciences, China

23B4-3 **Multiple Exciting Voltage Control for Maximization of Multi-Hop Wireless Power Transfer Efficiency**
Masato Sasaki, Masayoshi Yamamoto
Nagoya University, Japan

23B4-4 **General Analytical Model for Inductive Power Transfer System with EMF Canceling Coils**
Keita Furukawa, Keisuke Kusaka, Jun-ichi Itoh
Nagaoka University of Technology, Japan

Room C

Oral Session 23C4 Output Filter Technologies

23C4-1 **Stability Influence of Filter Components Parasitic Resistance on LCL-Filtered Grid Converters**
Hiroaki Matsumori[1], Toshihsia Shimizu[1], Frede Blaabjerg[2], Xiongfei Wang[2], Dongsheng Yang[2]
1) Tokyo Metropolitan University, Japan, 2) Aalborg University, Denmark

23C4-2 **Real-Time Estimation Control of Inductance Parameters Using Dust Core Materials for PWM Inverter**
Kazu Imai[1], Takuma Yoshino[1], Ohasi Shunsuke[2], Tomoki Yokoyama[1]
1) Tokyo Denki University, Japan, 2) Fuji Electric Co., Ltd, Japan

23C4-3 **Control Design of Output-Stage Filterless Sinusoidal-Wave Inverter**
Shinichi Hiroshige, Kenji Yamanaka, Masahide Hojo
Tokushima University, Japan

23C4-4 **Series Reactive Power Compensator with Reduced Capacitance for Hybrid Transformer**
Yuki Takahashi, Takanori Isobe, Hiroshi Tadano
University of Tsukuba, Japan

Room D

Oral Session 23D4 SiC Power Devices

23D4-1 **An Insight into the Voltage Rising Behavior during Turn-off Process of Series Connected SiC MOSFETs on Circuit Level**
Panrui Wang[1], Feng Gao[1], Yang Jing[1], Yufeng Chen[2], Lei Zhang[2]
1) Shandong University, Jinan, China, 2) State Grid Shandong Electric Power Research Institute, China

23D4-2 **Paralleling Six 320A 1200V All-SiC Half-Bridge Modules for a Large Capacity Power Stack**
David Hongfei Lu, Hiromu Takubo, Sho Takano, Yuhei Suzuki
Fuji Electric Co., Ltd., Japan

23D4-3 **3.3kV All-SiC Module for Electric Distribution Equipment**
Ryohei Takayanagi, Katsumi Taniguchi, Satoshi Kaneko, Naoyuki Kanai, Keishirou Kumada, Motohito Hori, Yoshinari Ikeda, Kouji Maruyama, Itsuo Kawamura
Fuji Electric Co., Ltd., Japan

23D4-4 **Present Status of SiC Based Power Converters and Gate Drivers – A Review**
Abhijit Choudhury
*Experimental Power Grid Centre (EPGC), Institute of Chemical and Engineering Sciences (ICES), Agency for Science Technology and Research (A*STAR), Singapore*

Room E

Oral Session 23E4 SRM & FSM Drives

23E4-1 **Method of Applying Force Distribution Function for Linear Switched Reluctance Motor Driven by Current Source Inverter**
Tadashi Hirayama, Shuma Kawabata
Kagoshima University, Japan

23E4-2 **A Novel Drive Circuit for Switched Reluctance Motors with Bipolar Current Drive**
Hiroki Ishikawa, Yuma Uesugi, Seiya Sakurai
Gifu University, Japan

23E4-3 **Torque Ripple Minimization Control of SRM Based on Novel Motor Model Considering Mutual Coupling Effect**
Sungyong Shin, Hikaru Naruse, Takashi Kosaka, Nobuyuki Matsui
Nagoya Institute of Technology, Japan

23E4-4 **Comparison of High Frequency Voltage Injection Methods for Shaft Sensorless Control of Wound-Field Flux Switching Machine**
Hong-Quan Nguyen, Sheng-Ming Yang
National Taipei University of Technology, Taiwan

Room F

Oral Session 23F4 FACTS

23F4-1 **Design and Experimental Verification of a DAB Medium Frequency Transformer for a 6.6kV/200V Solid State Transformer**
Rene Barrera-Cardenas[1], Takanori Isobe[1], Terazono Katsushi[2], Tadano Hiroshi[2]
1) University of Tsukuba, Japan, 2) Yaskawa Electric Corporation, Japan

23F4-2 **Research on the Unbalanced Compensation Range of Delta-connected Cascaded H-Bridge Multilevel SVG**
Rui Luo, Yingjie He, Yiming Tu, Xingxing Chen, Jinjun Liu
Xi'an Jiaotong University, China

23F4-3 **Y-Source Bi-Directional DC Circuit Breaker**
Haider Al-khafaf, Johnson Asumadu
Western Michigan University, USA

23F4-4 **Static Synchronous Compensator to Stabilize Grid Voltage for Wind and Photovoltaic Power Plant**
Ryota Okuyama, Naoki Morishima, Yusuke Ashizaki, Yohei Itaya
Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

Room G

Oral Session 23G4 Renewable Energy and Storage Applications

23G4-1 **Large Equalization Current Control Strategy for Series Connected Battery Packs Based on Buck-Boost Converter**
XinBo Liu[123], Zhuo Gao[123], XueHao Huang[123], YaoHan Zou[123]
1) Inverter Technologies Engineering Research Center of Beijing, China, 2) Collaborative Innovation Center of Key Power Energy-Saving Technologies in Beijing, China, 3) North China University of Technology, China

