

# PRELIMINARY TECHNICAL PROGRAM SCHEDULE

## Monday, September 30, 12:30PM-2:10PM

### Wind Systems

Monday, September 30, 12:30PM-2:10PM, Room: 344, Chair: Qiang Wei, Hengzhao Yang

**12:30PM** *Remote Monitoring and Diagnostics of Pitch Bearing Defects in a MW-Scale Wind Turbine Using Pitch Symmetrical-component Analysis* [#19010]

Lijun He, Liwei Hao and Wei Qiao, GE Research, United States; University of Nebraska-Lincoln, United States

**1:20PM** *Maximum Power Point Tracking for Wind Turbine Using Integrated Generator-Rectifier Systems* [#20013]

Phuc Huynh, Samira Tungare and Arijit Banerjee, University of Illinois at Urbana-Champaign, United States

**12:55PM** *LVRT Control of Back-to-Back Power Converter PMSG Wind Turbine Systems: an FPGA Based Hardware-in-the-Loop Solution* [#19069]

Zhenkun Zhang, Zhenbin Zhang, Xiaodong Liu, Quanrui Hao and Zhiwei Zhang, Shandong University, China; The Ohio State University, United States

**1:45PM** *Simple Empiric Root-Mean-Square Electric-Drivetrain Model for Wind Turbines with Full-Size Converter* [#20015]

Daniel von den Hoff, Denise Cappel, Abdul Baseer, Rik W. De Doncker and Ralf Schelenz, PGS, E.ON ERC, RWTH Aachen University, Germany; CWD, RWTH Aachen University, Germany

### Grid-Forming Converters

Monday, September 30, 12:30PM-2:10PM, Room: 342, Chair: Xiongfei Wang, Yanan Chen

**12:30PM** *Small-Signal Modeling, Stability Analysis, and Controller Design of Grid-Friendly Power Converters with Virtual Inertia and Grid-Forming Capability* [#19775]

Han Deng, Jingyang Fang, Jiale Yu, Vincent Debusschere and Yi Tang, Nanyang Technological University, Singapore; Grenoble Institute of Technology, France

**1:20PM** *Active Power Reserve Control for Grid-Forming PV Sources in Microgrids using Model-based Maximum Power Point Estimation* [#19592]

Zhe Chen, Robert H. Lasseter and Thomas M. Jahns, University of Wisconsin - Madison, United States

**12:55PM** *Transient Stability Analysis of Droop-Controlled Grid-Connected Converters With Inertia Emulating Low-Pass Filters* [#19666]

Donghua Pan, Xiongfei Wang, Fangcheng Liu and Rongliang Shi, Aalborg University, Denmark; Huawei Technologies Co., Ltd., China

**1:45PM** *An Optimized Virtual Synchronous Generator Control Strategy for Power Decoupling in Grid Connected Inverters* [#19581]

Yuzhi Zhang and Raheja Utkarsh, ABB Inc., United States

### Converters for HVDC

Monday, September 30, 12:30PM-2:10PM, Room: 343, Chair: Hans-Peter Nee, Balanthi Abdul Beig

**12:30PM** *Hybrid Phase Converter with Enhanced Efficiency and dc Fault Tolerant Capability for HVDC Application* [#20503]

Siba Kumar Patro and Anshuman Shukla, Indian Institute of Technology Bombay, India

**12:55PM** *Level-Shift Modulation and Control of a Dual H-bridge Current Flow Controller in Meshed HVDC Systems* [#19670]

Wei Liu, Jun Liang, Carlos Ugalde-Loo, Chuanyue Li, Gen Li and Peng Yang, Cardiff University, United Kingdom

**1:20PM** *HVDC Breaker Test Bench Based on a Power Converter Using Cascaded H-bridge Cells* [#19287]  
Nikola Krneta and Makoto Hagiwara, Tokyo Institute of Technology, Japan

**1:45PM** *Operation of a Novel Hybrid Modular Multilevel Energy Storage Converter under Fault Condition* [#19637]  
Wu Zeng and Rui Li, Shanghai Jiao Tong University, China

### **Datacenter and Computer Power Supplies**

Monday, September 30, 12:30PM-2:10PM, Room: 346, Chair: Taesic Kim, Gab-Su Seo

**12:30PM** *3kW Four-Level Flying Capacitor Totem-Pole Bridgeless PFC Rectifier with 200V GaN Devices* [#20092]  
Qingyun Huang, Qingxuan Ma, Pengkun Liu, Alex Huang and Michael de Rooij, University of Texas at Austin, United States; Efficient Power Conversion, United States

**12:55PM** *A Comparison of Multilevel "Zero Inductor Voltage" Converters for Datacenter Applications* [#20710]  
Samuel Webb, Tianshu Liu and Yan-Fei Liu, Queen's University, Canada

**1:20PM** *Low-Frequency Input Impedance Modeling of Single-Phase PFC Converters for Data Center Power System Stability Studies* [#20725]  
Jian Sun, Mingchun Xu, Mauricio Cespedes and Mike Kauffman, Rensselaer Polytechnic Institute, United States; Facebook, United States

**1:45PM** *Modeling and Analysis of Data Center Power System Stability by Impedance Methods* [#20726]  
Jian Sun, Mingchun Xu, Mauricio Cespedes, David Wong and Mike Kauffman, Rensselaer Polytechnic Institute, United States; Facebook, United States

### **Inductive Power Transfer**

Monday, September 30, 12:30PM-2:10PM, Room: 340, Chair: Burak Ozpineci, Yue Cao

**12:30PM** *Time-weighted Average Efficiency Optimization for Reconfigurable IPT system with CC and CV outputs* [#19037]  
Ruimin Dai, Ruikun Mai, Zhehui Zhu and Zhengyou He, Southwest Jiaotong University, China

**12:55PM** *Power Factor Correction in EV Charger with Bridgeless Zeta-SEPIC Converter* [#19541]  
Radha Kushwaha and Bhim Singh, Indian Institute of Technology Delhi, India

**1:20PM** *Study on Parasitic Capacitance Effect in High Power Inductive Power Transfer System* [#19327]  
Ying Mei, Jiande Wu, Hua Zhang, Fei Lu and Xiangning He, Zhejiang University, China; Drexel University, United States

**1:45PM** *Design of Isolated Gate Driver Power Supply in Medium Voltage Converters using High Frequency and Compact Wireless Power Transfer* [#19522]  
Van Thuan Nguyen, Veera Bharath Chandra Reddy Gandluru and Ghanshyamsinh Gohil, The University of Texas at Dallas, United States

### **DC-DC Non-Isolated Converter 1**

Monday, September 30, 12:30PM-2:10PM, Room: 347, Chair: Santanu Mishra, Christina DiMarino

**12:30PM** *MSP-LEGO: Modular Series-Parallel (MSP) Architecture and LEGO Building Blocks for Non-isolated High Voltage Conversion Ratio Hybrid Dc-Dc Converters* [#19963]  
Yueshi Guan, Ping Wang, Ming Liu, Dianguo Xu and Minjie Chen, Princeton University, United States; Harbin Institute of Technology, China

**12:55PM** *Ladder Transformerless Stacked Active Bridge Converters* [#19696]  
Jianglin Zhu, Roman Scheuss and Dragan Maksimovic, University of Colorado Boulder, United States; University of Applied Sciences Buchs NTB, Switzerland

**1:20PM** *Equilateral Triangle Modular Multilevel Step-Up DC/DC Converter for Offshore Wind Energy Systems* [#19156]  
Esmail Gandomkar, Hamid Naseem and Jul-Ki Seok, Yeungnam University, Korea (South)

**1:45PM** *A Novel High-Gain DC-DC Topology Based on Coupled Inductors and Decreased Voltage Stresses on Output Elements* [#20243]  
Nima Abdolmaleki, Roy McCann, Mohsen Mahmoudi and Ali Ajami, University of Arkansas, United States; Azarbaijan Shahid Madani University, Tabriz., Iran

**AC-DC – Single-Phase**

Monday, September 30, 12:30PM-2:10PM, Room: 349, Chair: Brian Cheng, Pritam Das

**12:30PM** *A kW Power Factor Corrector Using Low-voltage Current Device For Input Current Shaping* [#19301]

Chung-Pui Tung, John Wing-To Fan, Jeff Po-Wa Chow, Akhil Relekar, Wan-Tim Chan, Ka-Wai Ho, Ke-Wei Wang and Henry Shu-hung Chung, City University of Hong Kong, Hong Kong; BC Technology (Hong Kong) Limited, Hong Kong; Mosway Semiconductor Limited, Hong Kong

**12:55PM** *A High-performance 65 W Universal ac-dc Converter Using a Variable-Inverter-Rectifier-Transformer with Improved Step-down Capability* [#19435]

Intae Moon, Ranjram Mike, Sombuddha Chakraborty and David Perreault, Massachusetts Institute of Technology, United States; Texas Instruments, United States

**1:20PM** *5-Level Flying Capacitor Bridgeless PFC Converter Using Cost-Effective Low-Voltage GaN Transistors* [#19761]

Kun Xiong, Jun Wang, Sai Tang, Daming Wang, Chao Zhang, Z. John Shen and Xin Yin, Hunan University, China; Illinois Institute of Technology, United States

**1:45PM** *Analyzing and Reducing Current Harmonics on AC and DC sides of Cascaded H-Bridge Converters for Electric Vehicle Charging Stations* [#20393]

Amirhossein Moeini and Shuo Wang, University of Florida, United States

**Multilevel Converter Control**

Monday, September 30, 12:30PM-2:10PM, Room: 348, Chair: Vito Giuseppe Monopoli, Qing-Chang Zhong

**12:30PM** *Circulating Current Suppression Control of Modular Multilevel Converters Under Optimized Phase Disposition (PD) Modulation* [#19015]

Yichao Sun, Dan Lyu, Carlos Teixeira, Brendan McGrath, Grahame Holmes and Qi Wang, Nanjing Normal University, China; RMIT University, Australia

**12:55PM** *Strategies for Decoupling Internal and External Dynamics Resulting From Inter-Arm Passive Component Tolerances in HVDC-MMC* [#19518]

Shuren Wang, Grain Adam, Ahmed Massoud, Derrick Holliday and Barry Williams, University of Strathclyde, United Kingdom; Qatar University, Qatar

**1:20PM** *A Generalized Voltage Balancing Algorithm for Modular Multilevel Cascaded Converters* [#19814]

Ezequiel Rodriguez Ramos, Glen Farivar, Josep Pou, Hossein Dehghani Tafti, Christopher David Townsend and Sergio Vazquez, NTU: Nanyang Technological University, Singapore; Energy Research Institute at Nanyang Technologic, Singapore; UWA: University of Western Australia, Australia; US: Universidad de Sevilla, Singapore

**1:45PM** *Computationally-efficient Hierarchical Optimal Controller for Grid-tied Cascaded Multilevel Inverters* [#20369]

Mitchell Easley, Mohsen Hosseinzadehtaher, Amin Yousefzadeh Fard, Mohammad B Shadmand and Haitham Abu-Rub, Kansas State University, United States; Texas A and M University at Qatar, Qatar

**Modulation 1**

Monday, September 30, 12:30PM-2:10PM, Room: 350, Chair: John Shen, Marcello Pucci

**12:30PM** *Model Predictive Control with Secondary Objective Functions for Power Module Loss Reduction* [#20079]

Luo Cheng Wang, Tao Han, Jiangbiao He and Tiefu Zhao, University of North Carolina at Charlotte, United States

**12:55PM** *Fast Detection of Open Circuit Device Faults and Fault-Tolerant Operation of Single-Phase H-Bridge Flying Capacitor Multilevel Converters* [#20039]

Parham Hekmati, Z. John Shen and Ian P. Brown, Illinois Institute of Technology, United States

**1:20PM** *Self-healing Model Predictive Controlled Cascaded Multilevel Inverter* [#20519]  
Mitchell Easley, Matt Baker, Ahmad Khan, Mohammad B Shadmand and Haitham Abu-Rub, Kansas State University, United States; Texas A and M University at Qatar, Qatar

**1:45PM** *iTHD Improvement for Interleaved Totem-pole CRM PFC* [#19185]  
Xu Teng, Song Jinfeng, Wu Yuefei, Jiang Yajuan and Lin Zhuang, LGE China RD center, China

### Prof. Bob Lorenz Memorial Session 1

Monday, September 30, 12:30PM-2:10PM, Room: 338, Chair: Thomas M. Jahns, Bulent Sarliglu

**12:30PM** *Analysis of Novel Hybrid-Magnet-Circuit Variable Flux Memory Machines with Different Magnet Arrangements* [#19945]  
Hui Yang, Hao Zheng, Heyun Lin, Z. Q. Zhu, Jiaxing Lei, Wei Liu and Shukang Lyu, Southeast University, China; The University of Sheffield, Great Britain

**1:20PM** *Self-Sensing and Power Conversion Comparison for Flux Weakening Surface Mounted Permanent Magnet Servo Motors Designed using Symmetric and Asymmetric Rotors* [#20102]  
Huthaifa Flieh, Timothy Slininger, Shao-Chuan Chien, Li-Hsing Ku and Robert Lorenz, WEMPEC - University of Wisconsin Madison, United States; Motor Drive Solution BU, Delta Electronics, Inc, Taiwan

**12:55PM** *A Methodology of Permanent Magnet Material Selection for Active Magnetization Change* [#20607]  
Ryoko Imamura and Robert Lorenz, University of Wisconsin-Madison, WEMPEC, United States

### Doubly-Fed Electric Machines

Monday, September 30, 12:30PM-2:10PM, Room: 337, Chair: Tausif Husain, Renato Lyra

**12:30PM** *Radial Forces in Brushless Doubly-Fed Machines* [#19024]  
Peng Han and Ming Cheng, University of Kentucky, United States; Southeast University, China

**1:20PM** *Analysis of Operation Modes and Grid-Connected Control for the Dual-Stator Brushless Doubly Fed Induction Generator* [#19624]  
Yu Zeng, Ming Cheng and Xinchu Wei, Southeast University, China; State Grid Corporation of China, China

**12:55PM** *Synthesis of Airgap Magnetic Field Modulation Phenomena in Electric Machines* [#19025]  
Peng Han and Ming Cheng, University of Kentucky, United States; Southeast University, China

**1:45PM** *An Approach to Maximize Torque Density in a Brushless Doubly-fed Reluctance Machine* [#20336]  
Shivang Agrawal, Alexander Province and Arijit Banerjee, University of Illinois at Urbana-Champaign, United States

### High-Speed Electric Drives

Monday, September 30, 12:30PM-2:10PM, Room: 339, Chair: Shih-Chin Yang, Roberto Petrella

**12:30PM** *A real-time real-power DSCC-based emulator capable of reproducing both bending and torsional vibrations of a motor and load* [#19310]  
Kenichiro Saito and Hirofumi Akagi, Tokyo institute of technology, Japan

**1:20PM** *Comparison of high speed permanent magnet machine sensorless drive using trapezoidal BLDC and sinusoidal FOC under insufficient PWM frequency* [#20413]  
Ching-Lon Huang, Guan-Ren Chen and Shih-Chin Yang, National Taiwan University, Taiwan

**12:55PM** *Pseudo Six-Step Modulation with Optimal Flux Tracking for Control of High-Speed Permanent Magnet Synchronous Machines (PMSMs)* [#19321]  
Shangjian Dai, Jiabin Wang and Zhigang Sun, The University of Sheffield, United Kingdom; Rolls-Royce plc, United Kingdom

**1:45PM** *Optimized Flux-Weakening Control with Virtue Voltage Buffer for Saturated High-Speed Induction Motor Drives* [#19363]  
Zhen Dong, Zhengtao Ding and Dianguo Xu, The University of Manchester, United Kingdom; Harbin Institute of Technology, China

**Diagnostics and Fault Tolerance in Electric Drives**

Monday, September 30, 12:30PM-2:10PM, Room: 336, Chair: Pinjia Zhang, Antonio J. Marques Cardoso

**12:30PM** *Reuse of a Damaged Permanent Magnet Synchronous Motor for Torque Ripple and Acoustic Noise Elimination using a Novel Repetitive Observer* [#19813]

Mi Tang, Shafiq Odhano, Andrea Formentini and Pericle Zanchetta, the University of Nottingham, United Kingdom; The University of Nottingham, United Kingdom

**12:55PM** *Wavelet Transformation-Based Diagnosis of Turn-to-Turn Faults in Vector Control Drive system* [#20398]

Hassan Eldeeb, Haisen Zhao and Osama Mohammed, Florida International University, United States; North China Electric Power University, China

**1:20PM** *Modular 2n-phase Inverter (M2I) Topology with Novel Phase Current Injection Scheme for Fault-tolerant Multiphase Electric Machine Drives* [#20571]

Woongkul Lee, Seun Guy Min and Bulent Sarlioglu, UW-Madison, United States

**1:45PM** *Hardware-in-the-loop Simulations of Inverter Faults in an Electric Drive System* [#19251]

K. S. Amitkumar, Pragasen Pillay and Jean Belanger, Concordia University, Canada; OPAL-RT TECHNOLOGIES, Canada

**SiC Device and Application**

Monday, September 30, 12:30PM-2:10PM, Room: 341, Chair: Ruxi Wang, Jin Wang

**12:30PM** *Output Sine-Wave Filter Design and Characterization for a 10 kW SiC Inverter* [#19837]

Jan-Kaspar Mueller, Tobias Manthey, Di Han, Bulent Sarlioglu, Jens Friebe and Axel Mertens, Leibniz University Hannover, Germany; University of Wisconsin-Madison, United States

**12:55PM** *Analysing the Crosstalk Effect of SiC MOSFETs in Half-Bridge Arrangements* [#20023]

Ian Laird and Xibo Yuan, University of Bristol, United Kingdom

**1:20PM** *Design of 6.78 MHz SiC MOSFET Class-E Inverter with a Class-phi High-Speed Driver* [#20359]

Haruma Yogi, Xiuqin Wei, Hiroo Sekiya and Takashi Hikiyama, Chiba Institute of Technology, Japan; Chiba University, Japan; Kyoto University, Japan

**1:45PM** *An Analog Active Gate Drive Circuit Architecture for Wide Band Gap Devices* [#20106]

Ramanujam Ramabhadran, Maja Harfman Todorovic, Cong Li, Erdem Asa and Kum-Kang Huh, GE Global Research, United States

**Power Device Characterization and Measurement**

Monday, September 30, 12:30PM-2:10PM, Room: 345, Chair: Mark J Scott, Jun Wang

**12:30PM** *Characterization of the delay and transfer function of measurement equipment for SiC - power semiconductors* [#19082]

David Reiff, Jianghua Feng, Jing Shang and Volker Staudt, Ruhr University Bochum, Germany; CRRC Zhuzhou Institute, China

**12:55PM** *Impedance Matching Scheme of Electrical Variable Capacitors Using SiC MOSFET for 13.56Mhz RF Plasma Systems* [#19820]

Juhwa Min, Beomseok Chae, Yongsug Suh, Jinho Kim and Hyunbae Kim, Chonbuk National University, Korea (South); Samsung Electronics, Korea (South)

**1:20PM** *Analysis of PiN Diode Reverse Recovery Based on the Field-circuit Couple Modeling* [#20751]

Mingyang Wang, Zipeng Liang, Mufeng Xiong, Shaoxing Qu, Sideng Hu and Xiangning He, Zhejiang University, China

**1:45PM** *Teaching how to characterize and implement high speed power devices for tomorrow's engineers* [#19864]

Jean-Luc Schanen, Yvan Avenas, Benoit Sarrazin, Caio Freitas, Wendpanga Bikinga, Alexis Derbey, Sebastien Flury, Florian Dumas, Pierre Lefranc, Rachele Hanna and Herve Chazal, Univ Grenoble Alpes, France

**Special Session: Launching of ITRW 1.0**

Monday, September 30, 12:30PM-2:10PM, Room: 327, Chair: Braham Ferreira

**Special Session: Bidirectional DC-DC Converters for Medium and Low Voltage DC Power Systems - A**

Monday, September 30, 12:30PM-2:10PM, Room: 329, Chair: Kai Sun, Jung-Ik Ha

**Special Session: Sustainable Energy Systems and Opportunities for Power Electronics - A**

Monday, September 30, 12:30PM-2:10PM, Room: 328, Chair: Sudip Mazumder

**Monday, September 30, 2:20PM-4:25PM**

**Wind Systems**

Monday, September 30, 2:20PM-4:25PM, Room: 344, Chair: Jonathan Bird, Akanksha Singh

**2:20PM** *Impedance-Based Small-Signal Modeling and Stability Analysis of Type-3 Wind Turbines in Weak Grid* [#19764]

Donghai Zhu, Xudong Zou, Wen Dong, Xiang Guo, Yihang Yang, Xinchun Lin and Yong Kang, Huazhong University of Science and Technology, China; State Grid Jiangsu Electric Power Co., LTD. Main, China

**2:45PM** *SWT and BES Optimisation for Grid-connected Households in South Australia* [#19881]

Rahmat Khezri, Amin Mahmoudi and Mohammed Haque, Flinders University, Australia; University of South Australia, Australia

**3:10PM** *Transformerless Series Active Compensator operating with Floating Capacitors for DFIG based Wind Energy Conversion System* [#20099]

Italo Andre Cavalcanti de Oliveira, Cursino Brandao Jacobina, Nady Rocha, Emerson Lacerda Soares and Nayara Brandao de Freitas, UFCG, Brazil; UFPB, Brazil

**3:35PM** *Parametrically Robust Mutual Inductance Estimation based Adaptive Control Architecture for Doubly Fed Induction Generator (DFIG)* [#20408]

Anuprabha Ravindran Nair, Rojan Bhattarai and Sukumar Kamalasadana, University of North Carolina at Charlotte, United States; Argonne National Laboratory, United States

**4:00PM** *Design and Analysis of an Axial Flux Doubly Fed Induction Generator for Wind Turbine Applications* [#20758]

Shuvajit Das and Yilmaz Sozer, University of Akron, United States

**Stability in Smart Grid Applications**

Monday, September 30, 2:20PM-4:25PM, Room: 343, Chair: Norma Anglani, Adel Nasiri

**2:20PM** *Stability Boundary Acquisition of Weak Grid-Tied Single-Stage Inverter* [#19460]

Yiming Tu, Jinjun Liu, Zeng Liu, Danhong Xue and Xiangpeng Cheng, Xi'an Jiaotong University, China

**2:45PM** *Optimal Digital Controller Design for Passive Stabilization of a Grid-Connected Three-Phase Inverter with LCL filter* [#19045]

Toshiji Kato, Kaoru Inoue and Yuki Yamamoto, Doshisha University, Japan

**3:10PM** *An Active Voltage Stabilizer for a Generic DC Microgrid* [#20324]

Vishnu Mahadeva Iyer, Srinivas Gulur, Subhashish Bhattacharya, Jun Kikuchi, Srikanthan Sridharan, Ke Zou and Chingchi Chen, NC State University, United States; Ford Motor Company, United States

**3:35PM** *Passivity-Oriented Discrete-Time Voltage Controller Design for Grid-Forming Inverters* [#20160]

Hui Yu, Ma Awal, Hao Tu, Yuhua Du, Srdjan Lukic and Iqbal Husain, North Carolina State University, United States

**4:00PM** *Stability Analysis of the PV Generator Based on Describing Function Method* [#19093]

Yue Li, Yanghong Xia and Yonggang Peng, Zhejiang University, China

### Smart Buildings and Appliances

Monday, September 30, 2:20PM-4:25PM, Room: 342, Chair: Xiaonan Lu, Michael McIntyre

**2:20PM** *Model-Predictive Control of Electrical Energy Storage Systems for Microgrids-Integrated Smart Buildings* [#20117]

Enrico Mion, Tommaso Caldognetto, Francesco Simmini, Mattia Bruschetta and Ruggero Carli, University of Padova, Italy; Interdepartmental Centre Giorgio Levi Cases, Italy

**2:45PM** *An Improved Temperature Prediction Technique for HVAC Units Using Intelligent Algorithms* [#20198]

Keming Yan, Chris Diduch and Mary Kaye, University of New Brunswick, Canada

**3:10PM** *A Generic Load Forecasting Method for Aggregated Thermostatically Controlled Loads Based on Convolutional Neural Networks* [#19718]

Xun Gong, Eduardo Castillo Guerra, Julian Luciano Cardenas Barrera, Bo Cao, Liuchen Chang and Saleh Saleh, University of New Brunswick, Canada

**3:35PM** *On the Optimal Energy Controls for Large Scale Residential Communities including Smart Homes* [#20412]

Huangjie Gong, Vandana Rallabandi, Michael L McIntyre and Dan Ionel, University of Kentucky, United States; University of Louisville, United States

**4:00PM** *Peer-to-Peer Energy Arbitrage in Prosumer-based Smart Residential Distribution System* [#19787]

Md Habib Ullah and Jae-Do Park, University of Colorado Denver, United States

### Datacenter, UPS and Battery Management

Monday, September 30, 2:20PM-4:25PM, Room: 346, Chair: Katherine Kim, Josiah McClurg

**2:20PM** *High-Power-Density GaN-Based Single-Phase Online Uninterruptible Power Supply* [#19808]

Danish Shahzad, Nauman Zaffar and Khurram Afridi, Cornell University, United States; Lahore University of Management Sciences, Pakistan

**2:45PM** *Design Optimization of Unregulated LLC Converter with Integrated Magnetics for Two-Stage 48V VRM* [#20265]

Mohamed H. Ahmed, Fred C. Lee, Qiang Li and Michael De Rooij, CPES Virginia TEch, United States; Efficient Power Conversion, United States

**3:10PM** *Experimental validation of an Ultra-Fast Medium Voltage UPS Utility Disconnect Switch* [#19055]

Pietro Cairoli, Rodrigues Rostan, Raheja Utkarsh, Walton Simon and Elliott Nick, ABB Inc USRC, United States; ABB Ltd., New Zealand

**3:35PM** *A 13.56 MHz Multiport-Wireless-Coupled (MWC) Battery Balancer with High Frequency Online Electrochemical Impedance Spectroscopy* [#20209]

Ming Liu, Ping Wang, Yueshi Guan and Minjie Chen, Princeton University, United States; Harbin Institute of Technology, China

**4:00PM** *A Denoising SVR-MLP Method for Remaining Useful Life Prediction of Lithium-ion Battery* [#20367]

Weirong Liu, Lisen Yan, Xiaoyong Zhang, Dianzhu Gao, Bin Chen, Yingze Yang, Fu Jiang, Zhiwu Huang and Jun Peng, Central south university, China

### Other Charging Techniques

Monday, September 30, 2:20PM-4:25PM, Room: 340, Chair: Mithat Kisacikoglu, YINGJIE LI

**2:20PM** *Embedded compensation for DDQ/Bipolar-Q IPT Charging Pads* [#20063]

Daniel Efren Gaona Erazo, Saikat Ghosh and Teng Long, University of Cambridge, United Kingdom

**2:45PM** *Bidirectional Grid-Side Power Management in DWPT Systems for EV Charging Applications* [#20184]

Ahmed Azad and Zeljko Pantic, Utah State University, United States; Utah state University, United States

**3:10PM** *Zero-Torque Three-Phase Integrated On-board Charger based on Multi-Elements Machine Torque Cancellation* [#19198]

Jialou Gao, Yuanzhi Zhang, Wei Sun, Dong Jiang and Ronghai Qu, Huazhong University of Science and Technology, China

**3:35PM** *Fast and Ultra Fast Charging for Battery Electric Vehicles - A Review* [#19810]

Camilo Suarez and Wilmar Martinez, KU LEUVEN, Belgium; KE LUEVEN, Belgium

**4:00PM** *Analysis and Design of Double-sided LCLC Compensation Parameters with Coupling-insensitive ZVS Operation for Capacitive Power Transfer* [#20391]

Gao Feng, Wang Zhenpo, Li Lantian, Wang Shuo and Deng Junjun, Beijing Institute of Technology, China

### DC-AC – Multi-Phase

Monday, September 30, 2:20PM-4:25PM, Room: 349, Chair: Pedro Rodriguez, Alireza Safaee

**2:20PM** *High Power Density Design of a 1-MW Medium-Voltage High-Frequency Converter for Aircraft Hybrid-Electric Propulsion Applications* [#19436]

Di Zhang, Jiangbiao He, Di Pan, Michael Schutten and Mark Dame, GE Research, United States

**2:45PM** *Three Phase Quasi Z Source Inverters with Multiple AC Outputs* [#20040]

Shri Prakash Sonkar, Vivek Nandan Lal and Rajeev Kumar Singh, IIT(BHU) VARANASI, India

**3:10PM** *A Soft-switched isolated Single Stage Bidirectional Three phase AC-DC Converter* [#19782]

Dibakar Das and Kaushik Basu, Indian Institute of Science, India

**3:35PM** *A Modified PBC Controller Using Dynamic Damping Injection for LCL-Filtered Grid-Tied Inverter with Zero Steady-State Error* [#19048]

Jinping Zhao, Weimin Wu, Huang Min, Huai Wang, Frede Blaabjerg and Chung Henry, Shanghai Maritime University, China; Aalborg University, Denmark; CityU of Hongkong, Hong Kong

**4:00PM** *Stabilization of Inverter-Based Distributed Generation System via Virtual Impedance Regulator* [#20363]

Huanyue Liao and Xin Zhang, Nanyang Technological University, Singapore

### DC-AC – Modulation Techniques

Monday, September 30, 2:20PM-4:25PM, Room: 347, Chair: John Lam, Regan Zane

**2:20PM** *Constant Common-Mode Voltage Transformerless Inverter for Grid-Tied Photovoltaic Application* [#19370]

Md Noman Habib Khan Khan, Yam Siwakoti, Tan Kheng Suan Freddy and Li Li, Ph.D student at UTS, Sydney, Australia, Australia; Lecturer at UTS, Sydney, Australia, Australia; Lecturer at APUTI, KL, Malaysia, Malaysia; A/Prof at UTS, Sydney, Australia, Australia

**2:45PM** *Improved Three-Phase Critical-Mode-Based Soft-Switching Modulation Technique with Low Leakage Current for PV Inverter Applications* [#20660]

Zhengrong Huang, Qiang Li and Fred Lee, CPES, Virginia Tech, United States

**3:10PM** *Five-phase Series-end Winding Motor Controller: Converter Topology and Modulation Method* [#19176]

Li An, Jiang Dong, Liu Zicheng and Kong Wubin, Huazhong University of Science and Technology, China

**3:35PM** *An Asymmetrical Space Vector PWM Scheme for a Three Phase Single-stage DC-AC Converter* [#19526]

Parthasarathy Nayak and Kaushik Rajashekara, University of Houston, United States

**4:00PM** *Mixed Series-Parallel Connected Current Source Converters with Interleaved SPWM* [#20298]

Li Ding and Yun Wei Li, University of Alberta, Canada

### Small and Large Signal Modeling

Monday, September 30, 2:20PM-4:25PM, Room: 350, Chair: Jian Sun, Braham Ferreira



**2:20PM** *DC Impedance Model of MMC Considering Capacitor Voltage and Circulating Current Dynamics* [#19754]

Le Kong, Shuyao Wang, Nattapat Praisuwanna, Shuoting Zhang, Liang Qiao, Fred Wang and Leon M. Tolbert, University of Tennessee, Knoxville, United States

**2:45PM** *An Enhanced Multi-frequency Small-Signal Model for a High-Bandwidth PCM Buck Converter* [#19459]

Xiangpeng Cheng, Jinjun Liu, Zeng Liu, Li Cheng and Yiming Tu, Xi'an Jiaotong University, China

**3:10PM** *Accurate Small-signal Model for LLC Resonant Converters* [#20240]

Yi-Hsun Hsieh and Fred C. Lee, Center for power electronics systems, Virginia T, United States

**3:35PM** *Machine Learning based Modeling of Power Electronic Converters* [#20343]

Harish Krishnamoorthy and Tulasi Narayanan Aayer, University of Houston, United States

**4:00PM** *An Exact Time-Domain Based Novel Simulation-Design Tool For Study And Optimal Design Of LLC And CLL Resonant Converters* [#20556]

Amit Kumar, Abhishek Awasthi, Omid Salari, Arpan Laha and Praveen Jain, Queen's University, Canada

### DC-DC Converter Control

Monday, September 30, 2:20PM-4:25PM, Room: 348, Chair: Santanu Kapat, Chi Kong Tse

**2:20PM** *Current Sharing Method of Charge Controlled Interleaved Buck Converter* [#19325]

Minrui Leng, Guohua Zhou, Qingxin Tian, Lunbo Deng and Songrong Wu, Southwest Jiaotong University, China

**2:45PM** *Second Harmonic Current Reduction for Cascaded Inverter with Pre-regulator+LLC Converter as Front-End DC-DC Converter* [#19383]

Fei Liu, Xinbo Ruan, Xinze Huang and Yang Qiu, NUAA, China

**3:10PM** *Self-Correction and Dead-Beat Current Control Strategy for Digital Programmed Boost Converter* [#19487]

Bingqing Shi, Zhengming Zhao, Shusheng Wei and Chunpeng Zhang, Tsinghua University, China

**3:35PM** *An Extended Describing Function Model for A Hybrid Frequency/Phase-shift Controlled SiC-Based High-Gain DC-DC Resonant Converter Module* [#20511]

Mehdi Abbasi, Reza Emamalipour, Muhammad Ali Masood Cheema and John Lam, York University, Lassonde School of Engineering, Canada; Northern Transformer, Canada

**4:00PM** *Cycle-by-Cycle Digital Control of a Multi-Megahertz Variable-Frequency Boost Converter for Automatic Power Control of LiDAR* [#20581]

Xiaofan Cui, Christopher Keller and Al-Thaddeus Avestruz, University of Michigan Ann Arbor, United States

### Electric Machines: Direct Drive and Magnetic Gearing

Monday, September 30, 2:20PM-4:25PM, Room: 337, Chair: Jonathan Bird, Greg Heins

**2:20PM** *Comparative Study on a Novel Consequent-Pole Modular Linear Vernier Machine with Permanent Magnet Arrays on Both Mover and Stator Iron Cores* [#19107]

Chaojie Shi, Ronghai Qu, Dawei Li, Yuting Gao and Rui Li, Huazhong University of Science and Technology, China; HuaHuazhong University of Science and Technology, China

**2:45PM** *Acoustic Noise Analysis of a Magnetically Geared Permanent Magnet Generator* [#19576]

Steffen Korsgaard, Anders Byrdal Kjaer, Simon Staal Nielsen, Lorand Demsa and Peter Omand Rasmussen, Aalborg University, Denmark; Vestas Wind Systems A/S, Denmark

**3:10PM** *Design Optimisation and Comparison of Fractional-Slot Overlap and Non-Overlap Winding Direct-Drive PM Wind Generators for DC-Connected Applications* [#20133]

Casper Jeremias Johannes Labuschagne and Maarten Jan Kamper, University of Stellenbosch, South Africa

**3:35PM** *Electromagnetic Design and Assembly Analysis of a Halbach Rotor Magnetic Gear for a Marine Hydrokinetic Application* [#20505]

Hossein Baninajar, Jonathan Bird, Sina Modaresahmadi and Wesley Williams, Portland State University, United States; University of North Carolina at Charlotte, United States

**4:00PM** *Rotor Slots Design based on Skin Effect to Reduce Losses in Line-Start Vernier Motor* [#20524]

Vincent Fedida, Dawei Li and Ronghai Qu, Huazhong University of Science and Technology, China

### **Electric Machines: Additive Manufacturing**

Monday, September 30, 2:20PM-4:25PM, Room: 338, Chair: Nick Simpson, Rafal Wrobel

**2:20PM** *Characterization of Magnetic Anisotropy for Binder Jet Printed Fe<sub>93.25</sub>Si<sub>6.75</sub>* [#19244]

Thang Pham, Hawke Suen, Patrick Kwon and Shanelle Foster, Michigan State University, United States

**2:45PM** *Design and Experimental Characterisation of an Additively Manufactured Heat Exchanger for an Electric Propulsion Unit of a High-Altitude Solar Aircraft* [#19350]

Rafal Wrobel, Ben Scholes, Ahmed Hussein, Ahmad Mustaffar, Sana Ullah, David Reay and Barrie Mecrow, Newcastle University, United Kingdom; Necastle University, United Kingdom; HiETA technologies, United Kingdom