23G4-2 **A Multi-Port Bidirectional Power Conversion System for Reversible Solid Oxide Fuel Cell Applications**
Xiang Lin[1], Kai Sun[1], Jin Lin[1], Zhe Zhang[2], Wei Kong[3]
1) Tsinghua University, China, 2) Technical University of Denmark, Denmark, 3) Shanghai University of Electric Power, China

23G4-3 **Self-Preheating Method for Li-ion Battery Using Battery Impedance Estimator**
Dong-Kwan Kim[1], Young-Dal Lee[1], Sang-Hyun Ha[1,2], Yu-Jin Jang[1], Gun-Woo Moon[1]
1) KAIST, Korea, 2) Agency for Defense Development, Korea

23G4-4 **Active Anti-Islanding Technique with Reduced Non-Detection Zone for Centralized Inverters**
Prashant Jain[1], Vivek Agarwal[2], Bishnu Prasad Muni[1], Eswar Rao[1], Deepak Gehlot[1], S.Gautam Kumar[1]
1) BHEL R&D, India, 2) IITB, India

Room H

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

23H4-1 **Development of SiC Applied Traction System for Shinkansen High-Speed Train**
Kenji Sato, Hirokazu Kato, Takafumi Fukushima
Central Japan Railway Company, Japan

23H4-2 **Development of a High Power Density Auxiliary Converter Based on 1700V 225A SiC MOSFET for Trams**
Liu Hao[1], Fei Lin[1], Zhongping Yang[1], Hu Cao[2], Meng Xia[2]
1) Beijing Jiaotong University, China, 2) Qingdao Sifang Rolling Stock Research Institute Co. Ltd., China

23H4-3 **Experimental Tests Results of Damping Control with Over Voltage Resistor for Regenerative Brake Control of Railway Vehicle**
Natsuki Kawagoe[1], Febry Pandu Wijaya[1], Hiroyasu Kobayashi[1], Keiichiro Kondo[1], Tetsuya Iwasaki[2], Akihiko Tsumura[2], Takumi Nagashima[2], Yoshinori Yamashita[3], Ryota Gondo[3]
1) Chiba University, Japan, 2) Odakyu Electric Railway Co. Ltd., Japan, 3) Mitsubishi Electric Co. Ltd., Japan

23H4-4 **Coils Layout Optimization of Dynamic Wireless Power Transfer System to Realize Output Voltage Stable**
Yi Wang, Fei Lin, Zhongping Yang, Panpan Cai, Zhiyuan Liu
Beijing Jiaotong University, China

Room K

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

23K4-1 **Quick Charger for a Battery Using Modular Matrix Converter (MMxC)**
Kazuma Suzuki, Takaharu Takeshita
Nagoya Institute of Technology, Japan

23K4-2 **Variable Output Voltage Control of an Isolated Bi-Directional AC/DC Converter with a Soft-Switching Technique**
Takumi Hamaguchi, Kazuma Suzuki, Wataru Kitagawa, Takaharu Takeshita
Nagoya Institute of Technology, Japan

23K4-3 **A New Modulation Method Applying Optimal Duty Cycle and Phase Shift for Bidirectional Isolated Three-Phase AC/DC Converter Based on Matrix Converter**
Koji Shigeuchi[1], Jin Xu[2], Noboru Shimosato[2], Yukihiko Sato[1]
1) Chiba University, Japan, 2) Myway Plus Corporation, Japan

23K4-4 **Isolated AC/DC Converter Using Simple PWM Strategy**
Naoki Hirose, Yuto Matsui, Takaharu Takeshita
Nagoya Institute of Technology, Japan

Thursday, May 24: 8:35-10:40

Room A

Oral Session 24A1 PFC Converters

24A1-1 **Interleaved Voltage-Doubler Boost Converter for Power Factor Correction**
Ta-Hsun Lo, Jen-Hao Teng, Bo-Jia Huang
National Sun Yat-Sen University, Taiwan

24A1-2 **ZVS Interleaved Totem-pole Bridgeless PFC Converter with Phase-Shifting Control**
Moo-Hyun Park, Jae-Il Baek, Jung-Kyu Han, Cheon-Yong Lim, Gun-Woo Moon
Korea Advanced Institute of Science and Technology, Korea

24A1-3 **A Zero-Voltage-Switching Totem-Pole Bridgeless Boost Power Factor Correction Rectifier Having Minimized Conduction Losses**
Young-Dal Lee[1], Chong-Eun Kim[2], Jae-Il Baek[1], Dong-Kwan Kim[1], Gun-Woo Moon[1]
1) KAIST, Korea, 2) Solu-m Corp., Korea

24A1-4 **Power-Factor-Correction with Power Decoupling for AC-to-DC Converter**
Wan-Jung Chen[1], Tsung-Hsi Wu[1], Yao-Ching Hsieh[1], Chin-Sien Moo[1], Po-Hsiang Wen[2]
1) National Sun Yat-Sen University, Taiwan, 2) Lite-On Technology Corporation, Taiwan

Room B

Oral Session 24B1 Multi-level Inverters II

24B1-1 **Design and Analysis of the Distributed Controller for the Modular Multilevel Cascaded Converter**
Invited Paper Ping-heng Wu, Yu-chen Su, Po-tai Cheng
National Tsing Hua University, Taiwan