**3:10PM** *Design of High Performance Shaped Profile Windings for Additive Manufacture* [#20280]

Nick Simpson, Chris Tighe and Phil Mellor, University of Bristol, United Kingdom; Electrical Cooling Solutions Ltd, United Kingdom; Uni, United Kingdom

**3:35PM** *Ceramic 3D Printed Direct Winding Heat Exchangers for Improving Electric Machine Thermal Management* [#20548]

William Sixel, Mingda Liu, Gregory Nellis and Bulent Sarlioglu, University of Wisconsin-Madison, United States

**4:00PM** *Investigation of an Additively-Manufactured Modular Permanent Magnet Machine for High Specific Power Design* [#20612]

Fan Wu and Ayman EL-Refaie, Marquette University, United States

### **Sensorless Control of Electric Drives**

Monday, September 30, 2:20PM-4:25PM, Room: 339, Chair: Hinkkanen Marko, Radu Bojoi

**2:20PM** *Analysis of Position Control Stability Affected by Non-ideal Characteristics of IPMSM in Signal-Injection Sensorless Control* [#20678]

Joohyun Lee, Yong-Cheol Kwon and Seung-Ki Sul, Seoul National University, Korea, Republic of; PLECKO Co., Ltd., Korea, Republic of

**2:45PM** *A Linear Active Disturbance Rejection Controller-Based Sensorless Control Scheme for PMSM Drives* [#20684]

Lizhi Qu, Liyan Qu and Wei Qiao, University of Nebraska-Lincoln, United States

**3:10PM** *Discrete-time SMO based Sensorless Control of CSC-fed IPMSM Drives with Low Switching Frequency* [#20463]

Li Ding, Yun Wei Li, Navid R. Zargari and Richard Paes, University of Alberta, Canada; Rockwell Automation, Canada

**3:35PM** *High Frequency Injection Based Rotor Position Self-Sensing for Synchronous Electrostatic Machines* [#19689]

Aditya N. Ghule, Peter Killeen and Daniel C. Ludois, University of Wisconsin - Madison, United States

**4:00PM** *Sensorless Self-Commissioning of Synchronous Reluctance Machine with Rotor Self-Locking Mechanism* [#20116]

Anantaram Varatharajan, Paolo Pescetto and Gianmario Pellegrino, Politecnico di Torino, Italy

### **GaN Device and Application**

Monday, September 30, 2:20PM-4:25PM, Room: 341, Chair: Han Peng, Feng Qi

**2:20PM** *An Ultrafast Discrete Protection Circuit Utilizing Multi-Functional Dual-Gate Pads of GaN HEMTs* [#19415]

Ruoyu Hou and Juncheng Lu, GaN Systems Inc., Canada

**2:45PM** *Impact of Substrate Termination on Dynamic On-State Characteristics of a Normally-off Monolithically Integrated Bidirectional GaN HEMT* [#19798]

Carsten Kuring, Nick Wieczorek, Oliver Hilt, Mihaela Wolf, Boecker Jan, Wuerfl Joachim and Dieckerhoff Sibylle, Technische Universitaet Berlin, Germany; Ferdinand-Braun-Institut, Germany

**3:10PM** *Three-Dimensional Integrated GaN-based DC-DC Converter with an Inductor Substrate* [#19830]  
Qi Zhiyuan, Wang Laili, Pei Yunqing, Wang Kangping, Zhao Cheng, Yang Fengtao and Zheng Zijie, Xi'an Jiaotong University, China

**3:35PM** *Finite Element Modeling of IGBT Modules to Explore the Correlation between Electric Parameters and Damage in Bond Wires* [#20744]

Maogong Jiang, Guicui Fu, Martin Fogsgaard, Lorenzo Ceccarelli, He Du, Amir Bahman, Yongheng Yang and Francesco Iannuzzo, Beihang University, China; Aalborg University, Denmark

**4:00PM** *Design of GaN based ultra-high efficiency, high power density resonant Dickson converter for high voltage step-down ratio* [#19279]

Deepak Gunasekaran and Fang Peng, Michigan State University/Analog Devices Inc., United States; Florida State University, United States

## LED Drivers and Intelligent Illumination

Monday, September 30, 2:20PM-4:25PM, Room: 336, Chair: Omer Gundogmus, Efren Flores-Garcia

**2:20PM** *Fault-Tolerant LED Lighting Systems Featuring Minimal Loss of Luminous Flux* [#19867]

Fernando Bento and Antonio J. Marques Cardoso, CISE, University of Beira Interior, Portugal

**2:45PM** *Closed-Loop Control of LCL-T Resonant DC-DC Converter Operating as Automotive LED Driver* [#20044]

Mausamjeet Khatua, Satyaki Mukherjee, Alihossein Sepahvand, Vahid Yousefzadeh, Montu Doshi, Khurram Afridi and Dragan Maksimovic, Cornell University, United States; University of Colorado Boulder, United States; Texas Instruments, United States

**3:10PM** *Resonant Switched-Capacitor Auxiliary Circuit for Active Power Decoupling in Electrolytic Capacitor-less AC/DC LED Drivers* [#20389]

Zhenyu Shan, Xiaomei Chen, Shengwen Fan, Guofeng Yuan and Chi K. Tse, North China University of Technology, China; Hong Kong Polytechnic University, Hong Kong

**3:35PM** *Adapting the Outphasing Technique for VLC Based on Summing the Light* [#19950]

Daniel G. Aller, Diego G. Lamar, Juan Rodriguez, Pablo F. Miaja and Javier Sebastian, University of Oviedo, Spain

**4:00PM** *An Energy Efficient Li-Fi Transmitter with Single Inductor Multiple Output LED Driver* [#20703]

Kumar Modepalli, Soumya Chakraborty and Leila Parsa, Rensselaer Polytechnic Institute, United States; University of California, Santa Cruz, United States

## Emerging Design and Applications of Energy Conversion 1

Monday, September 30, 2:20PM-4:25PM, Room: 345, Chair: Eduard Muljadi, Aparna Saha

**2:20PM** *Low-Loss Switched Capacitor Voltage Balancing Circuit and Its Design Considerations* [#19114]

Liming Liu, Zach Pan, Yu Du, Yuxiang Shi and Yang Xiaobo, ABB Inc., United States; ABB, China

**2:45PM** *Design and Implementation of Switch-mode Solar Photovoltaic Emulator using Power-Hardware-in-the-loop Simulations for Grid Integration Studies* [#20557]

Isuru Jayawardana, Carl Ngai Man Ho and Mandip Pokharel, University of Manitoba, Canada

**3:10PM** *Discrete State Event-Driven Framework for Simulation of Switching Transients in Power Electronic Systems* [#19155]

Yicheng Zhu, Zhengming Zhao, Bochen Shi, Jiahe Ju, Zhujun Yu, Liqiang Yuan and Kainan Chen, Tsinghua University, China

**3:35PM** *Considerations of the Magnetic Field Uniformity for 2-D Rotational Core Loss Measurement* [#19921]

Shuaichao Yue, Yongjian Li, Qingxin Yang and Changgeng Zhang, Hebei University of Technology, China; Tianjin University of Technology, China

**4:00PM** *Application of Linear Permanent Magnet Flux-Switching Motors to Needle-free Jet Injection* [#19466]

Nick N. L. Do, Andrew J. Taberner and Bryan P. Ruddy, The University of Auckland, New Zealand

**Special Session: Bidirectional DC-DC Converters for Medium and Low Voltage DC Power Systems - B**

Monday, September 30, 2:20PM-4:25PM, Room: 329, Chair: Kai Sun, Jung-Ik Ha

**Special Session: Sustainable Energy Systems and Opportunities for Power Electronics - B**

Monday, September 30, 2:20PM-4:25PM, Room: 328, Chair: Sudip Mazumder

**Monday, September 30, 5:00PM-7:30PM**

**Poster Session: Alternative Energy Systems and Grid Connection**

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Ke Ma, Akshay Rathore

**P101** *Feed-forward Controlled Single-Switch Three-Phase Wind Power Converter with Harmonic Injection Mechanism* [#19018]

Ray-Lee Lin and Lung-Shing Lin, National Cheng Kung University, Taiwan

**P102** *On the Efficiency of Series-Connected Offshore DC Wind Farm Configurations* [#19094]

Marten Pape and Mehrdad Kazerani, University of Waterloo, Canada

**P103** *An Improved Modulation Strategy for Single-Phase Quasi-Single-Stage AC-DC Converter* [#19137]

Xiaoguang Li, Fengjiang Wu and Jianyong Su, Harbin Institute of Technology, China

**P104** *Multi-Frequency Signal Synthesis for Accurate Fuel Cell Impedance Estimation* [#19144]

Fabusuyi Akindele Aroge, Paul Barendse and Jessica Chamier, University of Cape Town, South Africa

**P105** *A Novel Control Scheme for High Efficiency Fuel Cell Power Systems in Parallel Structure* [#19259]

Yeonho Jeong, Ronald Rorrer, Byoung-Hee Lee and Jae-Do Park, University of Colorado Denver, United States; Hanbat National University, Korea, Republic of

**P106** *Experimental Studies on a Current-source Converter-based Wind Power Plant Composed of Series-connected Wind Turbine Generators and Synchronous-compensator-commutated Thyristor Inverter* [#19317]

Ken-ichiro Yamashita, Fujio Tatsuta and Shoji Nishikata, Salesian Polytechnic, Japan; Tokyo Denki University, Japan

**P107** *Frequency support enhancement of a permanent magnet-based adjustable-speed pumped storage hydropower plant* [#19358]

Jinho Kim, Eduard Muljadi, Chartan Erol Kevin, Henry Oberneyer and Lindsay George, Auburn University, United States; National Renewable Energy Laboratory, United States; Obermeyer Hydro, INC., United States; Small Hydro Consulting, LLC, United States

**P108** *Power Quality Improvement in PMSG Based Hydro-BES System Operating in Isolated Remote Areas Using CF-FLL Control* [#19389]

Vineet P Chandran, Shadab Murshid and Bhim Singh, Indian Institute of Technology, Delhi, India

**P109** *Active Power Limit for DFIG-Based Wind Turbine under Weak Grid* [#19772]

Xiang Guo, Xudong Zou, Congcong Jiang, Donghai Zhu, Yihang Yang, Li Peng and Xinchun Lin, Huazhong University of Science and Technology, China

**P110** *Energy Harvesting from Moving Vehicles on Highways* [#20776]

Fubing Han, Abdul W. Bandarkar and Yilmaz Sozer, University of Akron, United States

**P111** *An Approach in Torque Control of Hydraulic Wind Turbine Powertrains* [#20225]

Rasoul Akbari, Afshin Izadian and Weissbach Robert, PhD student at IUPUI, United States; Associate Professor at IUPUI, United States

**P112** *Five-level gird-connected ANPC inverter with novel energy transfer strategy to be used for battery energy storage system* [#20370]

Hamid Reza Teymour, Reza Sabzehgar, Mohammad

Rasouli, Danny Sutanto and Kashem Muttaqi, Jabil Circuit, United States; San Diego State University, United States; Penn State Behrend, United States; University of Wollongong, Australia

### Poster Session: Grid Applications of Power Electronics

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Zhe Zhang, Srdjan Lukic

**P301** *Online Stabilization of DC Power Distribution Systems Applying MIMO-Identification Method and Resonance-Enhanced Voltage Controller* [#19710]  
Hessamaldin Abdollahi, Tomi Roinila, Silvia Arrua and Enrico Santi, University of South Carolina, United States; Tampere University of Technology, Finland

**P302** *A Proposed Capacitor Voltage-Balancing Strategy for Double-Y STATCOM Operated Under Unbalanced Conditions* [#19903]  
Ehsan Behrouzian, Massimo Bongiorno, Jan R Svensson and Aravind Mohanaveeramani, Chalmers university of technology, Sweden; Chalmers University of Technology, Sweden; ABB Corporate research, Sweden

**P303** *Controller Design of Parallel Buck Voltage Balancers for Bipolar DC Microgrids* [#20144]  
Luis Herrera, Dane DiMaria, Chad Miller and Bang-Hung Tsao, University at Buffalo, United States; Air Force Research Laboratories, United States; University of Dayton Research Institute, United States

**P304** *Robust Control for Islanded and Seamless Mode Switching of Wind-PV-Grid Tied Generation System* [#19523]  
Seema Kewat and Bhim Singh, IIT Delhi, India, India

**P305** *A Hybrid Method for Islanding Detection of Inverter Interfaced Distributed Generators Utilizing Superimposed Component of d-axis Voltage* [#19166]  
Diptak Pal, Bijaya Ketan Panigrahi and Seema Kewat, Indian Institute of Technology Delhi, India

**P306** *A Reliable Suppression Method of High Frequency Circulating Current in Parallel Grid Connected Inverters* [#19442]  
Sungjoon Cho, Yun Jang, Sejong Jeon and Kyo-Beum Lee, Ajou University, Korea, Republic of

**P307** *Back-to-Back 31 Levels Modular Multilevel Converter with EtherCAT Communication* [#20631]  
Chagn-Hwan Park, Belete Belayneh Negesse, Chan-Ki Kim and Jang-Mok Kim, Pusan National University, Korea (South); KEPCO Research Institute, Korea (South)

**P308** *Operation of MMC Based HVDC Under SM Failure at Sending End Converter* [#19353]  
Richa Kumar, Abdul Beig, Khaled Al-Jaafari and Jayashree Rj, B.S.Abdur Rahman Crescent Institute of Science a, India; Khalifa University of Science and Technology, United Arab Emirates

**P309** *A DC Circuit Breaker with Artificial Zero Current Interruption* [#20545]  
Shrishti Singh, Subhashish Bhattacharya and Leonard White, North Carolina State University, United States

**P310** *The Impact of Multi-Terminal DC Grids on AC Line Overload Alleviation: A Model Predictive Approach* [#20743]  
Mahmoud Mehrabankhomartash and Maryam Saeedifard, Georgia Tech, United States

**P311** *Flexible Intelligent Real-time dc-ac grid Emulator (FIRE): Power Electronic Hardware-in-the-Loop (PE-HIL) Amplifier* [#19671]  
Suman Debnath, Sheng Zheng, Nathaniel Watson, Steven Campbell, Rong Zeng and Madhu Chinthavali, Oak Ridge National Laboratory, United States

**P312** *Systematic Characterization of Power Hardware-in-the-Loop Evaluation Platform Stability* [#20338]  
Jing Wang, Blake Lundstrom, Ismael Mendoza and Annabelle Pratt, National Renewable Energy Laboratory, United States

**P313** *Identification of Grid Impedance During Severe Faults* [#19132]  
Robert Eric Betz and Mads Graungaard Taul, University of Newcastle, Australia, Australia; Aalborg University, Denmark

**P314** *A Bidirectional Single-Stage Isolated AC-DC Converter for Electric Vehicle Chargers* [#19688]  
Leonardo Adriano Ramos, Rafael Felipe Van Kan, Marcello Mezaroba, Alessandro Luiz Batschauer and Cassiano Rech, Santa Catarina State University - UDESC, Brazil; Federal University of Santa Maria - UFSM, Brazil

**P315** *Development of Submodule Test Equipment for MMC-Based VSC-HVDC System* [#20136]  
Chang-Yeol Oh, Ki Ryong Kim, Ho Sung Kim, Jong-Pil Lee and Tae-Jin Kim, Korea Electrotechnology Research Institute, Korea (South)

**P316** *Switching Device Number Reduction for Three-Phase Cascade-Modular Solid-State Transformer System with Employment of Three-Phase T-Type Converter* [#19801]

Hoai Nam Le, Satoshi Nagai, Keisuke Kusaka and Junichi Itoh, Nagaoka University of Technology, Japan

**P317** *Short Circuit Protection for AC Solid State Power Controller Based on GaN* [#20474]

Zixuan Zhao and Li Wang, Nanjing University of Aeronautics & Astronautics, China

**P318** *A Reconfigurable Test Bed for Experimental Studies on Islanded Hybrid AC/DC Microgrids* [#19030]

Mahmoud Allam, Marten Pape and Mehrdad Kazerani, University of Waterloo, Canada

**P319** *A 2kV Intelligent DC Solid State Circuit Breaker Using Series Connected SiC JFETs* [#19285]

Dong He, Zhikang Shuai, Wei Wang, Ying Cheng, Lei Yu and Z. John Shen, Hunan University, China; Electric Power Research Institute, China Southern, China; Illinois Institute of Technology, United States

**P320** *High Efficiency Isolated Resonant PFC Converter for Two-stage AC-DC Converter with Enhanced Performance* [#19453]

Sung-Ho Lee and Min-Jae Kim, Korea Atomic Energy Research Institute (KAERI), Korea (South); Pohang Accelerator Laboratory (PAL), Korea (South)

### Poster Session: Power Converters for Datacenters and LED Drivers

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Ray-Lee Lin, Yu-Chen Liu

**P501** *Efficient Power Transfer to Data Center Racks using Medium Voltage Inductive Coupling* [#20214]

Suvendu Samanta, Richard Beddingfield, Isaac Wong and Subhashish Bhattacharya, North Carolina State University, Raleigh, NC, United States; National Energy Technology Laboratory, United States

**P502** *A Current Sensorless Coulomb-Counting Method for Enhanced Battery SOC Estimation Accuracy* [#20227]

Zakariya Dalala, Osama Saadeh and Ala Hussein, German Jordanian University, Jordan; Yarmouk University, Jordan

**P503** *Predicting Lithium-ion Battery Resistance Degradation in a Log-Linear Model* [#19614]

Soren Byg Vilsen, Soren Knudsen Kaer and Daniel-Ioan Stroe, Aalborg University, Denmark

**P504** *An Ideal Current-Source Gate Driver for Buck VRMs* [#20488]

Iman Abdali Mashhadi, Seyedali Seif Kashani, Behzad Poorali and Majid Pahlevani, Queen's University, Canada

**P505** *A Multiplexing Off-Line LED Driver Achieves High Power Factor and Flicker-Free Operation* [#20337]

Peng Fang, Yan-Fei Liu and P.C. Sen, University of Minnesota, United States; Queen's University, Canada

### Poster Session: Inductive Power Transfer & Charging Techniques

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Omer Onar, Jason Pries

**P701** *Challenges in the Z-Class Compatible Inductive Power Transfer System Considering the Wide Varying Range of the Coupling Coefficient* [#19516]

Hua Zhang, Ying Mei, Chong Zhu, Yao Wang, Sheng Zheng and Fei Lu, Drexel University, United States; Zhejiang University, China; Shanghai Jiao Tong University, China; Oak Ridge National Lab, United States

**P702** *An Universal On-board Battery Charger with Wide Output Voltage Range for Electric Transportation* [#20048]

Jaya Sai Praneeth A v, Deepa Vincent and Sheldon S Williamson, UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY, Canada

**P703** *Enhanced Rotary Transformer-Based Field Excitation System for Wound Rotor Synchronous Motor* [#20143]

Josiah Haruna, Tsarafidy Raminosa and Jonathan Wilkins, Tennessee Tech University, United States; Oak Ridge National Laboratory, United States

**P704** *Coupled-Inductor Bidirectional DC-DC Converter for EV Charging Applications with Wide Voltage Conversion Ratio and Low Parts Count* [#20165]

Agasthya Ayachit, Saad Ul Hasan, Yam Siwakoti, Mohamad Abdul-Hak, Marian K. Kazimierczuk and Frede Blaabjerg, Mercedes-Benz Research and Development N America, United States; University of Technology Sydney, Australia; Wright State University, United States; Aalborg University, Denmark

**P705 Transformer-less Medium Voltage EV Chargers** [#20211]

Muhammad Alvi and Venkataramanan Giri, University of Wisconsin-Madison WEMPEC, United States

**P706 Design Considerations of a Bipolar Track for Dynamic Electric Vehicle Charging** [#20300]

Weitong Chen, Feiyang Lin, Grant Covic and John Boys, The University of Auckland, New Zealand

**P707 Leakage Current Mitigation of Non-Isolated Integrated Chargers for Electric Vehicle** [#20462]

Yue Zhang, William Perdikakis, Yizhou Cong, Xiao Li, Mohamed Elshaer, Yousef Abdullah, Jin Wang, Ke Zou, Zhuxian Xu and Chingchi Chen, The Ohio State University, United States; Ford Motor Company, United States

**P708 Passive Reflection Winding for Ferrite-less Double D Topology for Roadway IPT Applications** [#20470]

Matthew Pearce, Grant Anthony Covic and John Talbot Boys, The University of Auckland, New Zealand

**P709 Empirical Closed-Form Analysis for Inductance and Coupling Coefficient Calculation for Ferrite-Based Matched Inductive Charging Systems** [#20554]

Benny Varghese, Abhilash Kamineni and Regan Zane, Utah State University, United States

**P710 A Novel Maximum Efficiency Point Tracking Technique for Modular Paralleled Electric Vehicle Charging System** [#19344]

Zhuang Lin, Xuexiao Luo, Yajuan Jiang, Lingli Fan, Yuefei Wu and Yingqi Zhang, LG Electronics China R&D Center, China

**P711 Natural convection cooled SiC-based LLC Resonant Converters in wide voltage range battery charger application** [#19430]

Rui Zhou, Qianqian Jiao and Yincan Mao, EnerSys, United States

**P712 High Performance Active Battery Management System with Multi-Winding Transformer** [#19347]

Umberto Abronzini, Ciro Attaianese, Matilde D'Arpino, Mauro Di Monaco, Francesco Porpora and Giuseppe Tomasso, University of Cassino and Southern Lazio, Italy; OSU Center for Automotive Research, United States

**P713 Medium Voltage Dual Active Bridge Using 3.3 kV SiC MOSFETs for EV Charging Application** [#20574]

Lee Gill, Takayuki Ikari, Toshihiro Kai, Bo Li, Khai Ngo and Dong Dong, Virginia Tech, United States

**P714 A Parallel Topology for Modularized IPT Systems** [#19195]

Hongsheng Hu, Tao Cai, Xiaoming Zhang, Jintao Niu, Hao Feng and Shanxu Duan, Huazhong University of Science and Technology, China; North Carolina State University, United States

**Poster Session: DC-DC Converters**

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Arijit Banerjee, Youim (Kelly) Tray

**P901 Analysis and Implementation of a New Non-isolated High-Voltage Gain Boost Converter** [#19396]

Anh Dung Nguyen, Jih-Sheng Lai and Huang-Jen Chiu, Virginia Tech, United States; Taiwan Tech, Taiwan

**P902 A Novel Circuit Topology and Its Design for Class-E<sup>2</sup> DC-DC Converter** [#19842]

Yusuke Ogi, Fumiya Ebihara, Xiuqin Wei and Hiroo Sekiya, Chiba Institute of Technology, Japan; Chiba University, Japan

**P903 In-situ Direct Magnetic Loss Measurement in a DC-DC Converter** [#20145]

Jinyeong Moon, Florida State University, United States

**P904 400 V to 12 V Step-down DC-DC Power Converter Based on the Differential Concept** [#20002]

Neilor Colombo Dal Pont, Matheus Schramm Dall'Asta, Jessika Melo de Andrade, Telles Brunelli Lazzarin and Brad Lehman, Federal University of Santa Catarina, Brazil; Northeastern University, United States

**P905 Multi-resonant Non-Inverting Buck-Boost Converter** [#20030]

Dulika Nayanasiri, Pasan Gunawardena and Yunwei (Ryan) Li, University of Alberta, Canada; University of Moratuwa, Sri Lanka; University of Alberta, Canada

**P906 An IPOS LLC Converter with Current Sharing Capability** [#19386]

Yucen Li, Shuai Shao, Hui Chen, Junming Zhang and Kuang Sheng, Zhejiang University, China; Zhejiang University City College, China

**P907** *A Comprehensive Analysis of Gate Drive Delay in CLLC Converters and Its Compensation Method* [#19378]

Huan Chen, Hongsheng Chong, Kai Sun, Zheyuan Yi, Shujun Mu and Yang Mei, Tsinghua University, China; Nation Institute of Clean and Low Carbon Energy, China; North China University of Technology, China

**P908** *Improvement on Transient Performance of Cooperative Triple-Phase-Shift Control for Dual Active Bridge DC-DC Converter* [#19128]

Jianyong Su, Suhua Luo and Fengjiang Wu, Harbin Institute of Technology, China

**P909** *An Improved Power Processing Unit for Multi-Mode Monopropellant Electro Spray Thrusters for Satellite Propulsion Systems* [#19334]

Kartikaya Veeramraju and Jonathan Kimball, Missouri S&T, United States

**P910** *A Soft-switching Current-fed Isolated Bidirectional DC-DC Converter with Low Circulating Power and Easy-implemented Control Strategy* [#19930]

Zhao Zhang, Zhiying Wu, Shaojun Xie, Xiaoyu Ma, Jinming Xu and Miao Liu, Nanjing University of Aeronautics and Astronautics, China

**P911** *A Two-Stage Isolated Converter without Intermediate Capacitor for Wide Voltage Range Applications* [#19742]

Pengyu Jia, Zehui Huang, Yaozong Hao, Qian Chen and Shengwen Fan, North China University of Technology, China; State Grid Zhejiang Electric Power Corporation, China

**P912** *Analytical Solution For Minimum RMS Current and Reactive Power Modulation of A Soft Switched Dual Active Bridge Converter* [#20426]

Amit Bhattacharjee, Xi Chen and Issa Batarseh, UCF, United States

**P913** *The Multi-Phase Input-Parallel Output-Parallel (IPOP) Dual Active Bridge (DAB) with Current Sharing and the Optimum Integrated Transformer to Improve Power Density and Efficiency* [#20205]

Wucheng Ying, Hui Zhao, Yanfeng Shen, Zhaokai Li, Hao Hu and Teng Long, University of Cambridge, United Kingdom

**P914** *Time-Domain Analysis of APWM-Frequency Modulated Low-Q LLC Resonant Converter for Wide Input and Load Range Applications* [#19766]

Abhishek Awasthi, Amit Kumar, Snehal Bagawade and Praveen Jain, Queen's University, Canada

**P915** *Four-Port Bidirectional Dual Active Bridge Converter for EVs Fast Charging* [#20124]

Maurizio La Mendola, Marco di Benedetto, Alessandro Lidozzi, Luca Solero and Stefano Bifaretti, Roma Tre University, Italy; University of Roma Tor Vergata, Italy

**P916** *Digitally-assisted Hysteresis Voltage Prediction Control For Series-Form Switch-Linear Hybrid Envelope Tracking Power Supply* [#19411]

Ying Li, Xinbo Ruan, Yazhou Wang and Chengxiang Zhang, Nanjing Univ. of Aero. and Astro., China

**P917** *Current Balancing Technique in Symmetrical Configuration of Quad-Active-Bridge Converter using Integrated Magnetic Current Balancing Cells* [#19789]

Nabeel Naseem, Honnyong Cha and Jong-Soo Kim, Kyungpook National University, Korea, Republic of; Daejin University, Korea, Republic of

**P918** *Fault-Tolerant Bidirectional Series Resonant DC-DC Converter with Minimum Number of Components* [#20080]

Dmitri Vinnikov, Chub Andrii, Korkh Oleksandr and Malinowski Mariusz, TalTech University, Estonia; Warsaw University of Technology, Poland

**P919** *Development of a High Power Density GaN-based Transistor Low-Voltage High-Current Phase-Shift Full-Bridge Current Doubler Converter for Electric Vehicles* [#19874]

Sangjin Kim, Adhistira Madhyasta Naradhupa and Sewan Choi, Seoultech, Korea (South)

**P920** *A Small Signal Model of Dual Bridge Series Resonant DC/DC Converter for Power Electronic Traction Transformer* [#19382]

Yang Bo, Ge Qiongxuan, Zhao Lu, Zhou Zhida and Li Yaohua, Institute of Electrical Engineering, CAS, China, China; Institute of Electrical Engineering, CAS, China, China

**P921** *Analysis and Design of SR Driver Circuit for LLC DC-DC Converter Under High Load Current Application* [#20675]

Xiang Zhou, Bo Sheng, Wenbo Liu, Yang Chen, Andrew Yurek, Yan-fei Liu and Paresch C Sen, Queen's University, Canada, Canada

**P922** *Simultaneous Model Based Control of a Non-Inverting Buck-Boost Converter for PFC Applications at a Reduced Current Stress* [#20771]

Velasquez Franklin, Akarsh Murthy and Mohamed Badawy, San Jose State University, United States

**P923** *Class E Resonant Low dv/dt Rectifier Using Common Grounded Switch Controlled Capacitor* [#19756]

Yuki Hiram, Yoshikazu Sakai and Hirotaka Koizumi, Tokyo University of Science, Japan



**P924** *Exact Steady-State Analysis of The Phase-Shifted Dual-Input LLC Converter* [#20454]

Abdullah Alhatlani, Sumana Ghosh, Issa Batarseh and Nasser Kutkut, University of Central Florida, United States; Advanced Charging Technologies, United States

**P925** *Stacked DC-DC Converter with Wide Voltage Range* [#19115]

Liming Liu, Sandeep Bala and Francisco Canales, ABB Inc., United States; ABB, Switzerland

**Poster Session: Power Converter Control**

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: John Lam, Han Peng

**P1101** *Novel Switching Control Method for Synchronous Rectifier of Phase-Shifted Full-Bridge Converter in Light-Load Conditions* [#19109]

Sunho Lee, Junhyuk Lee, Usman Ali Khan and Jung-Wook Park, Yonsei University, Korea (South)

**P1102** *Zero Sequence Circulating Current Reduction of Paralleled Converters With Interleaved Discontinuous PWM* [#19297]

Hanwei Xu, Lie Xu, Kui Wang, Zedong Zheng and Yongdong Li, Tsinghua University, China

**P1103** *Design and control of a modular 48/400V power converter for the grid integration of energy storage systems* [#20026]

Miguel Crespo, Pablo Garcia, Ramy Georgious, Geber Villa and Jorge Garcia, University of Oviedo, Spain

**P1104** *LMI-based Control Design to Enhance Robustness of Synchronous Power Controller* [#20237]

Ngoc Bao Lai, Andres Tarraso and Pedro Rodriguez, University Loyola Andalucia, Spain; Universitat Politecnica de Catalunya, Spain

**P1105** *All-Fixed Switching Frequency Control of CRM Boost PFC Converter Based on Variable Inductor in a Wide Input Voltage Range* [#19133]

Zhen Zhang, Kai Yao, Chunwei Ma, Jienan Chen, Lingge Li, Chanbo Guan and Chengjian Wu, Nanjing University of Science and Technology, China

**P1106** *Optimized Carrier Disposition Based Discontinuous Pulse-width Modulation Method for three-level NPC Converters* [#19351]

Meiqi Wang, Lie Xu, Bo Yang, Jing Li, Chunyang Gu, He Zhang, Gerada Chris and Yongdong Li, University of Nottingham Ningbo China, China; Tsinghua University, China; Xi'an University of Technology, China; University of Nottingham, United Kingdom

**P1107** *FS-MPC Algorithm for Optimized Operation of a Hybrid Active Neutral Point Clamped Converter* [#19679]

Mateja Novak, Victor Ferreira, Markus Andresen, Tomislav Dragicevic, Frede Blaabjerg and Marco Liserre, Aalborg University, Denmark; Kiel University, Germany

**P1108** *Virtual DC Generator Control Strategy Based on Differential Compensation* [#20349]

Na Zhi, YouGuo Ding and Liang Du, Xi'an University of technology, China; Temple University, United States

**P1109** *Optimal Dual Constant Switching Frequency Control for CRM Buck-Buck/Boost PFC Converter* [#19136]

Chunwei Ma, Kai Yao, Chengjian Wu, Jienan Chen, Lingge Li, Chanbo Guan and Zhen Zhang, Nanjing University of Science and Technology, China

**P1110** *An Enhanced Power Decoupling Control for Grid-connected Capacitive-Coupling Inverters* [#19381]

Wenyang Deng, Ningyi Dai, Lao Keng-Weng and Josep M. Guerrero, University of Macao, China; University of Macao, Macau; University of Aalborg, Denmark

**P1111** *Carrier-Based MPC For Grid-Tied Interleaved 2L-VSIs with Zero-Sequence Circulation Elimination* [#19763]

Changpeng Jiang, Zhongyi Quan, Dehong Zhou and Yunwei Li, University of Alberta, Canada

**P1112** *Improved Voltage Control Scheme for Single-Phase UPS Inverter with Repetitive Current Controller* [#20451]

Seunghoon Baek, Younghoon Cho and Sijun Yeo, Konkuk University, Korea (South); Sungshin Electric Co., Ltd, Korea (South)

**P1113** *A Simplified Voltage Balancing Control of a Modular Medium-Frequency Transformer-Based Current Source Converter* [#19140]

Qiang Wei, David Xu, Bin Wu and Navid R. Zargari, Lakehead University, Canada; Ryerson University, Canada; Rockwell Automation Canada, Canada

**P1114** *State-Space Control for LCL Filters: Comparison Between the Converter and Grid Current Measurements* [#19390]

F. M. Mahafugur Rahman, Jarno Kukkola, Ville Pirsto, Mikko Routimo and Marko Hinkkanen, Aalto University, Finland; ABB Drives, Finland

**P1115** *Low-Frequency Oscillation Suppression in Series Resonant Dual-Active-Bridge Converters under Fault Tolerant Operation* [#19858]

Yiwei Pan, Yongheng Yang, Jinwei He, Ariya Sangwongwanich and Frede Blaabjerg, Aalborg University, Denmark; Tianjin University, China

**P1116** *Grid Impedance Identification Using the VSC Switching Ripple* [#20075]

Diego Perez-Estevéz and Jesus Doval-Gandoy, University of Vigo, Spain

**P1117** *An FPGA-based Switch-mode Power Amplifier using Boundary Control to achieve High System Bandwidth* [#20452]

Zhuang Zhang, Carl Ngai Man Ho and Wenxun Xiao, University of Manitoba, Canada; South China University of Technology, China

**P1118** *Segmented Constant-On-Time Control Method for CRM Buck-Buck/Boost PFC Converter* [#19196]

Jienan Chen, Kai Yao, Bin Fang, Lingge Li, Chanbo Guan, Chengjian Wu, Zhen Zhang, Chunwei Ma and Huili Zhang, Nanjing University of Science and Technology, China

**P1119** *Nested-Loop Control for a Bidirectional Cuk-Inverter* [#19925]

Linda Shelembe and Paul Barendse, University of Cape Town, South Africa

**P1120** *Optimal Frequency and Critical Soft Switching Control of DC/DC Converter* [#20150]

Zhou Liwei and Preindl Matthias, Columbia University, United States

**P1121** *Spatial Repetitive Controller based Harmonic Mitigation Methodology For Wide Varying Base Frequency Range* [#20528]

Hao Zeng, Christoph van der Broeck, Robert Lorenz and Rik De Doncker, University of Wisconsin-Madison WEMPEC, United States; RWTH Aachen University ISEA, United States; University of Wisconsin-Madison WEMPEC, Germany; RWTH Aachen University ISEA, Germany

**P1122** *A Novel Model Predictive Current Control Strategy for Non-Isolated Single-Phase Grid-Connected Inverter* [#19201]

Qi Liu, Jian Yang, Dong ran Song and Guo xun Xiao, Central South University, China; Changsha Best Electrical Technology Co., Ltd, China

**P1123** *A Novel Dual Phase Shift Modulation for Dual-Active-Bridge Converter* [#19492]

Song Chi, Peng Liu, Xue Li, Mocheng Xu and Shanhu Li, Hebei University of Technology, China

**P1124** *Cable Overcurrent Control Strategy of Stand-Alone Brushless Doubly-Fed Power Generation System* [#19934]

Debin Zhang, Yu Chen, Jingyuan Su and Yong Kang, Huazhong University of Science and Technology, China

**P1125** *Switching Losses Reduction of Grid-tied Inverters With Variable Switching Frequency Discontinuous PWM* [#19296]

Hanwei Xu, Lie Xu, Kui Wang, Zedong Zheng and Yongdong Li, Tsinghua University, China

**P1126** *Predictive Switching Sequence-based Control for Constant Power Load* [#19601]

Debanjan Chatterjee and Sudip Mazumder, University of Illinois at Chicago, United States