24B1-2 **Asymmetric Mixed Modular Multilevel Converter Topology in Hybrid Bipolar HVDC Transmission Systems**
Invited Paper Joon-Hee Lee[1], Jae-Jung Jung[2], Seung-Ki Sul[1]
1) Seoul National University, Korea, 2) Samsung Electronics Company, Ltd., Korea

24B1-3 **High Power Medium Voltage 10 kV SiC MOSFET Based Bidirectional Isolated Modular DC–DC Converter**
Invited Paper Sayan Acharya, Ritwik Chattopadhyay, Anup Anurag, Satish Rengarajan, Yos Prabowo, Subhashish Bhattacharya
North Carolina State University, USA

24B1-4 **Multi-Level Power Converter Using Series-Connected Solid-State Transformers**
Invited Paper Yuichi Mabuchi, Yuki Kawaguchi, Kimihisa Furukawa, Mitsuhiro Kadota, Mizuki Nakahara, Akihiko Kanoda
Hitachi, Ltd., Japan

24B1-5 **Capacitor Voltage Control of MMC-STATCOM during Unbalanced AC System Fault**
Invited Paper Kaho Nada[1], Takeshi Kikuchi[1], Tsuguhiro Takuno[1], Toshiyuki Fujii[1], Ryosuke Uda[1], Takashi Sugiyama[2]
1) Mitsubishi Electric Corporation, Japan, 2) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

Room C

Oral Session 24C1 Recent Advances in Power Semiconductors

24C1-1 **SiC Based Power Semiconductor in Applications – Aspects and Prospects**
Invited Paper Peter Friedrichs
Infineon Technologies AG, Germany

24C1-2 **Electromagnetic Modeling Approaches Towards Virtual Prototyping of WBG Power Electronics**
Invited Paper Ivana Kovačević-Badstübner[1], Daniele Romano[2], Giulio Antonini[2], Jonas Ekman[3], Ulrike Grossner[1]
1) ETH Zurich, Switzerland, 2) University of L'Aquila, Italy, 3) Luleå University of Technology, Sweden

24C1-3 **Silicon Based Devices for Demanding High Power Applications**
Invited Paper A. Kopta, J. Vobecky, M. Rahimo, T. Wikström, U. Vemulapati, C. Papadopoulos, C. Corvasce, M. Andenna, F. Dugal, F. Fischer, S. Hartmann
ABB Switzerland, Ltd, Switzerland

24C1-4 **Recent Progress in High to Ultra-High-Voltage SiC Power Devices: Development and Application**
Invited Paper Yoshiyuki Yonezawa
National Institute of Advanced Industrial Science and Technology, AIST, Japan

24C1-5 **Dynamic Drift Effects in GaN Power Transistors: Correlation to Device Technology and Mission Profile**
Invited Paper Joachim Würfl[1], Eldad Bahat-Treidel[1], Oliver Hilt[1], Maria Troppenz[1,3], Mihaela Wolf[1], Jan Böcker[2], Carsten Kuring[2], Sibylle Dieckerhoff[2]
1) Ferdinand-Braun-Institut, Leibniz Institut für Höchstfrequenztechnik, Germany, 2) Technical University of Berlin, Germany, 3) Humboldt Universität zu Berlin, Germany

Room D

Oral Session 24D1 Bearingless Machines & Magnetic Bearings I

24D1-1 **Compensation Method of Radial Unbalance Force at Failure of a Motor Section in a d-q Axis Current Control Bearingless Motor**
Invited Paper Masahide Ooshima
Tokyo University of Science, Japan

24D1-2 **A Bearingless Synchronous Reluctance Slice Motor with Rotor Flux-Barriers**
Invited Paper Thomas Holenstein[1], Thomas Nussbaumer[2], Johann W. Kolar[1]
1) ETH Zurich, Switzerland, 2) Levitronix GmbH, Switzerland

24D1-3 **Parameter Identifications of Current-Force Factor and Torque Constant in Single-Drive Bearingless Motors**
Invited Paper Hiroya Sugimoto, Akira Chiba
Tokyo Institute of Technology, Japan

24D1-4 **Dampening of Axial Vibrations in a Bearingless Flux-Switching Slice Motor by Field Current Regulation**
Invited Paper Bianca Klammer[1], Karlo Radman[1], Wolfgang Gruber[2]
1) Mechatronics GmbH, Austria, 2) Johannes Kepler University, Austria

24D1-5 **Analysis and Design of a Bearingless Axial- Force/Torque Motor with Flex-PCB Windings**
Invited Paper Nobuyuki Kurita[1], Walter Bauer[2], Gerald Jungmayr[3], Wolfgang Gruber[2], Wolfgang Amrhein[2]
1) Gunma University, Japan, 2) Johannes Kepler University, Austria, 3) Linz Center of Mechatronics GmbH, Austria

Room E

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

24E1-1 **A Plotter-Based Automatic Measurement and Statistical Characterization of Multiple Discrete Power Devices**
Invited Paper Michihiro Shintani[1], Benjamin Dauphin[2], Kazuki Oishi[2], Masayuki Hiromoto[2], Takashi Sato[2]
1) Nara Institute of Science and Technology, Japan, 2) Kyoto University, Japan

24E1-2 **A Novel High-Speed SiC MOSFET Driver with a Low Switch-Voltage Stress**
Invited Paper Xiuqin Wei[1], Yuchong Sun[2], Hiroo Sekiya[2]
1) Chiba Institute of Technology, Japan, 2) Chiba University, Japan