**P1127** *Thermal Stress Reduction for DC-link Capacitors of Three-phase VSI with Multiple PWM Switching Patterns* [#19941]

Koroku Nishizawa, Jun-ichi Itoh, Satoru Fujita, Akihiro Odaka, Akio Toba and Hidetoshi Umida, Nagaoka University of Technology, Japan; Fuji Electric Co., Ltd., Japan

**P1128** *An Optimized SM Fault-Tolerant Control Method for MMC-based HVDC Applications* [#20235]

Mohammed Alharbi, Semih Isik and Subhashish Bhattacharya, North Carolina State University, United States

**P1129** *Wear-Out Failure of a Power Electronic Converter Under Inversion and Rectification Modes* [#19643]

Saeed Peyghami, Davari Pooya, Zhou Dao, Fotuhi-Firuzabad Mahmud and Blaabjerg Frede, Aalborg University, Denmark; Aalborg University, Denmark; Sharif University of Technology, Iran; Aalborg University, Denmark

**P1130** *Control Scheme for LLC Resonant Converter with Improved Performance Under Light Loads and Wide Input-Output Voltage Variation* [#19857]

Jaspreet Narli, Hossein Dehghani Tafti, Josep Pou, Ghias Farivar, Koh Leong Hai and Nguyen Xuan Bac, Energy Research Institute at NTU, Singapore; Nanyang Technological University, Singapore

### Poster Session: Induction and Synchronous Machines

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Ramakrishnan Rajavenkatasubramony, Alireza Fatemi

**P1301** *48V Starter-Generator Induction Machine with Pole Changing Windings* [#19088]  
Srinivas Mallampalli, Zi-Qiang Zhu, Jean-Claude Mipo and Sophie Personnaz, University of Sheffield, United Kingdom; Valeo, France

**P1302** *A Fault Tolerant Induction Motor Drive* [#19095]  
Fangbo Liu, Barrie Mecrow, Alexander C. Smith, Bernardo Alvarenga and Xu Deng, Newcastle University, United Kingdom; Manchester University, United Kingdom; Federal University of Goias (UFG), Brazil

**P1303** *Rotor Fault Detection of Squirrel Cage Induction Motor Using Spectrum Analysis of Dynamic Simulation and Experimental Validation* [#19275]  
Ariunbolor Purvee, Enkhbat Tsend-Ayush, Natsagdorj Erdenetsogt and Robert Morelos-Zaragoza, German Mongolian Institute for Resources & Techn, Mongolia; Mongolian University of Science and Technology, Mongolia; Mongolian National Defense University, Mongolia; San Jose State University, United States

**P1304** *Online Estimation of Rotor Temperature in Induction Motors Based on Parameter Identification* [#20049]  
Haisen Zhao, Hassan Eldeeb, Jinyu Wang, Yang Zhan, Guorui Xu and Osama A. Mohammed, North China Electric Power University, China; Florida International University, United States

**P1305** *A study on efficiency of magnetic levitation trains using linear induction motor by slip pattern* [#20358]  
Seo Hyunuk, Lim Jaewon, Park Sang Uk and Mok Hyung Soo, Konkuk University, Korea, Republic of; KIMM, Korea, Republic of

**P1306** *Real-time Loss Minimizing Control of Induction Machines for Dynamic Load Profiles under Deadbeat-Direct Torque and Flux Control* [#20509]  
Yuying Shi, Robert Lorenz and Bulent Sarlioglu, University of Wisconsin-Madison, United States

**P1307** *On Shortening the Numerical Transient in Time-Stepping Finite Element Analysis of Induction Motor Under Broken Rotor Bar Faults* [#19438]  
Hossein Nejadi Koti, Hao Chen, Yue Sun and Nabeel A. O. Demerdash, Marquette University, United States

**P1308** *Induction Machine Efficiency at Variable Frequencies* [#19904]  
Emmanuel Agamloh, Andrea Cavagnino and Silvio Vaschetto, Baylor University, Waco, Texas, United States; Politecnico di Torino, Italy

**P1309** *Design of a PM-Assisted Synchronous Reluctance Motor Utilizing Additive Manufacturing of Magnetic Materials* [#19343]  
Maged Ibrahim, Fabrice Bernier and Jean-Michel Lamarre, National research council of Canada, Canada

**P1310** *Comparison of two Analytical Methods for Calculating the Maximum Mechanical Stress in the Rotor of High Speed Assisted Synchronous Reluctance Machines* [#19550]  
Iman Kleilat, Khadija El Kadri Benkara, Guy Friedrich, Stephane Vivier, Nazih Moubayed and Rabih Dib, UTC, France; UL, Lebanon

**P1311** *Stochastic Analysis for Influence of Manufacturing Tolerance of Permanent Magnet on Performance of IPMSM* [#19888]  
Deok-Jae Kwon, Jun-Hyuk Im, Seung-Tae Lee and Jin Hur, Incheon National University, Korea (South); Wiseworks, Korea (South)

**P1312** *Online Diagnosis and Severity Estimation of Partial and Uniform Irreversible Demagnetization Fault in Interior Permanent Magnet Synchronous Motor* [#19922]  
Zia Ullah, Seung-Tae Lee, Mudassir Raza Siddiqi and Jin Hur, Incheon university, Korea, Korea, Republic of

**P1313** *FEA based Separation of Torque Components in Interior Permanent Magnet Machines* [#20680]  
Mohamed Zubair M Jaffar and Iqbal Husain, North Carolina State University, United States

**P1314** *Modeling of Electromagnetic Torque in Synchronous Reluctance Machines using Inductance Harmonics* [#20735]  
Mazharul Chowdhury, Mohammad Islam and Iqbal Husain, Halla Mechatronics, United States; North Carolina State University, United States

**P1315** *Scalability of Synchronous Reluctance Machines Considering Thermal Performance* [#19983]  
Yawei Wang, Michele Bonfante, Nicola Bianchi and Roberto Petrella, University of Padova, Italy; University of Udine, Italy

**P1316** *Synchronous Reluctance Rotor Design Considerations based on Winding Configuration* [#20546]  
Dheeraj Bobba, Gerd Bramerdorfer, Hao Ding, Siegfried Silber and Bulent Sarlioglu, Univ. of Wisconsin-Madison, United States; Johannes Kepler University Linz, Austria; Linz Center of Mechatronics, Austria

**P1317** *Influence of Rotor Pole Number on Performance of Novel Slot Permanent Magnet Machines with Complementary Rotors* [#19100]  
Qingsong Wang, Martin Ordonez, Junnian Wang, Mohammad Saket and Rouhollah Shafaei, University of British Columbia, Canada; Jilin University, China

**P1318** *A Novel Dual-Sided PM Machine with Stator Spoke-Type PM Structure* [#19173]  
Ya Li, Hui Yang, Heyun Lin, Wei Liu and Shukang Lyu, Southeast University, China

**P1319** *Influence of Rotor Damping Structures of Synchronous Generator on Damping Torque Coefficient during Large Disturbance* [#19475]  
Guorui Xu, Jingdi Zhou, Zhiqiang Li, Haisen Zhao, Zhiwei Cao and Jihao Wang, North China Electric Power University, China; China Electric Power Research Institute, China; Electric Power Research Institute of Shandong Po, China

**P1320** *Evaluation of Slotless Permanent Synchronous Motor with Toroidal Winding* [#19606]  
Ho-Young Lee, Eui-Chun Lee, Gi-Ju Lee and Soon-O Kwon, Korea Institute of Industrial Technology(KITECH), Korea, Republic of

**P1321** *Wound Field Synchronous Machine with Segmented Rotor Laminations and Die Compressed Field Winding* [#20028]  
Mohamad Salameh, Thomas Spillman, Mahesh Krishnamurthy, Daniel C. Ludois and Ian P. Brown, Illinois Institute of Technology, United States; University of Wisconsin-Madison, United States

**P1322** *Investigation of Rotor Designs of Variable-Flux Interior Permanent Magnet Synchronous Machines for Traction Applications* [#20218]  
Cong Ma and Tausif Husain, BorgWarner Inc., United States

**P1323** *Electromagnetic Forces On Coils And Bars Inside The Slot of Hydro-Generator* [#20281]  
Barvir Sanosian, Philippe Wendling, Tan Pham and Willian Akaishi, Stantec Consulting Services Inc., United States; Altair, United States; Solar Turbines, United States

**P1324** *Analytical Model and Sensitivity Analysis of Tooth-Coil-Winding Permanent Magnet Synchronous Machine with Modular U-Shape Stator* [#20445]  
Carlos Madariaga, Werner Jara, Juan Tapia, Javier Riedemann, Gerd Bramerdorfer, Pablo Castro and Bulent Sarlioglu, Pontificia Universidad Catolica de Valparaiso, Chile; University of Concepcion, Chile; Johannes Kepler University Linz, Austria; University of Wisconsin-Madison, United States

**P1325** *Extended Field Weakening Range in Slotless/Coreless Permanent Magnet Machines* [#20676]  
Md Sariful Islam, Rajib Mikail and Iqbal Husain, North Carolina State University, United States; ABB Inc., United States

**P1326** *Sliding Mode Current Control of Mutually Coupled Switched Reluctance Machines using a Three-phase Voltage Source Converter* [#19594]  
Kun Hu, Jin Ye and Javad Mohammadpour Velni, University of Georgia, United States

**P1327** *A Modest Attempt on the Electromagnetic Design and Performance Prediction of Turbo Wound-Field Flux Switching Synchronous Condensers* [#20464]  
Udochukwu B. Akuru and Maarten J. Kamper, Stellenbosch University, South Africa

### Poster Session: Control of Electric Drives

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Luca Zarri, Milijana Odavic

**P1501** *Current Ripple Reduction for Dual-Segment Three-phase PMSM with ZCMV PWM Scheme through Neutral Point Separation* [#19049]  
Zewei Shen, Dong Jiang, Zicheng Liu and Dawei Li, Huazhong University of Science and Technology, China

**P1502** *An Advanced Harmonic Compensation Strategy for Dual Three Phase Permanent Magnet Synchronous Machines Considering Different Angle Displacements* [#19232]  
Jin Xu, Milijana Odavic and Zi-Qiang Zhu, The University of Sheffield, United Kingdom

**P1503** *A Nonlinear Control of Synchronous Reluctance Motors (SynRM) Based on Feedback Linearization Considering the Self and Cross-Saturation Effects* [#19410]  
Angelo Accetta, Maurizio Cirrincione, Marcello Pucci and Antonino Sferlazza, INstitute for Marine engineering (INM), Italy; University of the South Pacific, Fiji; University of Palermo, Italy

**P1504** *Torque Ripple Minimization of Four-Phase Switched Reluctance Motor Using Direct Torque Control with an Innovative Switching Sequence Scheme* [#19490]

Krishna Reddy Pittam, Deepak Ronanki, Parthiban Perumal, Abdul R. Beig and Sheldon S. Williamson, National Institute of Technology Karnataka, India; University of Ontario Institute of Technology, Canada; Khalifa University, United Arab Emirates

**P1505** *On the Concept of Four Nearest Space Vector Modulation for Multi Source Inverters* [#20662]

Omid Salari, Hashtrudi Zaad Keyvan, Bakhshai Alireza, Amit Kumar and Praveen Jain, Queens university, Canada; Queens University, Canada

**P1506** *Power Decoupling Technique for Reducing DC-Link Capacitor of Switched Reluctance Machine Drives* [#20721]

Md Ehsanul Haque, Anik Chowdhury and Yilmaz Sozer, University of Akron, United States

**P1507** *Analytic MTPA Solution for Synchronous Reluctance Machine* [#19911]

Wonhee Lee, Kwanghee Nam and Jaehong Kim, POSTECH, Korea, Republic of; Chosun University, Korea, Republic of

**P1508** *A Simpler Gopinath-Style Flux Observer without a Constant Speed Assumption for Low and High Sampling-to-Fundamental Frequency Ratios for Induction Machines* [#20323]

Austin Gaspar, Yang Xu and Robert Lorenz, University of Wisconsin-Madison, United States

**P1509** *Improved Finite Control Set Model Predictive Control for Permanent Magnet Synchronous Motor Drives with Current Ripple Minimization* [#20178]

Guanghan Zhao, Shamsuddeen Nalakath and Ali Emadi, McMaster University, China; McMaster University, Canada

**P1510** *Rotor Position Estimation Error Analysis of Indirect High Frequency Signal Injection Method for Sensorless Starting Control of Aircraft Starter-Generator* [#19854]

Heng Lu, Jiadan Wei, Hua Xue, Zhuoran Zhang and Xianghao Kong, Nanjing University of Aeronautics and Astronauts, China

**P1511** *A Novel Virtual Space Vector Modulation Scheme for Three-Level NPC Power Converter with Neutral-Point Voltage Balancing and Common-Mode Voltage Reduction for Electric Starter/Generator System in More-Electric-Aircraft* [#19355]

Feng Guo, Tao Yang, Serhiy Bozhko and Patrick Wheeler, The University of Nottingham, United Kingdom

**P1512** *Grid-Connected Induction Motor Using a Floating DC-Link Converter under Unbalanced Voltage Sag* [#20047]

Maxsuel Ferreira Cunha, Cursino Brandao Jacobina and Nayara Brandao de Freitas, Federal University of Campina Grande (UFCG), Brazil

**P1513** *Robust Signal Offset Identification for Sensorless Control of Induction Machines at Rated Load using One-Active Modulating Pulse Excitation* [#19823]

Eduardo Rodriguez Montero, Markus Vogelsberger, Felix Baumgartner and Thomas Wolbank, Technical University of Vienna, Austria; Bombardier Transportation Austria GmbH, Austria

**P1514** *Dual Converter for Connection of a Doubly-Fed Induction Generator to a DC-Microgrid* [#19417]

Emerson de Lacerda Soares, Cursino Brandao Jacobina, Victor Felipe Moura Bezerra Melo, Nady Rocha and Edinson Roberto Cabral da Silva, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil

**P1515** *Quantitative Characterization Comparison between Six Step and Field Oriented Control Methods for Permanent Magnet Brushless DC Motors* [#20397]

Feilang Li, Wenxi Yao and Kevin Lee, Zhejiang University, China; Eaton Corporation, United States

**P1516** *A Full-Speed Range Hybrid PWM Strategy for High-Speed Permanent Magnet Synchronous Machine Considering Mitigation of Current Harmonics* [#19214]

Yang Liang, Deliang Liang, Shaofeng Jia, Shuaijun Chu and Jiangbiao He, Xi'an Jiaotong University, China; University of Kentucky, United States

**P1517** *Comparative Study on Decoupling Synchronous Current Proportional-Plus-Integral Regulator Design in High Speed PMSM Drives* [#20396]

Xiaolong Zhang, Yuyao Wang, Kiruba Sivasubramaniam Haran and Philip Krein, University of Illinois at Urbana-Champaign, United States

## Poster Session: SiC Devices and Applications

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Bilal Akin, David Feng

**P1701** *A 400V/300A Ultra-Fast Intelligent DC Solid State Circuit Breaker Using Parallel Connected SiC JFETs* [#19263]

Wei Wang, Zhikang Shuai, Ying Cheng, Dong He, Xue Yang, Jinyong Lei and Z. John Shen, Hunan University, China; Electric Power Research Institut, China; Illinois Institute of Technology, United States

**P1702** *Analysis of antiparallel diode connection for hybrid Si/SiC based ANPC for PV applications* [#20018]

Satish Belkhole, Anshuman Shukla and Suryanarayana Doolla, IIT Bombay, India

**P1703** *Analytical Switching Model of the 1200V SiC MOSFET in a High-voltage High-frequency Pulsed Power Converter for Plasma Generation* [#20248]

Qunfang Wu, Mengqi Wang, Weiyang Zhou, Xiaoming Wang and Guanliang Liu, University of Michigan-Dearborn, ECE Department, United States

**P1704** *Comparison of Traditional and Monolithic JBS Integrated SiC MOSFETs in Si/SiC Hybrid Switch Based Inverter* [#20101]

Jiajun Yu, Zongjian Li, Zhizhi He, Xi Jiang, Chao Zhang and Jun Wang, Hunan University, China, China

**P1705** *Current-dependent Variable Switching Strategy for Si/SiC Hybrid Switch-based Single-phase Inverter* [#19448]

Zeng Liu, Zishun Peng, Xiaogui Peng and Jun Wang, Hunan University, China

**P1706** *Design and Testing of a Modular Multilevel Converter Submodule Based on 10 kV SiC MOSFETs* [#19591]

Xingxuan Huang, James Palmer, Shiqi Ji, Li Zhang, Fred Wang, Leon Tolbert and William Giewont, University of Tennessee, Knoxville, United States; EPC Power, United States

**P1707** *Evaluation and Characterization of Parallel Connected Ultra-Low Inductance 400A SiC MOSFET Modules* [#19988]

Eddy Aeloiza, Arun Kadavelugu, Rostan Rodrigues, Mika Niemi, Markus Oinonen and Veli-Matti Leppanen, ABB Inc., United States; ABB Motion, Finland

**P1708** *Experimental Investigation and Verification of States Affecting the Performance of 3C-SiC-on-Si Schottky Barrier Diodes* [#19669]

Anastasios Arvanitopoulos, Fan Li, Mike Jennings, Samuel Perkins, Konstantinos N. Gytakis, Marina Antoniou, Phil Mawby and Neophytos Lophitis, Coventry University, United Kingdom; University of Warwick, United Kingdom; Swansea University, United Kingdom; The University of Edinburgh, United Kingdom

**P1709** *Measurement of important circuit parasitics for switching transient analysis of SiC MOSFET and Schottky diode pair* [#19898]

Shamibrota Kishore Roy and Kaushik Basu, Indian Institute of Science, India

**P1710** *Medium Voltage (13.8 kV) Transformer-less Grid-Connected DC/AC Converter Design and Demonstration Using 10 kV SiC MOSFET with High Frequency* [#19230]

Shiqi Ji, Xingxuan Huang, James Palmer, Li Zhang, Fred Wang, Leon Tolbert and William Giewont, University of Tennessee, Knoxville, United States; EPC Power, United States