24E1-3 **Enhancement of Driving Capability of Gate Driver Using GaN HEMTs for High-Speed Hard Switching of SiC Power MOSFETs**
Invited Paper
Takafumi Okuda, Takashi Hikihara
Kyoto University, Japan

24E1-4 **Design and Experimental Verification of Robot Arm Operation for Power Packet Dispatching System**
Invited Paper
Tomoki Yokoyama, Ryunosuke Araumi, Kazunori Asada, Takashi Ando
Tokyo Denki University, Japan

24E1-5 **A Resource Sharing Model in a Power Packet Distribution Network**
Invited Paper
H. Ando[1], R. Takahashi[2], S. Azuma[3], M. Hasegawa[4], T. Yokoyama[5], T. Hikihara[6]
1) University of Tsukuba, Japan, 2) Aichi University of Technology, Japan, 3) Nagoya University, Japan, 4) Tokyo University of Science, Japan, 5) Tokyo Denki University, Japan, 6) Kyoto University, Japan

Room F

Oral Session 24F1 Grid-tied Converter Control I

24F1-1 **Decoupled DSOGI-PLL for Improved Three Phase Grid Synchronisation**
A. A. Nazib, D. G. Holmes, B. P. McGrath
RMIT University, Australia

24F1-2 **A Deviation Elimination Control Based on Autonomous Current-Sharing Controller for the Parallel-Connected Inverters in AC Microgrids**
Yajuan Guan[1], Wei Feng[2], Baoze Wei[1], Wenzhao Liu[1], Mingshen Li[1], Juan C. Vasquez[1], Josep M. Guerrero[1]
1) Aalborg University, Denmark, 2) Tsinghua University, China

24F1-3 **SISO Transfer Functions for Stability Analysis of Grid-Connected Voltage-Source Converters**
Hongyang Zhang[1], Lennart Harnefors[2], Xiongfei Wang[3], Jean-Philippe Hasler[1], Hans-Peter Nee[4]
1) Power Grids Division, ABB, Västerås, Sweden, 2) Corporate Research, ABB, Västerås, Sweden, 3) Aalborg University, Denmark, 4) KTH Royal Institute of Technology, Sweden

24F1-4 **A Communication-Independent Reactive Power Sharing Scheme with Adaptive Virtual Impedance for Parallel Connected Inverters**
Ronghui An, Zeng Liu, Jinjun Liu, Shike Wang
Xi'an Jiaotong University, China

24F1-5 **Design and Integration of the Bi-Directional Electric Vehicle Charger into the Microgrid as Emergency Power Supply**
Yang Song[1], Pengcheng Li[2], Yuanliang Zhao[3], Shuai Lu[1]
1) Chongqing University, China, 2) Electric Power Research Institute of Guizhou Power Grid Co. Ltd., China, 3) Guizhou Power Grid Co. Ltd., China

Room G

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

24G1-1 **Stability Impact of PV Inverter Generation on Medium Voltage Distribution Systems**
Invited Paper
Ye Tang, Rolando Burgos, Chi Li, Dushan Boroyevich
Virginia Tech, USA

24G1-2 **1MW Power Conditioning System with Multiple DC Inputs for PVs and Batteries**
Invited Paper
Yasuaki Furusho, Yasuyuki Noto, Kansuke Fujii
Fuji Electric Co., Ltd., Japan

24G1-3 **A Robust and Flexible DC-Linked 3-Phase Energy Management System with Adaptive Droop Control Strategy**
Invited Paper
Yue Ma, Yuki Ishikura, Hitoshi Tsuji, Kazuaki Mino
Murata Manufacturing Co., Ltd., Japan

24G1-4 **Maximum Power Point Tracking Control for Small Hydroelectric Generation**
Invited Paper
Kazuya Azegami, Masashi Takiguchi, Junya Yano, Hirohiko Tsutsumi, Toshitake Masuko
Meidensha Corporation, Japan

24G1-5 **Design and Experimental Verification of a Three-Phase Dual-Active Bridge Converter for Offshore Wind Turbines**
Invited Paper Takushi Jimichi[1], Murat Kaymak[2], Rik W. De Doncker[2]
1) Mitsubishi Electric Corporation, Japan, 2) RWTH Aachen University, Germany

Room H

Oral Session 24H1 Inverters/Converters by WBG Devices

24H1-1 **Optimized Bidirectional PFC Rectifiers & Inverters - Si vs. SiC vs. GaN in 2L and 3L Topologies -**
Jonas Wyss, Jürgen Biela
ETH Zürich, Switzerland

24H1-2 **A Standard Block of "Series Connected SiC MOSFET" for Medium/High Voltage Converter**
Qin Lei, Chunhui Liu, Yunpeng Si, Yifu Liu
Arizona State University, USA

24H1-3 **TBD**

24H1-4 **A Flyback Converter with SiC Power MOSFET Operating at 10 MHz: Reducing Leakage Inductance for Improvement of Switching Behaviors**
Kazuki Hashimoto, Takafumi Okuda, Takashi Hikihara
Kyoto University, Japan

24H1-5 **A Study on Load Fluctuation of Isolated DC-DC Converter with Class Phi-2 Inverter Using GaN-HFET**
Yuta Yanagisawa[1], Yushi Miura[1], Hiroyuki Handa[2], Tetsuzo Ueda[2], Toshifumi Ise[1]
1) Osaka University, Japan, 2) Panasonic Corporation, Japan

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

Room A

Oral Session 24A2 Control for DC-DC Converters

24A2-1 **Single-Inductor Multiple-Output Current-Source Converter with Improved Cross Regulation and Simple Control Strategy**
Zheng Dong, Xiaolu Lucia Li, Chi K. Tse
Hong Kong Polytechnic University, China

24A2-2 **Limit Operating Frequency of Peak Current-Mode Control DC-DC Converter Considering Turn-Off Delay Time**
Ryo Ute, Kazuya Fujiwara, Jun Imaoka, Masahito Shoyama
Kyushu University, Japan

24A2-3 **A Novel Single Switch High Frequency DC/DC Converter and Its Mathematic Model**
Yueshi Guan, Xihong Hu, Shu Zhang, Yijie Wang, Dianguo Xu, Wei Wang
Harbin Institute of Technology, China

24A2-4 **Analysis of Closed Loop Operation of an Isolated Bidirectional DAB DC-DC Converter with LC Coupling**
Bruno Yukio Enomoto, Kelly C. M. Carvalho, Lourenço Matakas Junior, Wilson Komatsu
University of São Paulo, Brazil

Room B

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

24B2-1 **Analysis of One Phase Loss Operation of Three-Phase Isolated Buck Matrix-Type Rectifier with Eight-Segment PWM Scheme**
Jahangir Afsharian[1], Dewei (David)Xu[1], Bin Wu[1], Bing Gong[2], Zhihua Yang[2], Jun-Ichi Itoh[3]
1) Ryerson University, Canada, 2) Murata Power Solutions, AC/DC Power Module, Canada, 3) Nagaoka University of Technology, Japan

24B2-2 **Decoupling Control Method for Eliminating DC Bias Flux of High Frequency Transformer in a Bidirectional Isolated AC/DC Converter**
Kensuke Sakuma[1], Koji Shigeuchi[1], Jin Xu[2], Noboru Shimosato[2], Yukihiko Sato[1]
1) Chiba University, Japan, 2) Myway Plus Corporation, Japan

24B2-3 **Novel Isolated Bidirectional Integrated Dual Three-Phase Active Bridge (D3AB) PFC Rectifier**
F. Krismer, E. Hatipoglu, J. W. Kolar
ETH Zürich, Switzerland

24B2-4 **Load Voltage Regulation Method for an Isolated AC-DC Converter with Power Decoupling Operation**
Shohei Komeda[1], Hideaki Fujita[2]
1) Tokyo University of Marine Science and Technology, Japan, 2) Tokyo Institute of Technology, Japan

Room C

Oral Session 24C2 Soft Switching Converters

24C2-1 **Optimal Design of a Low Cost 20kW 99.1% Efficiency Active ZCS Isolated Dc-Dc Converter**
Timothé Delaforge, Sébastien Mariéthoz
Bern University of Applied Sciences, Switzerland

24C2-2 **Soft-Switching Analysis and PFM Control Method of Bidirectional DC/DC Converter Topology**
Yijie Wang, Haoyu Wang, Hongyu Song, Dianguo Xu
Harbin Institute of Technology, China

24C2-3 **A Fully Soft-Switched PWM DC-DC Converter Using An Active-Snubber-Cell**
Tran N. Hai, Adhistira M. Naradhipa, Sunju Kim, Ali Tausif, Sewan Choi
Seoul National University of Science and Technology, Korea

24C2-4 **Flying Capacitor Resonant Pole Inverter with Direct Inductor Current Feedback**
Sjef J. Settels, Jorge L. Duarte, Jeroen Van Duivenbode
Eindhoven University of Technology, The Netherlands

Room D

Oral Session 24D2 Wireless Power Transfer Systems III

24D2-1 **Design of a GaN-Based Wireless Power Transfer System at 13.56 MHz to Replace Conventional Wired Connection in a Vehicle**
Kawin Surakitbovorn, Juan Rivas-Davilla
Stanford University, USA

24D2-2 **Efficiency Maximization of Inductive Power Transfer System by Impedance and Switching Frequency Control in Secondary-Side Converter**
Ryosuke Ota, Dannisworo S. Nugroho, Nobukazu Hoshi
Tokyo University of Science, Japan

24D2-3 **Analysis of Optimal Operation Frequency Range for Battery Charging in WPT System**
Yongbin Jiang, Min Wu, Junwen Liu, Yue Wang, Laili Wang, Hailong Zhang
Xi'an Jiaotong University, China

24D2-4 **Initial Current Injection Method of a Direct Three-Phase to Single-Phase AC/AC Converter for Inductive Charger**
Ferdi Perdana Kusumah, Jorma Kyyrä
Aalto University, Finland

Room E

Oral Session 24E2 Various Topics of PM Drives

24E2-1 **Mission Profile Emulator for Permanent Magnet Synchronous Machine Based on Three-Phase Power Electronic Converter**
Yubo Song, Ran Cheng, Ke Ma
Shanghai Jiao Tong University, China

24E2-2 **A Variable DC Bus Voltage Based Power Hardware-in-the-Loop Emulation of Electric Motors with Wide Variation in Interface Filter Inductance**
Tsai-Fu Wu, Mitradatta Misra, Ying-Yi Jhang, Chang-Jun Yang, Yin-Chi Xu
National Tsing Hua University, Taiwan