**P1711** *Characterization and Modeling of SiC MOSFETs Turn On in a Half Bridge Converter* [#19075]

Mario Pulvirenti, Luciano Salvo, Giacomo Scelba, Angelo Giuseppe Sciacca, Massimo Nania, Giuseppe Scarcella and Mario Cacciato, STMicroelectronics, Italy; University of Catania, Italy

**P1712** *Multiple-Step Commutation Scheme for Avoiding High dv/dt in Modular Multilevel Converter with 10 kV SiC MOSFETs* [#19577]

Li Zhang, Shiqi Ji, Xingxuan Huang, James Everette Palmer, Giewont William, Fred Wang and Leon M Tolbert, University of Tennessee, United States; EPC Power, United States

**P1713** *Optimal DC-Link RC Snubber Design for SiC MOSFET Applications* [#19687]

Zheng Chen, Julius Rice, Jianwen Shao and Yuequan Hu, Wolfspeed, A Cree Company, United States

**P1714** *Performance Comparison of the Auxiliary Resonant Commutated Pole Inverter (ARCP) using SiC MOSFETs or Si IGBTs* [#19662]

Wenzhi Zhou, Xibo Yuan and Ian Laird, University of Bristol, United Kingdom

**P1715** *Performance Improvement of Dual Active Bridge DC-DC Converter Using Cost-Effectiveness Si/SiC Hybrid Switch* [#19616]

Zongjian Li, ZhiZhi He, Jiajun Yu, Xi Jiang and Jun Wang, Hunan University, China

**P1716** *SiC-hybrid based railway inverter for metro application with 3.3kV low inductance power modules* [#19509]

Alejandro Rujas, Victor M Lopez, Irma Villar, Txomin Nieva and Ivan Larzabal, IKERLAN Technology Research Centre, Spain; CAF Power&Automation, Spain

**P1717** *Switching behavior method to estimate the intrinsic gate resistance of a transistor by using the gate plateau voltage* [#19622]

Tatsuya Yanagi and Ken Nakahara, Rohm Co., Ltd., Japan

**P1718** *Testing and Validation of 10 kV SiC MOSFET Based 35 kVA MMC Phase-leg for Medium Voltage (13.8 kV) Grid* [#20084]

James Palmer, Shiqi Ji, Xingxuan Huang, Li Zhang, William Giewont, Fred Wang and Leon Tolbert, University of Tennessee, Knoxville, United State, United States; EPC Power, United States, United States

### Poster Session: Emerging Design and Applications of Energy Conversion

Monday, September 30, 5:00PM-7:30PM, Room: Exhibit Hall, Chair: Fei Lu, Salman Harasis

**P1901** *Miniature High-Voltage DC-DC Power Converters for Space and Micro-Robotic Applications* [#19074]

Sanghyeon Park, Aaron Goldin and Juan Rivas-Davila, Stanford University, United States

**P1903** *Aging Condition Assessment for Live XLPE-Type Cables through Precise High Frequency Impedance Phase Detection* [#20775]

Okan Boler, Yilmaz Sozer, Alex De Abreu Garcia and John Lauletta, University of Akron, United States

**P1902** *Consensus Control for CC-CV Charging of Supercapacitors* [#20453]

Xiaoyong Zhang, Yexin Liao, Heng Li, Yongjie Liu, Rui Zhang, Zhiqiang Meng, Jun Peng and Zhiwu Huang, Central south university, China; Central South University, China

**P1904** *A Cost-effective, Compact, Automatic Testing System for Dynamic Characterization of Power Semiconductor Devices* [#19959]

Avishek Ghosh, Carl Ngai Man Ho and Jared Prendergast, University of Manitoba, Canada

### Tuesday, October 1, 8:30AM-10:10AM

#### PV Systems 1

Tuesday, October 1, 8:30AM-10:10AM, Room: 344, Chair: Mohammad B Shadmand, Hengzhao Yang

**8:30AM** *Comprehensive Approach of Estimating Power-Peaks of Partially Shaded PV Strings with Overlapping Bypass Diodes* [#19118]

Zaid Alqaisi and Yousef Mahmoud, Student, United States; Professor, United States

**9:20AM** *One Year Submillisecond Fast Solar Database: Collection, Investigation, and Application* [#20535]

Yue Cao, John Magerko, Rodrigo Serna, Shibin Qin, Robert Pilawa-Podgurski and Philip Krein, Oregon State University, United States; EPRI, United States; Citadel LLC, United States; Apple Inc, United States; UC Berkeley, United States; Univ of Illinois - Urbana-Champaign, United States

**8:55AM** *A GaN-Based Active Power Decoupling Approach for Enhancing the Efficiency and Reliability of Residential PV Microinverters* [#20314]

Malek Ramezani, Fariborz Musavi, Saeed Golestan, Siavash Beheshtaein, Josep M. Guerrero and Robert Cuzner, Washington State University, United States; Aalborg University, Denmark; University of Wisconsin Milwaukee, United States

**9:45AM** *A Novel Approximate Model Based Fault Diagnosis Technique for a Photovoltaic DC/AC Grid Tied Inverter* [#20770]

Laurice Ann Smith, Naidu Satya and Mohamed O Badawy, San Jose State University, United States

#### DC Microgrid Control

Tuesday, October 1, 8:30AM-10:10AM, Room: 343, Chair: Yaow-Ming Chen, Anshuman Shukla

**8:30AM** *Finite-time Stabilization of Constant Power Loads in DC Microgrids* [#19632]

Qianwen Xu, Frede Blaabjerg and Chuanlin Zhang, Nanyang Technological University, Singapore; Aalborg University, Denmark; Shanghai University of Electric Power, China

**8:55AM** *Optimal Droop Coefficient Computation by Multi-Objective Optimization for Distributed Generators in DC Microgrids* [#19120]

Anushka Dissanayake and Nishantha Ekneligoda, Oklahoma State University, United States

**9:20AM** *Time Optimal Control of Constant Power Loads in DC Microgrids* [#19092]

Anushka Dissanayake and Nishantha Ekneligoda,  
Oklahoma State University, United States

**9:45AM** *Hysteresis Droop Controller with One Sample Delay for DC-DC Converters in DC Microgrids* [#20664]

Guangyuan Liu, Paolo Mattavelli and Stefano Saggin,  
University of Padova, Italy; University of Udine, Italy

### Virtual Synchronous Generators

Tuesday, October 1, 8:30AM-10:10AM, Room: 342, Chair: Qing-Chang Zhong, Pedro Rodriguez

**8:30AM** *Improved VSG Control for Type-IV Wind Turbine Generator Considering Operation Limitations* [#19776]

Chu Sun, Syed Qaseem Ali, Geza Joos and Francois Bouffard, McGill University, Canada; OPAL-RT TECHNOLOGIES Inc., Canada

**9:20AM** *Transient Stability Analysis of Virtual Synchronous Generator Connected to an Infinite Bus* [#19194]

Pengkun Li, Yue Wang, Yonghui Liu, Hui Zhou, Guoqing Gao and Wanjun Lei, Xi'an Jiaotong University, China

**8:55AM** *Stability Analysis Considering Dual Physical Constraints of Parallel-connected Virtual Synchronous Generators forming Microgrids* [#20169]

Peilin Xie, Chang Yuan, Yajuan Guan, Sen Tan, Mingshen Li, Juan C. Vasquez and Josep M. Guerrero, Aalborg University, Denmark; North China Electric Power Uni, China

**9:45AM** *Multi-parameter Adaptive Power Allocation Strategy for Microgrid with Parallel PV/Battery-VSGs* [#19984]

Meiqin Mao, Jian Hu, Yong Ding and Liuchen Chang, Hefei University of Technology, China

### Inductive Power Transfer 2

Tuesday, October 1, 8:30AM-10:10AM, Room: 340, Chair: Mohammad Islam, Jin Ye

**8:30AM** *A Reactive Compensation Method Using Switch Controlled Capacitor for Wireless Power Transfer* [#19268]

Jin Zhao, Jianzhong Zhang, Yaqian Zhang, Zakiud Din and Juri Jatskevich, Southeast University, China; University of British Columbia, Canada

**9:20AM** *A Self-oscillating Controller Based on Pulse Density Modulator in Wireless Power Transfer* [#19295]

Dong Wu, Ruikun Mai, Shiqiao Zhao, Zhengyou He and Fan Peng, Southwest Jiaotong University, China

**8:55AM** *Variable Duty Control of Three-Phase Voltage Source Inverter for Wireless Power Transfer Systems* [#20654]

Gui-Jia Su, Omer Onar, Jason Pries and Veda Galigekere, Oak Ridge National Lab, United States

**9:45AM** *A Soft-switched Active Clamped Half-bridge Current Source Inverter for Wireless Inductive Power Transfer* [#19699]

Phuoc Sang Huynh and Sheldon Williamson, University of Ontario Institute of Technology, Canada

### AC-DC – Multi-Phase

Tuesday, October 1, 8:30AM-10:10AM, Room: 349, Chair: Srdjan Lukic, Mohamed Youssef

**8:30AM** *Improved Modulation for DAB based Three-Phase Single-Stage AC-DC Converter* [#19134]

Fengjiang Wu and Xiaoguang Li, Harbin Institute of Technology, China

**9:20AM** *Integration of Minimum-Voltage Active-Clamping to Three-Phase Four-Wire Rectifiers with a Balancing Leg* [#19590]

An Zhao, Yangtao Huang, Keyan Shi, Jinyi Deng, Changsheng Hu and Dehong Xu, Zhejiang University, China

**8:55AM** *A Single-Stage High Frequency-link Modular Three-Phase Soft-Switching AC-DC Converter for EV Battery Charger* [#19303]

Tomokazu Mishima and Shoya Mitsui, Kobe University, Japan



**9:45AM** *AC-DC Power Conversion Systems for Open-End Winding PMSM Based on Vienna Rectifiers* [#20056]

Amanda Pereira Monteiro, Cursino Brandao Jacobina,

Filipe Antonio Da Costa Bahia and Reuben Palmer Rezende de Sousa, Federal University of Campina Grande, Brazil

### DC-DC Non-Isolated Converter 2

Tuesday, October 1, 8:30AM-10:10AM, Room: 347, Chair: Parag Kshirsagar, Dong Cao

**8:30AM** *Voltage-Controlled Tunable Capacitor based Resonant Power Converter* [#20450]

Ben Guo, Suman Dwari and Priay Shashank, United Technologies Research Center, United States; Pennsylvania State University, United States

**9:20AM** *Resonant network design methodology based on two-port network analysis considering load impedance variation* [#19770]

Euihoon Chung and Jung-Ik Ha, Seoul National Univ., Korea (South)

**8:55AM** *An Inductor-less DC to DC Converter Suitable For Use In 1500V Solar Power Applications* [#19236]

Mahesh Swamy, Yaskawa America, Inc., United States

**9:45AM** *A Novel Switched-Capacitor Converter with Phase Shift Modulation* [#19539]

Hongyang Xie and Rui Li, Shanghai Jiao Tong University, China

### Design for Reliability

Tuesday, October 1, 8:30AM-10:10AM, Room: 350, Chair: Ke Ma, Alan Mantooth

**8:30AM** *DC Pulsed Transient Waveform Characterization Under Wavelet Transformation* [#19762]

Damian Oslebo, Keith Corzine, Todd Weatherford, Roberto Cristi and Atif Maqsood, Naval Postgraduate School, United States; University of California, Santa Cruz, United States

**9:20AM** *A Quasi-Online Monitoring Method of Output Capacitor and Boost Inductor for DCM Boost Converter* [#19209]

Lingge Li, Kai Yao, Chanbo Guan, Chengjian Wu, Bin Fang, Zhen Zhang, Chunwei Ma, Jienan Chen and Junfang Zhang, Nanjing University of Science and Technology, China

**8:55AM** *Application of Digital Twin for Condition Monitoring in DC-DC Power Converters* [#20273]

Yingzhou Peng and Wang Huai, Aalborg University, Denmark

**9:45AM** *PCB Layout Based Short-Circuit Protection Scheme for GaN HEMTs* [#20027]

Ozturk Sahin Alemdar, Furkan Karakaya and Ozan Keysan, Aselsan Inc., Turkey; Middle East Technical University, Turkey

### Large Signal Stability and Control

Tuesday, October 1, 8:30AM-10:10AM, Room: 346, Chair: Minjie Chen, Yunwei Li

**8:30AM** *An Asymmetrical Fault Current Iterative Algorithm of Droop-Controlled Inverter* [#19216]

Huimin Zhao, Jun Ge, Zhikang Shuai, Ying Cheng, Jinyong Lei and John Shen, Hunan University, China; China Southern Power Grid, China

**9:20AM** *Conceptual Systematic Stability Analysis of Power Electronics based Power Systems* [#19795]

Qianwen Xu, Xiongfei Wang, Taul Mads Graungaard and Frede Blaabjerg, Aalborg University, Denmark

**8:55AM** *Suppression of Quantization-Induced Limit Cycles in Digitally Controlled DC-DC Converters by Dyadic Digital Pulse Width Modulation* [#19638]

Maksudjon Usmonov, Paolo Crovetto, Francesco Gregoretti and Francesco Musolino, Politecnico di Torino, Italy

**9:45AM** *A Stabilizer for Inverters Operating in Grid-Feeding, Grid-Supporting and Grid-Forming Modes* [#20360]

Aswad Adib, Fariba Fateh and Behrooz Mirafzal, Kansas State University, United States

### Modeling and Simulation Tools

Tuesday, October 1, 8:30AM-10:10AM, Room: 329, Chair: Han Peng, Dragan Maksimovic

**8:30AM** *A Numerical Method for Calculating the Output Spectrum of an H-Bridge Inverter with Dead-time Based on Switching Mode Analysis* [#19575]  
Qihao Yu, Erik Lemmen and Bas Vermulst, Eindhoven University of Technology, Netherlands

**8:55AM** *Three-Phase Test Bench for Multiple Submodules in Modular Multilevel Converter System* [#19617]  
Shan Jiang, Ke Ma and Ye Zhu, Shanghai Jiao Tong University, China

**9:20AM** *Hierarchical Layout Synthesis and Design Automation for 2.5D Heterogeneous Multi-Chip Power Modules* [#19372]  
Imam Al Razi, Quang Le, H. Alan Mantooth and Yarui Peng, University of Arkansas, United States

**9:45AM** *Estimation of lumped equivalent circuit elements of a SiC power module* [#19083]  
David Reiff, Axel Rothstein, Jianghua Feng, Jing Shang and Volker Staudt, Ruhr University Bochum, Germany; CRRC Zhuzhou Institute, China

### Inverter Control

Tuesday, October 1, 8:30AM-10:10AM, Room: 348, Chair: Carl Ho, Marcello Pucci

**8:30AM** *Optimized Based Algorithm First Order Sliding Mode Control for Grid-Connected Packed E-Cell (PEC) Inverter* [#19418]  
Mohammad Babaie, Mohammad Sharifzadeh, Majid Mehrasa and Kamal Al-Haddad, Ecole de technologie superieure, Canada; Babol Noshirvani University of Technology, Iran

**8:55AM** *A Novel Decentralized Control Strategy for Input-Series Output-Parallel Inverter System* [#19545]  
Ke Zhang, Wu Chen, Liangcai Shu, Chenyang Xue, Han Ye and Waqar Azeem Syed, Southeast University, China; Southeast university, China

**9:20AM** *Power Decoupling Control for Boost-Type Single-Phase Inverter with Active Power Buffer* [#19548]  
Shenquan Liu, Yufei He, Gang Wang and Minghao Wang, South China University of Technology, China; The Hong Kong Polytechnic University, Hong Kong

**9:45AM** *Harmonic Analysis of Common-mode Reduction Modulation for Three-level Inverter* [#20256]  
Ruirui Chen, Jiahao Niu, Handong Gui, Zheyu Zhang, Fred Wang, Leon Tolbert, Daniel Costinett, Benjamin Blalock and Benjamin Choi, University of Tennessee, United States; Clemson University, United States; NASA Glenn Research Center, United States

### Electric Machines: Loss analysis 1

Tuesday, October 1, 8:30AM-10:10AM, Room: 337, Chair: Gerd Bramerdorfer, Franco Leonardi

**8:30AM** *A new Zig-Zag Variable Load Test Approach for Enhanced Stray-Load Loss Measurements* [#19568]  
Silvio Vaschetto, Andrea Cavagnino, Emmanuel Agamloh and Alberto Tenconi, Politecnico di Torino, Italy; Baylor University, Waco, Texas, United States

**8:55AM** *Effect of Inverter Output dv/dt with Respect to Gate Resistance and Loss Comparison with dv/dt Filters for SiC MOSFET based High Speed Machine Drive Applications* [#19684]  
Heonyoung Kim, Sayan Acharya, Anup Anurag, Byeong-Heon Kim and Subhashish Bhattacharya, North Carolina State University, United States

**9:20AM** *Investigation and Prediction of PWM-induced Iron Loss in Lamination Steels Using High-Frequency Inverters with Wide-Bandgap Switches* [#20020]  
Le Chang, Woongkul Lee, Thomas Jahns and Khwaja Rahman, University of Wisconsin- Madison, United States; General Motors Global Propulsion Systems, United States

**9:45AM** *Iron loss calculation under PWM inverter switching for SiFe steel materials* [#20376]  
Hiroaki Matsumori, Toshihisa Shimizu, Takashi Kosaka and Nobuyuki Matsui, Nagoya Institute of Technology, Japan; Tokyo Metropolitan University, Japan

### Induction Machines

Tuesday, October 1, 8:30AM-10:10AM, Room: 338, Chair: Cong Ma, Silvio Vaschetto

**8:30AM** *Induction Motor Mapping Using Rotor Field-Oriented Analysis Technique* [#19240]  
Matteo Carbonieri, Nicola Bianchi and Luigi Alberti, University of Padova, Italy

**8:55AM** *Prediction of Drive-Fed Induction Machine Efficiency Using Sine Wave Efficiency Results* [#19249]  
Mahmud Ghasemi Bijan and Pragasen Pillay, Concordia University, Canada

**9:20AM** *Hybrid Method for Measuring Rotor Bar-Lamination Contact Resistances [#19506]*  
Andrea Cavagnino, Silvio Vaschetto and Zbigniew Gmyrek, Politecnico di Torino, Italy; Lodz University of Technology, Poland