24E2-3 **Copper Loss Minimization Control at Zero Output Voltage for Electrolytic Capacitor-Less Inverter**
Kodai Abe, Haruya Kada, Kiyoshi Ohishi, Hitoshi Haga, Yuki Yokokura
Nagaoka University of Technology, Japan

24E2-4 **Armature Temperature Estimation Insensitive to Rotor Flux Variation for SPMSM**
Toshiki Sano[1], Kiyoshi Ohishi[1], Yuki Yokokura[1], Hiroki Iwata[1], Yuji Ide[2], Daigo Kuraishi[2], Akihiko Takahashi[2]
1) Nagaoka University of Technology, Japan, 2) Sanyo Denki Co., Ltd, Japan

Room F

Oral Session 24F2 Grid-tied Converter Control II

24F2-1 **Virtual Synchronous Generator Control with Reliable Fault Ride-through Capability by Adopting Model Predictive Control**
Jonggrist Jongudomkarn, Jia Liu, Toshifumi Ise
Osaka University, Japan

24F2-2 **Reshaping Quadrature-Axis Impedance of Three-Phase Grid-Connected Converters for Low-Frequency Stability Improvement**
Yi Tang, Jingyang Fang, Xiaoqiang Li, Hongchang Li
Nanyang Technological University, Singapore

24F2-3 **Comparison between Traditional Droop and A New Autonomous Control Scheme for Parallel Inverters**
Mohammad Bani Shamseh[1], Teruo Yoshino[1], Atsuo Kawamura[2]
1) Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan, 2) Yokohama National University, Japan

24F2-4 **A Novel Microgrid Power Sharing Scheme Enhanced by a Non-Intrusive Feeder Impedance Estimation Method**
Baojin Liu, Zeng Liu, Jinjun Liu, Ronghui An, Shuguang Song
Xi'an Jiaotong University, China

Room G

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

24G2-1 **Development of a 3.2MW Photovoltaic Inverter for Large-Scale PV Power Plants**
Naoya Shibata, Tsuguhiro Tanaka, Masahiro Kinoshita
Toshiba Mitsubishi-Electric Industrial Systems Corporation (TMEIC), Japan

24G2-2 **Impedance-Based Stability Analysis of Large-Scale PV Station under Weak Grid Condition Considering Solar Radiation Fluctuation**
YiMing Tu, Jinjun Liu, Teng Liu, Xiangpeng Cheng
Xi'an Jiaotong University, China

24G2-3 **Experimental Verification of Grid-Connection of a PV Converter Using a Symmetrically Connected Boost Converter for a High-Leg Delta Transformer**
Daiki Yamaguchi, Hideaki Fujita
Tokyo Institute of Technology, Japan

24G2-4 **A Novel Single-Stage High-Frequency Boost Inverter Cascaded by Rectifier-Inverter System for PV Grid-Tie Applications**
Hamdy Radwan[1,2], Mahmoud A. Sayed[2], Takaharu Takeshita[2], Adel A. Elbaset[3], G. Shabib[1,4]
1) Aswan University, Egypt, 2) Nagoya Institute of Technology, Japan, 3) Minia University, Egypt, 4) Higher Institute of Engineering and Technology, King Mariout, Egypt

Room H

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

24H2-1 **Nine Switches Matrix Converter Using Bi-Directional GaN Device**
Takashi Hirota, Kentaro Inomata, Daisuke Yoshimi, Masato Higuchi
Yaskawa Electric Corporation, Japan

24H2-2 **A Model Predictive Dual Current Control Method for Indirect Matrix Converter Fed Induction Motor Drives**
Mei Yang[1], Chen Lisha[1], Liang Wang[1], Yunwei Li[2]
1) North China University of Technology, China, 2) University of Alberta, Canada

24H2-3 **Fault Tolerant Predictive Control of Three-Level Neutral-Point-Clamped Back-to-Back Power Converters**
Zhenbin Zhang[1], Xicai Liu[2,3], Kejun Cai[2], Feng Gao[1], Ralph Kennel[2]
1) Shandong University, China, 2) Technische Universität München, Germany, 3) Huazhong University of Science and Technology, China

24H2-4 **Two-Stage Optimization Based Predictive Torque Control with Reduced Complexity for a Three-Level Inverter Driven Induction Motor**
Ilham Osman, Dan Xiao, Faz Rahman
University of New South Wales, Australia

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

Room A

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

24A3-1 **Design Challenges of SiC Devices for Low- and Medium-Voltage DC-DC Converters**
Invited Paper Georges Engelmann, Alexander Sewergin, Markus Neubert, Rik W. De Doncker
RWTH Aachen University, Germany

24A3-2 **Design and Testing of 6 kV H-Bridge Power Electronics Building Block Based on 10 kV SiC MOSFET Module**
Invited Paper Jun Wang, Slavko Mocevic, Jiewen Hu, Yue Xu, Christina DiMarino, Igor Cvetkovic, Rolando Burgos, Dushan Boroyevich
Virginia Tech, USA

24A3-3 **High Power Medium Voltage Converters Enabled by High Voltage SiC Power Devices**
Invited Paper Sanket Parashar, Ashish Kumar, Subhashish Bhattacharya
North Carolina State University, USA

24A3-4 **Soft-Switching – The Key to High Power WBG Converters**
Invited Paper Deepak Divan, Zheng An, Prasad Kandula
Georgia Institute of Technology, USA