**9:45AM** *A Method to Estimate Torque and Stray Load Loss of Induction Motor without Torque Detector [#20432]*  
Shu Yamamoto, Hideaki Hirahara and Balapuwaduge Amith Shantha Gunasekara, Polytechnic University, Japan

### Energy Efficiency Issues in Electric Drives

Tuesday, October 1, 8:30AM-10:10AM, Room: 336, Chair: Lijun He, Arijit Banerjee

**8:30AM** *Novel Winding Changeover Method for A High Efficiency AC Motor Drive [#19374]*  
Seong-Hwan Im, Gwangmin Park and Bon-Gwan Gu, Kyungpook National University, Korea (South); Korea Automotive Technology Institute, Korea (South)

**9:20AM** *An H8 Current-Source Inverter using Wide Bandgap Bidirectional Switches [#20424]*  
Hang Dai, Renato Amorim Torres, Thomas Jahns and Bulent Sarlioglu, WEMPEC, University of Wisconsin-Madison, United States

**8:55AM** *Operation and Analysis of Current-Source Inverters using Dual-Gate Four-Quadrant Wide-Bandgap Power Switches [#20354]*  
Renato Amorim Torres, Hang Dai, Thomas Jahns and Bulent Sarlioglu, University of Wisconsin-Madison, United States

**9:45AM** *Implementation of the Master-Slave Windings Scheme for the Low Pulse Ratio Operation in Motor Drivers [#20613]*  
Mufeng Xiong, Zipeng Liang, Sideng Hu, Wenxi Yao and Xiangning He, Zhejiang University, China

### Prof. Bob Lorenz Memorial Session 2

Tuesday, October 1, 8:30AM-10:10AM, Room: 339, Chair: Thomas M. Jahns, Bulent Sarlioglu

**8:30AM** *Design of Current Regulator for Induction Machines at Low Sampling-to-Fundamental Frequency Ratios with Improved Current Observer [#20308]*  
Yang Xu, Chikara Morito and Robert Lorenz, University of Wisconsin-Madison, United States; Toshiba Mitsubishi-Electric Industrial Sys Corp, Japan

**9:20AM** *Enhancement of SPMSMs Sensorless Torque Estimation Using High Frequency Signal Injection [#19570]*  
David Reigosa, Ye Gu Kang, Maria Martinez, Daniel Fernandez, Juan Manuel Guerrero and Fernando Briz, University of Oviedo, Spain; University of Wisconsin, Korea (South)

**8:55AM** *Spatial Deadbeat Torque Control for Six-Step Operation [#20262]*  
Marc Petit, Bulent Sarlioglu, Robert Lorenz, Brent Gagas and Caleb Secrest, UW-Madison, WEMPEC, United States; General Motors, United States

### Gate Drive for Wide Band Gap Device 1

Tuesday, October 1, 8:30AM-10:10AM, Room: 341, Chair: Tanya Gachovska, He Li

**8:30AM** *An Intelligent Model-Based Multi-Level Active Gate Driver for Power Semiconductor Devices [#19163]*  
Shuang Zhao, Xingchen Zhao, Haider Mehisan, Chris Farnell and Alan Mantooth, University of Arkansas, United States

**9:20AM** *Design and Implementation of Digital Active Gate Control with Variable 63-level Drivability Controlled by Serial 4-bit Signals [#20709]*  
Hidemine Obara, Tomoyuki Mannen, Keiji Wada, Koutaro Miyazaki, Toru Sai, Makoto Takamiya and Takayasu Sakurai, Yokohama National University, Japan; Tokyo Metropolitan University, Japan; The University of Tokyo, Japan

**8:55AM** *Economical methods for SiC JFET's short-circuit protection using commercial gate drivers [#19715]*  
Rostan Rodrigues and Xiaoqing Song, ABB Inc, United States

**9:45AM** *Current Sharing and Overvoltage Issues of Paralleled SiC MOSFET Modules [#20639]*  
Krishna Mainali, Ruxi Wang, Juan Sabate and Steven Klopman, GE global research, United States; GE global research, United States

**Emerging Design and Applications of Energy Conversion 2**

Tuesday, October 1, 8:30AM-10:10AM, Room: 345, Chair: Kaveh Ashenayi, Ahmet Yeksan

**8:30AM** *Electronically Assisted Circuit Breaker (EACB) for DC Power Systems [#19540]*

Yanjun Feng, Yuanfeng Zhou, Z. John Shen, Xin Zhou and Slobodan Krstic, Illinois Institute of Technology, United States; Eaton Corporation, United States

**8:55AM** *High-Frequency Resonant Inverter for Power Transfer Between Distributed Modules of a Biomedical Implant [#20244]*

Usama Anwar, Dejan Markovic and Khurram Khan Afridi, UCLA, United States; Cornell, United States

**9:20AM** *Development of a Power Electronics Teaching Lab Incorporating WBG Semiconductors with Plug and Play Modular Hardware and Advanced Curriculum [#20387]*

Chondon Roy, Namwon Kim, Robert Cox and Babak Parkhideh, University of North Carolina at Charlotte, United States

**9:45AM** *A New Adaptive Virtual Impedance based Fault Current Limiter for Converters [#20630]*

Siavash Beheshtaein, Saeed Golestan, Robert Cuzner and Josep Guerrero, University of Wisconsin Milwaukee, United States; Aalborg University, Denmark

**Special Session: Empower Billion Lives - A**

Tuesday, October 1, 8:30AM-10:10AM, Room: 328, Chair: Deepak Divan, Szilard Liptak

**Special Session: Virtual Factory Tours**

Tuesday, October 1, 8:30AM-10:10AM, Room: 327, Chair: Ira Pitel

**Tuesday, October 1, 10:30AM-12:10PM****Poster Session: Energy Storage Systems**

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Adel Nasiri, Ke Ma

**P2101** *Residential (Secondary-Use) Energy Storage System with Modular Software and Hardware Power Electronic Interfaces [#19359]*

Michael Starke, Mahdu Chinthavali, Zeng Rong, Zheng Sheng, Campbell Steven, Smith Mitch and Dean Benjamin, Oak Ridge National Lab, United States; University of Tennessee, United States

**P2102** *Energy Storage Systems Based on Sodium Metal Halides Batteries [#19480]*

Mauro Boi, Daniele Battaglia, Andrea Salimbeni and Alfonso Damiano, Universita degli Studi di Cagliari, Italy

**P2103** *Measuring Individual Battery Dimensional Changes for State-of-Charge Estimation using Strain Gauge Sensors [#19571]*

Ryan Hickey and Thomas Jahns, University of Wisconsin - Madison, United States

**P2104** *Direct Comparison of State-of-Charge and State-of- Energy Metrics for Li-Ion Battery Energy Storage [#19572]*

Ryan Hickey and Thomas Jahns, University of Wisconsin - Madison, United States

**P2105** *High-Efficiency Silicon Carbide (SiC) Converter Using Paralleled Discrete Devices in Energy Storage Systems [#20204]*

Zheyu Zhang, Hao Tu, Xu She, Tomas Sadilek, Ramanujam Ramabhadran, Huan Hu and William Earls, General Electric, United States; North Carolina State University, United States; United Technologies, United States

**P2106** *Battery Loss Modelling Using Equivalent Circuits [#20222]*

Siwei Liu, Andrew Forsyth and Rebecca Todd, University of Manchester, United Kingdom

**P2107** *Nonlinear Control Design for Bidirectional Synchronous Buck-Boost Converters used in Residential Battery Storage Systems* [#20294]

Andres Salazar, Alberto Berzoy and Javad Mohammadpour, sonnen Inc, United States; University of Georgia, United States

**P2108** *Li-ion batteries parameter estimation using converter excitation and fusion methods* [#20341]

Irene Pelaez, Pablo Garcia, Geber Villa and Sarah Saeed, University of Oviedo, Spain; University of Oviedo, Egypt

**P2109** *Measurement and Estimation of the Equivalent Circuit Parameters for Multi-MW Battery Systems* [#20539]

Oluwaseun Akeyo, Vandana Rallabandi, Nicholas Jewell and Dan Ionel, University of Kentucky, United States; LG&E and KU, Louisville, KY, United States

**P2110** *Power Allocation for Energy Stored Quasi-Z-Source Inverter Based on the Power Loss Modelling* [#20643]

Meng Yangyang, Wang Yujie, Xiong Mufeng, Hu Sideng and He Xiangning, Zhejiang University, China

**P2111** *Polynomial Regression method-based Remaining Useful Life Prediction and Comparative Analysis of Two Lithium Nickel Cobalt Manganese Oxide Batteries* [#20668]

Soonjong Kwon, Jinhyeong Park, Jin Hyeok Choi, Ji-Hun Lim, Sung-Eun Lee and Jonghoon Kim, Department of Electrical Engineering, Chungnam N, Korea (South); Korea Electric Power Corporation Research Insti, Korea (South)

**P2112** *Battery internal resistance estimation using a battery balancing system based on switched capacitors* [#20718]

Cristina Gonzalez Moral, Diego Fernandez Laborda, Lidia Sanchez Alonso, Juan Manuel Guerrero, Daniel Fernandez Alonso, Carlos Rivas Pereda and David Diaz Reigosa, Universidad de Oviedo, Spain; ELINSA, Spain

**P2113** *Impact of Energy Storage System Response Speed on Enhanced Frequency Response Services* [#20179]

Qingwei Zhu, Alberto Bolzoni, Andrew Forsyth and Rebecca Todd, The University of Manchester, United Kingdom

**P2114** *Evaluation of BESS Management Strategies for Grid Primary and Enhanced Frequency Response* [#20190]

Yiheng Hu, Xihai Cao, Nigel Schofield and Nan Zhao, University of Huddersfield, United Kingdom; University College Dublin, Ireland; University of Huddersfield, Ireland; University College Dublin, United Kingdom

## Poster Session: Renewable Generation and Energy Storage

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Mahshid Amirabadi, Katherine Kim

**P2301** *Grid Interfaced PV System Using a Generalized Mixed p-Norm Adaptive Filtering Algorithm* [#20107]

Shalvi Tyagi, Shailendra Kumar, Bhim Singh and Subarni Pradhan, Indian Institute of Technology Delhi, India

**P2302** *Enhancing Power System Transient Stability by Virtual Synchronous Generator Control Using Wide-Area Measurements* [#20217]

Yiwei Ma, Lin Zhu, Fred Wang and Leon Tolbert, University of Tennessee, United States

**P2303** *Neural Network Based Control Algorithm for Solar PV Interfaced System* [#19602]

Pavitra Shukl and Bhim Singh, Indian Institute of Technology Delhi, India

**P2304** *Improvement of Grid Current Quality for Droop-Controlled Grid-Connected Inverters under Distorted Grid Conditions* [#19890]

Baojin Liu, Jinjun Liu and Zeng Liu, Xi'an Jiaotong University, China

**P2305** *Synchronization and Current Sharing for Nonlinear-oscillator-based Inverters in Islanded Three-phase Microgrid* [#19546]

Mingshen Li, Baoze Wei, Xie Peilin, Sen Tan, Juan C. Vasquez and Josep M. Guerrero, Aalborg Universtiy, Denmark

**P2306** *Instantaneous Zero Sequence Voltage for Grid Energy Balancing Under Unbalanced Power Generation* [#19926]

Ricardo P. Aguilera, Pablo Acuna, Christian Rojas, Georgios Konstantinou and Josep Pou, UTS Sydney, Australia; University of Talca, Chile; Universidad Tecnica Federico Santa Maria, Chile; UNSW Sydney, Australia; Nanyang Technological University, Singapore

**P2307** *LCL-Filter Design to Suppress Transient Overshoots of Grid-Connected Inverters under Grid Voltage Fluctuations or Faults* [#20591]

Jinming Xu, Zhao Zhang, Shenyiyang Bian, Miao Liu and Shaojun Xie, Nanjing University of Aeronautics & Astronautics, China

**P2308** *Analysis of the Parallel Operation Between Synchronverters and PLL-Based Converters* [#19651]

Roberto Rosso, Soenke Engelken and Marco Liserre, WRD GmbH, Germany; Chair of Power Electronics University of Kiel, Germany

**P2309** *Analysis and Mitigation of Voltage Measurement Errors for Three-Phase Parallel Voltage Source Inverters* [#19745]

Yang Qi, Jiazhe Liu, Yi Tang and Kaushik Rajashekara, Nanyang Technological University, Singapore; University of Houston, United States

**P2310** *Selective Harmonic Elimination and Balancing of Capacitor Voltage in Hybrid Cascaded Multilevel Inverter Using Model Predictive Control* [#20069]

Abhinandan Routray, Rajeev Kumar Singh and Ranjit Mahanty, Indian Institute of Technology (BHU), Varanasi, India

**P2311** *Leakage Current Mitigation in Transformerless Z-Source/Quasi Z-Source PV Inverters: An Overview* [#19680]

Jing Yuan, Yongheng Yang and Blaabjerg Frede, Aalborg University, Denmark; Aalborg university, Denmark

**P2312** *Impedance Characterization of Utility-Scale Renewable Energy and Storage Systems* [#19701]

Shahil Shah, Przemyslaw Koralewicz, Vahan Gevorgian and Robb Wallen, National Renewable Energy Laboratory, United States

**P2313** *A DC Component Suppression Technique Based on Virtual Capacitors* [#19797]

Bo Long, Wenting Fang and Udaya K. Madawala, University of Electronic Science and Technology, China; University of Auckland, New Zealand

**P2314** *Influence of the ICFF Decoupling Technique on the Stability of the Current Control Loop of a Grid-Tied VSC* [#20340]

Leonardo Marin, Rebecca Rye, Tarraso Andres, Candela Jose Ignacion and Rodriguez Pedro, Polytechnic University of Catalonia, Spain; Virginia Polytechnic Institute and State Unvers, United States; Loyola University, Spain

**P2315** *Active Compensator for Multi-Paralleled Grid-Tied Inverters under variable Grid Conditions* [#19489]

Peng Yuqi, He Yuanbin and Hang Lijun, Hangzhou Dianzi University, China

**P2316** *Reactive Power Injection and SOGI Based Active Anti-Islanding Protection Method* [#20224]

Yunpeng Si, Yifu Liu, Chunhui Liu, Zhengda Zhang and Qin Lei, Arizona State University, United States

**P2317** *A Grid-compatible Virtual Oscillator Controller: Analysis and Design* [#20419]

Minghui Lu, Soham Dutta, Victor Purba, Sairaj Dhople and Brian Johnson, University of Washington, United States; University of Minnesota, United States

**P2318** *Design of Bipolar Interface Converter for Purely DC Microgrid with Minimally Processed Maximum Power Point Operation of Photovoltaics* [#20310]

Sanchit Mishra, Visweshwar Chandrasekaran, Sreekanth T. and Ned Mohan, University of Minnesota, United States, United States

**P2319** *Multi-mode Control for Three-phase Bidirectional AC/DC Converter in Hybrid Microgrid under Unbalanced AC voltage Conditions* [#20392]

Chunguang Ren, Longfeng Liu, Xiaoqing Han, Baifu Zhang, Lei Wang and Peng Wang, Tauyuan University of Techonology, China; Tauyuan university of techonology, China; Nanyang Techonology University, Canada

### Poster Session: Batteries Management & Infrastructures

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Veda Prakash Galigekere, Sifat Chowdhury

**P2501** *State of Charge and Equivalent Internal Resistance Estimation for a Multi-cell Application based on Cell-Difference-Model* [#19171]  
Woo-Yong Kim, Pyeong-Yeon Lee, Jonghoon Kim and Kyung-Soo Kim, Korea Advanced Institute of Science & Technology, Korea, Republic of; Chungnam National University, Korea, Republic of

**P2502** *Thermal Modeling of a Lithium-Ion Battery Pack in a Plug-in Electric Vehicle* [#19586]  
Xiaohui Li, Meng Yao, Linpei Zhu, Xiayi Yuan, Jin Shang and Bozhi Yang, GAC R&D center Silicon Valley, United States; Guangzhou Automobile Engineering Institute, China

**P2503** *A Selection Switch Based Cell-to-cell Battery Voltage Equalizer with Reduced Switch Count* [#19889]  
Shimul K Dam and Vinod John, Indian Institute of Science, India

**P2504** *A Three-Level DC-DC Converter for Battery Impedance Spectroscopy* [#19998]  
Omolola Faloye and Paul Barendse, University Of Capetown, South Africa

**P2505** *Modelling and Simulation of Fuel Cell/supercapacitor passive hybrid vehicle system* [#19932]  
Qian Xun, Yujing Liu, Jian Zhao and Emma Arfa Grunditz, Chalmers University of Technology, Sweden

**P2506** *Online Adaptive SOC Estimation Via information on Linear Regression Model based SOH for Electric-Powered Application* [#20669]  
Pyeong-Yeon Lee, Seong-Yun Park, Seoungjun Lee, Woonki Na, Cheolwoo Lim and Jonghoon Kim, Chungnam National University, Korea (South); Chosun University, Korea (South); California State University, Fresno, United States; Satellite Research Center, Korea (South)

### Poster Session: Rectifiers & Inverters

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Arijit Banerjee, Youim (Kelly) Tray

**P2701** *WBG Partial Power Processing: A New PFC Design with Interleaved MHz- Frequency GaN and Low-Frequency Si Phases* [#19549]  
Chao Zhang, Xin Yin, Sai Tang, Daming Wang, Xifei Liu, Jun Wang and Z.John Shen, Hunan University, China; Illinois Institute of Technology, United States

**P2702** *Reconfigurable Universal Buck-Boost PFC with Ultra Wide Input Voltage Range* [#20177]  
Mohammad Mahdavi, Hamed Valipour and Martin Ordonez, The University of British Columbia, Canada

**P2703** *A New AC/DC Half-Bridge/String-Inverter Hybrid-Structured Isolated Bi-directional Converter* [#20525]  
Reza Emamalipour and John Lam, York University, Canada

**P2704** *Low Frequency Finite Set Model Predictive Control for Seven-Level Modified Packed U-Cell Rectifier* [#20767]  
Mohammad Babaie, Majid Mehrasa, Mohammad Sharifzadeh and Kamal Al-Haddad, Ecole de technologie superieure, Canada; Babol Noshirvani University of Technology, Iran

**P2705** *A Two-phase Three-dimension Common Capacitor LLC Resonant Converter* [#20071]  
Wenhui Mo, Xiumei Yue, Kui Li, Xinyue Chen and Hongliang Wang, Hunan University, China