24A3-5 **SiC: Technology Enabler for MV DC/DC Galvanically Insulated Modular Converters**
Invited Paper S. Alvarez, M. Bellini, U. Vemulapati, F. Canales, M. Rahimo
ABB Switzerland, Ltd, Switzerland

Room B

Oral Session 24B3 Bearingless Machines & Magnetic Bearings II

24B3-1 **A Bearingless Slice Motor with a Solid Iron Rotor for Disposable Centrifugal Blood Pump**
Invited Paper Tadahiko Shinshi[1], Ryo Yamamoto[1], Yoshiki Nagira[1], Junichi Asama[2]
1) Tokyo Institute of Technology, Japan, 2) Shizuoka University, Japan

24B3-2 **Reduced Hardware Parallel Drive for No Voltage Bearingless Motors**
Invited Paper Eric L. Severson
University of Wisconsin-Madison, USA

24B3-3 **Dual Field-Oriented Control of Bearingless Motors with Combined Winding System**
Invited Paper Wolfgang Gruber[1], Siegfried Silber[2]
1) Johannes Kepler University Linz, Austria, 2) Linz Center of Mechatronics, Austria

24B3-4 **Open-Circuit Fault Tolerant Study of Bearingless Multi-Sector Permanent Magnet Machines**
Invited Paper G. Valente[1], L. Papini[1,2], A. Formentini[1], C. Gerada[1,2], P. Zanchetta[1]
1) Univeristy of Nottingham, UK, 2) Univeristy of Nottingham, China

24B3-5 **Balance Control of Split Capacitor Potential for Magnetically Levitated Motor System Using Zero-Phase Current**
Invited Paper Yusuke Fujii[1], Junichi Asama[1], Takaaki Oiwa[1], Akira Chiba[2]
1) Shizuoka University, Japan, 2) Tokyo Institute of Technology, Japan

Room C

Oral Session 24C3 Isolated DC-DC Converters IV

24C3-1 **Asymmetrical Half-Bridge Converter With Zero DC-offset Current in Transformer Using New Rectifier Structure**
Jung-Kyu Han[1], Jong-Woo Kim[2], Seung-Hyun Choi[1], Jih-Sheng Lai[2], Gun-Woo Moon[1]
1) KAIST, Korea, 2) Virginia Tech, USA

24C3-2 **Circulating Current-Less Phase-Shifted Full-Bridge Converter With New Rectifier Structure**
Jung-Kyu Han, Gun-Woo Moon
KAIST, Korea

24C3-3 **A Bi-Directional Current Detection Using Current Transformers for Bi-Directional DC-DC Converter**
Seiji Iyasu[1], Yuji Hahashi[1], Yuuichi Handa[2], Kimikazu Nakamura[2], Keiji Wada[3]
1) Soken,Inc., Japan, 2) Denso Corpolation, Japan, 3) Tokyo Metropolitan University, Japan

24C3-4 **A 10 MHz GaNFET Based Isolated High Step-Down DC-DC Converter**
Prasanth Thummala[1], Dorai Babu Yelaverthi[2], Regan Zane[2], Ziwei Ouyang[1], Michael A. E. Andersen[1]
1) Technical University of Denmark, Denmark, 2) Utah State University, USA

24C3-5 **Analysis and Design of a Parallel Resonant Converter for Constant Current Input to Constant Voltage Output DC-DC Converter Over Wide Load Range**
Tarak Saha, Hongjie Wang, Baljit Riar, Regan Zane
Utah State University, USA

Room D

Oral Session 24D3 AC-AC Converters

24D3-1 **Novel Sinusoidal Input Current Single-to-Three-Phase Z-Source Buck+Boost AC/AC Converter**
M. Haider[1], D. Bortis[1], J. W. Kolar[1], Y. Ono[2]
1) ETH Zürich, Switzerland, 2) Nabtesco Corporation, Japan

24D3-2 **Simple PWM Strategy of a Matrix Converter for Minimizing Output Voltage Harmonics**
Takuya Oshima, Takaharu Takeshita
Nagoya Institute of Technology, Japan

24D3-3 **Novel Three-Level Back-to-Back Converters: Structure, Modulation Method, and Experiment**
S. Sangwongwanich[1], K. Niyomsatian[2], S. Samermurn[1], S. Nuchnoi[1], S. Suwankawin[1]
1) Chulalongkorn University, Thailand, 2) University of Leuven, Belgium

24D3-4 **Model Predictive Control Using Subdivided Voltage Vectors for Current Ripple Reduction in an Indirect Matrix Converter**
Keon Young Kim, Yeongsu Bak, Jin-Hyuk Park, Kyo-Beum Lee
Ajou University, Korea

24D3-5 **DC-Link Ripple Current Reduction in Back-to-Back Converters with DPWM**
Anatolii Tcai, Kyo-Beum Lee
Ajou Univeristy, Korea

Room E

Oral Session 24E3 High Frequency High Power-Density Power Electronics with Its Design Techniques

24E3-1 **An Analysis of Class DE Voltage-Source Parallel Resonant Inverter**
Invited Paper Takeshi Kondo, Tsuyoshi Inaba, Yoshikazu Sakai, Hirotaka Koizumi
Tokyo University of Science, Japan

24E3-2 **An Improvement on Extended Impedance Method towards Efficient Steady-State Analysis of High-Frequency Class-E Resonant Inverters**
Invited Paper
Junrui Liang
ShanghaiTech University, China

24E3-3 **Output Power Capability Comparisons of Class-E Power Amplifiers with Harmonic Resonance**
Invited Paper Hiroo Sekiya[1], Xiuqin Wei[2], Yuchong Sun[1]
1) Chiba University, Japan, 2) Chiba Instite of Technology, Japan

24E3-4 **A Class $\Phi 2$ Resonant Buck Converter with Ripple Injection Burst Control Method**
Invited Paper Min Lin, Masahiko Hirokawa
TDK Corporation, Japan

24E3-5 **Practical Design Technique for High Power Density LLC Resonant Converter**
Invited Paper Shingo Nagaoka, Hiroyuki Onishi, Koji Takatori, Toshiyuki Zaitsu, Takeshi Uematsu
Omron Corporation, Japan

Room F

Oral Session 24F3 DC Microgrids

24F3-1 **Operational Study and Protection of a Series Resonant Converter with DC Current Input Applied in DC Current Distribution Systems**
Hongjie Wang, Tarak Saha, Baljit Riar, Regan Zane
Utah State University, USA

24F3-2 **A Study on Improvement of Power Utilization Rate of Energy Systems with PV sand Batteries**
Hiroaki Endo[1], Masakatsu Kurisaka[1], Tsutomu Ueno[1], Yusuke Yoshioka[1], Kaoru Inoue[2], Toshiji Kato[2]
1) GS Yuasa International Ltd., Japan, 2) Doshisha University, Japan

24F3-3 **A Novel DC Distribution Network with Multi-Level Bus Voltages and Its Energy Management System Design**
Jingjin Huang[1,2], Xin Zhang[2], Zhixun Ma[3,2], Jianfang Xiao[2]
1) Xi'an University of Technology, China, 2) Nanyang Technological University, Singapore, 3) Tongji University, China

24F3-4 **A Novel DC-Side-Port Impedance Modeling of Modular Multilevel Converters Based on Harmonic State Space Method**
Jing Lyu[1], Xin Zhang[2], Zhixun Ma[2], Xu Cai[1]
1) Shanghai Jiao Tong University, China, 2) Nanyang Technological, Singapore

24F3-5 **An Improved Master-Slave Control for Threeport Converter Based Distributed DC Gridconnected PV System**
Siyue Jiang[1], Kai Sun[1], Hongfei Wu[2], Haixu Shi[1], Xiaofeng Dong[2], Syed Muhammad Raza Kazmi[3]
1) Tsinghua University, China, 2) Nanjing University of Aeronautics and Astronautics, China, 3) National University of Sciences and Technology, Pakistan

Room G

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

24G3-1 ***Invited Paper*** **Sensorless Position Estimation, Parameter Identification and Control Integration for Permanent Magnet Synchronous Machines Using Current Derivative Measurements**
M. X. Bui, M. F. Rahman, D. Xiao
UNSW, Australia

24G3-2 ***Invited Paper*** **Dynamic Performance Improvement of Bidirectional Switched-Capacitor DC/DC Converter by Right-Half-Plane Zero Elimination**
Ding Kaicheng, Zhang Yan, Liu Jinjun, Zeng Pengxiang, Zhang Jinshui
Xi'an Jiaotong University, China

24G3-3 ***Invited Paper*** **A Matrix Based Isolated Bidirectional AC-DC Converter with LCL type Input Filter for Energy Storage Application**
Prathamesh Pravin Deshpande, Amit Kumar Singh, Sanjib Kumar Panda
National University of Singapore, Singapore

24G3-4 ***Invited Paper*** **On a Study of Voltage Dividing Class Φ Amplifier**
Katsutoshi Hirayama[1], Tadashi Suetsugu[2], Yudai Furukawa[1], Fujio Kurokawa[3]
1) Nagasaki University, Japan, 2) Fukuoka University, Japan, 3) Nagasaki Institute of Applied Science, Japan

24G3-5 ***Invited Paper*** **A DPWM Based Control Strategy to Integrate Photovoltaic System and Battery Storage Using Grid Connected Three-Level T-Type Inverter**
Mohammad M. Hashempour, Yue-Ting Tsai, T. L. Lee
National Sun Yat-sen University, Taiwan

Room H

Oral Session 24H3 Applications of Grid -tied Inverters II

24H3-1 **Impedance Measurement of Megawatt-Level Renewable Energy Inverters Using Grid-Forming and Grid-Parallel Converters**
Matias Berg, Tuomas Messo, Tomi Roinila, Henrik Alenius
Tampere University of Technology, Finland

24H3-2 **Improved Virtual Inductance Based Control Strategy of DFIG under Weak Grid Condition**
Ran Fang, Wenjia Chen, Xueguang Zhang, Dianguo Xu
Harbin Institute of Technology, Harbin, China

24H3-3 **Control of VSC-HVDC for Wind Farm Integration with Real-Time Frequency Mirroring and Self-Synchronizing Capability**
Renxin Yang, Chen Zhang, Xu Cai, Gang Shi, Jing Lyu
Shanghai Jiao Tong University, China

24H3-4 **A Study on Steady-State Characteristics of Series-Connected Wind Farm Using an Experimental Set of Laboratory Size**
Fujio Tatsuta, Shoji Nishikata
Tokyo Denki University, Japan

24H3-5 **A Novel Islanding Detection Method with Twophase Magnification Inspection**
Jian-Tang Liao, Shun-Hao Yeh, Hong-Tzer Yang
National Cheng Kung University, Taiwan