**P2706** *A Multimode Bridge-less SiC-Based AC/DC Step-up Converter with a Dual Active Auxiliary Circuit for Wind Energy Conversion Systems with MVDC Grid* [#20402]  
Mehdi Abbasi and John Lam, York University, Lassonde School of Engineering, Canada

**P2707** *3-Level Asymmetric Full-Bridge Soft-Switched PWM Converter for 3-Phase Unfolding Based Battery Charger Topology* [#20602]  
Dorai Babu Yelaverthi, Rees Hatch, Mahmoud Mansour, Hongjie Wang and Regan Zane, Utah State University, United States

**P2708** *Experimental Validation of Single-Stage Three-Phase Non-Isolated Cuk Rectifier* [#20681]  
Nikhil Kumar, Sudip Mazumder and Mohamadi Moien, University of Illinois at Chicago, United States

**P2709** *Design Methodology of a ZVS Class-E Inverter with Fixed Gain* [#19354]  
Lujie Zhang and Khai Ngo, CPES, Virginia Tech, United States

**P2710** *A Novel Auxiliary Resonant Snubber Inverter Using Wide Bandgap Devices* [#19496]  
Yu Wei, Ming-Cheng Chen, Chih-Shen Yeh and Jih-Sheng Lai, Cummins Inc., United States; National Taiwan University of Science and Tech., Taiwan; Virginia Polytechnic Institute and State Univ., United States

**P2711** *Design and Implementation of Parallel Dual-Frequency Single-Phase Grid-Connected Inverter* [#19629]

Liyong Yang, Aoyu Chang, Shuo Liu, Zhigang Chen and Guofeng Yuan, North China University of Technology, China; University of Science & Technology Beijing, China

**P2712** *An Improved Time-Delay Compensation Scheme for Enhancing Control Performance of Digitally Controlled Grid-Connected Inverter* [#19641]

Yinglin Jin, Tianzhi Fang and Kai Yao, Nanjing Univ. of Aeronautics and Astronautics, China; Nanjing University of Science and Technology, China

**P2713** *A high power density three phase inverter for microcars based on 100V/600A Six-pack MOSFET module* [#19794]

Dongmyoung Joo, Yong-Su Noh, Jin-Hong Kim, Joon Sung Park, Byoung-Jo Hyon and Jun-Hyuk Choi, Intelligent Mechatronics Research Center, Korea, Korea (South)

**P2714** *Single-Phase Cascaded-Transformer Converter with Two DC Links* [#20036]

Nayara Brandao de Freitas, Cursino Brandao Jacobina and Maxsuel Ferreira Cunha, Federal University of Campina Grande (UFCG), Brazil

**P2715** *A Modified Lyapunov-based Control Strategy for a Single-Phase VSI with a Load Estimator* [#20303]

Chan Chok You John, Jinsong He, Xiaochao Hou and Xin Zhang, Nanyang Technological University, Singapore; Central South University, China

**P2716** *Gain Enhancement of Switched Boost Inverter Using a Novel PWM Scheme* [#20558]

Anil Gambhir and Santanu Mishra, IIT Kanpur, India

**P2717** *Implementation and Comparison of Active and Reactive Power Flow Control Methods in a Single Phase Grid-Connected Microgrid* [#20625]

Dimitrios Kanavaros, Giovanna Oriti and Alexander Julian, Naval Postgraduate School, United States; Consultant, United States

**P2718** *A Single-Stage Three-Phase Split-Y-Source Inverter* [#19443]

Manxin Chen, Changqing Yin, Poh Chiang Loh and Lei Ming, The Chinese University of Hong Kong, Hong Kong

**P2719** *A Variable Switching Frequency Virtual Space Vector Pulse-Width Modulation Based on the Current Ripple Prediction* [#19471]

Xingchen Zhao, Shuang Zhao, Zhe Zhao, Fei Diao, Yue Zhao, Chris Farnell and Alan Mantooth, University of Arkansas, United States

**P2720** *Zero-sequence Component Injection ZVS-PWM for Three-phase Grid Inverter with Arbitrary Power Factor Angle* [#19703]

Yuying Wu, Ning He and Dehong Xu, Zhejiang University, China

**P2721** *Reduction of DC-link Ripples for SiC-based Three-phase Four-wire Inverters with Unbalanced Loads* [#20054]

Peng Yang, Wenlong Ming, Jun Liang, Jianzhong Wu and Liu Wei, Cardiff University, United Kingdom

**P2722** *A Novel Three-Phase H7 Current-Source Inverter with Improved Reliability* [#20125]

Fazal Akbar and Honnyong Cha, Kyungpook National University, Korea (South)

**P2723** *Control of a Three-Phase Grid-Tied Inverter Designed for Discontinuous Current Mode Operation* [#20515]

Minami Terada, Hiroaki Toyoda, Ryuji Iijima, Takanori Isobe and Hiroshi Tadano, University of Tsukuba, Japan

**P2724** *A Single-Stage Isolated Three-Phase Bidirectional AC/DC Converter for High-Power Applications* [#19997]

Ling Gu and Kai Peng, Nanjing University of Science and Technology, China

### Poster Session: Converter Modeling, Control and Design 1

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Sheng Zheng, Fei Lu

**P2901** *Quantitative Analysis of Incomplete Shielding Layer in Flyback Converter for Common Mode Noise Suppression* [#19599]

Yan Liu, Fanghua Zhang and Guangdong Dong, Nanjing University of Aeronautics and Astronautics, China

**P2902** *High-Frequency Noise Suppression in a Buck-Converter System Based on SiC Devices* [#19537]

Shotaro Takahashi, Satoshi Ogasawara, Masatsugu Takemoto, Koji Orikawa and Michio Tamate, Hokkaido University, Japan; Fuji Electric Co., Ltd., Japan



**P2903** *Pulse Width Modulation-Based Common-Mode Noise Source Characterization of Three-Phase Two-Level Split-Source Inverter* [#19357]

M. S. Hassan and Masahito Shoyama, Kyushu University, Japan

**P2904** *Current-bias Dependent Permeability of Powder and Amorphous Core Induced Unbalanced DM Impedance and Mixed-mode Noise* [#19686]

Ren Ren, Bo Liu, Zhou Dong and Fred Wang, University of Tennessee at Knoxville, United States; United Technologies Research Center, United States

**P2905** *On the Stability of Virtual Inertia Control Implemented by Grid-Connected Power Converters with Delay Effects* [#19644]

Haixin Yang, Jingyang Fang, Ching-Ming Lai, Yi Tang and Han Deng, Nanyang Technological University, Singapore; National Chung Hsing University, Taiwan

**P2906** *Transient Angle Stability Comparison of Paralleled VSGs system and Hybrid System Comprised by VSG and Diesel Generator* [#19280]

Huijie Cheng, Ying Cheng, Zhikang Shuai, Chao Shen, Zhiyong Yuan, Ke Zhou and John Shen, Hunan University, China; China Souther Power Grid, China; Guangxi Power Grid Co., Ltd., China; Illinois Institute of Technology, United States

**P2907** *Re-synchronization Capability Analysis of Virtual Synchronous Generators in Microgrids* [#20409]

Chao Shen, Ying Cheng, Zhikang Shuai, Jinyong Lei, Ke Zhou, John Shen and Huijie Cheng, Hunan University, China; China Southern Power Grid, China; Illinois Institute of Technology, United States

**P2908** *Universal Active Power Filter Based on Three Three-Leg Converters and a Single DC-link* [#20074]

Phelipe Leal Serafim Rodrigues, Cursino Brandao Jacobina, Andre Elias Lucena da Costa and Italo Andre Cavalcanti De Oliveira, Federal University of Campina Grande, Brazil

**P2909** *Cascaded Dual Output Multilevel Converter to Enhance Power Delivery and Quality* [#20739]

Vijesh Jayan and Amer Ghias, Nanyang Technological University, Singapore

**P2910** *A Single-Objective FCS-MPC Method for Three-Level APF* [#19291]

Bo Peng and Guorong Zhang, Hefei University of Technology, China

**P2911** *A New Fault-Tolerant Control Method for CHB Inverter to Increase Maximum Output Voltage* [#19451]

Saeed Ounie, Mehdi Narimani, Navid Zargari and Zhongyuan Cheng, McMaster University, Hamilton, ON, Canada, Canada; Rockwell Automation, Cambridge, ON, Canada, Canada

**P2912** *Detecting Method for an Open-Switch Fault of SiC MOSFET and Si IGBT in Hybrid ANPC Inverter System* [#19886]

Bong-Hyun Kwon, Kyu-Chul Bae, Seok-Min Kim and Kyo-Beum Lee, LSIS, Korea, Republic of; Ajou University, Korea, Republic of

**P2913** *Model Based Parametric Fault Detection in Power Electronic Circuits* [#19916]

Kang Yue, Yu Liu, Rong He, Minfan Fu and Haoyu Wang, ShanghaiTech University, China

**P2914** *Arc Fault Detection in DC Distribution Using Semi-Supervised Ensemble Machine Learning* [#20078]

Vu Le, Xiu Yao, Chad Miller and Bang-Hung Tsao, University at Buffalo, United States; Air Force Research Laboratory, United States; University of Dayton Research Institute, United States

**P2915** *A Data-driven RUL Prediction Method Enhanced by Identified Degradation Model for Lithium-ion Battery of EVs* [#20353]

Jun Peng, Mingjian Wu, Dianzhu Gao, Xiaoyong Zhang, Yijun Cheng, Zhiyong Zheng, Bin Chen, Fu Jiang and Zhiwu Huang, Central south university, China

**P2916** *Online Monitoring Method for a DC-Link Capacitor in an AC/DC/AC Converter* [#20251]

Weiyang Zhou, Mengqi Wang, Qunfang Wu, Xi Lu, Kewei Xiao and Chingchi Chen, University of MI-Dearborn, United States; Ford Motor Company, United States

**P2917** *Junction temperature model and degradation effect in IGBT multichip power modules* [#20154]

Fernando Gonzalez-Hernando, Jon San-Sebastian, Asier Garcia-Bediaga, Manuel Arias and Alejandro Rujas, IKERLAN TECHNOLOGY RESEARCH CENTRE, Spain; Oviedo University, Spain; IKERLAN Technology Research Centre, Spain

**P2918** *A Nonintrusive IGBT Open-Circuit Fault and Current Sensor Fault Diagnosis Method for Grid-Tied Three-phase Three-wire Inverter with Two Current Sensors* [#19717]

Zhan Li, Pat Wheeler, Alan Watson, Alessandro Costabeber, Zhihong Bai, Xin Zhang, Bohui Zhao and Hao Ma, Zhejiang University, Nanyang Technological Univ., China; University of Nottingham, United Kingdom; Zhejiang University, China; Nanyang Technological University, Singapore

**P2919** *Fault Detection of Switch Mode Power Converters Based on Radiated EMI Analysis* [#20756]

Mohammad Arifur Rahman, Elham Pazouki, Yilmaz Sozer and Alex De Abreu, University of Akron, United States; Rockwell Automation, United States

**P2920** *MOSFET Junction Temperature Measurements using Conducted Electromagnetic Emissions and Support Vector Machines* [#20455]

Justin Demus, Viktoriia Sysoeva, Qianyi Cheng, Matt Boubin, Ahmed Siraj and Mark Scott, Miami University, United States

**P2921** *Grid Voltage Estimation and Feedback Linearization based Control of a Three phase Grid Connected Inverter under Unbalanced Grid Conditions with LCL Filter* [#20182]

Vikram Roy Chowdhury and Jonathan Kimball, Missouri University of Science and Technology, United States

**P2922** *A New Fault-Tolerant Method for 5-Level Active Neutral Point Clamped Inverter Using Sinusoidal PWM* [#19486]

Peter Azer, Saeed Ouni and Mehdi Narimani, ECE Department, McMaster University, Canada

### Poster Session: Machine Modelling and Non-Conventional Machines

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Wen Ouyang, Shafiq Ahmed Odhano

**P3101** *High Torque Density Fractional-Slot Concentrated-Winding Axial-Flux Permanent-Magnet Machine with Modular SMC Stator* [#19990]

Weiwei Geng, Zhuoran Zhang and Qiang Li, Nanjing University of Science and Technology, China; Nanjing University of Aeronautics and Astronautics, China

**P3102** *2-D Modeling and Experimental Testing of Single Rotor and Dual Stator Axial-Flux Permanent Magnet Machine* [#20191]

Calvin Corey, Ju Hyung Kim and Bulent Sarlioglu, DRS Naval Power Systems and U.W. Madison, United States; University of Wisconsin, Madison, United States

**P3103** *Design of a Novel Axial Flux Permanent Magnet Assisted Synchronous Reluctance Motor* [#20766]

Md Tawhid Bin Tarek and Yilmaz Sozer, University of Akron, United States

**P3104** *Basic Design of an Ultra-lightweight Machine Based on Magnetic Resonance Coupling and Influence of AC Losses due to High Frequency* [#19062]

Kazuto Sakai and Kenta Takishima, Toyo University, Japan

**P3105** *Comparison of different capacitor tuning criteria in air-cored resonant induction machines* [#19238]

Zhao Jin, Matteo F. Iacchetti, Alexander C. Smith, Rajesh P. Deodhar and Keisuike Mishima, The University of Manchester, United Kingdom; IMRA Europe SAS, United Kingdom; Aisin Seiki Co., Ltd., Japan

**P3106** *Synthesis of an Equivalent pi-model of Two-winding Transformer and Resonance Frequency Estimation Using Lumped Circuit Parameters* [#20171]

Annoy Kumar Das and Baylon G. Fernandes, Indian Institute of Technology, Bombay, India, India

**P3107** *A Novel Modular Transverse Flux Linear Permanent Magnet Vernier Machine with Halbach Arrays and Consequent Poles* [#20372]

Rui Li, Ronghai Qu, Dawei Li, Yuting Gao and Chaojie Shi, Huazhong University of Science and Technology, China

**P3108** *Analytic magnetic field modelling approach for iron-less tubular permanent magnet linear synchronous motors* [#20444]

Matthew Forbes, William S. P. Robertson, Anthony C. Zander and Johannes J. H. Paulides, University of Adelaide, Australia; Advanced Electromagnetics Group, Netherlands

**P3109** *Converter-fed induction motor efficiency measurement under variable frequency/ load points: An extension of the IEC/TS 60034-2-3* [#19188]

Muhammad Aminu, John Mushenya, Paul Barendse and Mohammed Azeem Khan, University of Cape Town, South Africa

**P3110** *Electromagnetic and thermal behavior of a triple redundant 9-phase PMA SynRM with insulation deterioration fault* [#19235]

Yanwen Shi, Jiabin Wang, Rongguang Hu and Bo Wang, University of Sheffield, United Kingdom; Southeast University, China

**P3111** *Minimization of AC Losses in Permanent Magnet Machines by Transposed Coil Connection* [#20502]

Liu Jingyi, Fan Xinggong, Li Dawei, Qu Ronghai and Fang Haiyang, Huazhong University of Science and Technology, China

**P3112** *Spatial MMF Harmonic Mitigation in Aluminum-Cage Induction Motors* [#19395]

Andrea Cavagnino, Silvio Vaschetto, Luca Ferraris, Zbigniew Gmyrek, Emmanuel Agamloh and Gerd Bramerdorfer, Politecnico di Torino, Italy; Lodz University of Technology, Poland; Baylor University, Waco, Texas, United States; Johannes Kepler University Linz, Austria

**P3113** *On the Accuracy and Improvement of FE-Based Electric Machine Evaluation Concerning Soft Magnetic Material Modeling* [#19909]

Gerd Bramerdorfer, Gereon Goldbeck and Martin Kitzberger, Johannes Kepler University Linz, Austria

**P3114** *Impact of Local Degradation in Soft Magnetic Materials on Performance of Permanent Magnet Synchronous Machines* [#20175]

Gereon Goldbeck, Gerd Bramerdorfer and Wolfgang Amrhein, Johannes Kepler University, Austria

**P3115** *On Shortening the Numerical Transient in Time-Stepping Finite Element Analysis of Induction Motors Under Static and Dynamic Eccentricity Faults* [#19439]

Hossein Nejadi Koti, Hao Chen, Yue Sun and Nabeel A. O. Demerdash, Marquette University, United States

**P3116** *An Upper Bound of the Torque Production for Round Rotor Wound Field Synchronous Machines and its Electromagnetic Scalability* [#19753]

Baoyun Ge, Independent Researcher, United States

**P3117** *Conjugate Heat Transfer and CFD Modeling of Self-ventilated Traction Motors* [#19880]

Luca Boscaglia, Fabio Bonsanto, Aldo Boglietti, Shafiqh Nategh and Claudio Scema, Politecnico di Torino, Italy; Ansys Inc., Italy; ABB AB, Sweden

**P3118** *Design of a High Bandwidth Open Loop Motor System Considering Electrical and Mechanical Time Constants* [#19936]

Soo-Hwan Park, Jin-Cheol Park, Ji-Min Kim, Ho-Young Lee, Soon-O Kwon and Myung-Seop Lim, Hanyang University, Korea, Republic of; Samsung Electronics, Korea, Republic of; Korea Institute of Industrial Technology, Korea, Republic of; Yeungnam University, Korea, Republic of

**P3119** *Automated HF Modelling of Induction Machines Considering the Effects of Aging* [#20748]

Riccardo Leuzzi, Vito Giuseppe Monopoli, Francesco Cupertino and Pericle Zanchetta, Politecnico di Bari, Italy; University of Nottingham, Great Britain

**P3120** *Axial-field Vernier-type Flux Modulation Machines for Low-speed Direct-drive Applications* [#20618]

Vandana Rallabandi, Peng Han, Murat G. Kesgin, Narges Taran and Dan M. Ionel, GE Research, United States; University of Kentucky, United States

**P3121** *Performance Impacts of Practical Fabrication Tradeoffs for a Radial Flux Coaxial Magnetic Gear with Halbach Arrays and Air Cores* [#20691]

Matthew C. Gardner, Matthew Johnson and Hamid A. Toliyat, Texas A&M University, United States; US Army Research Laboratory, United States

**P3122** *Study on AC Resistance of Winding According to Configuration of Strands* [#19702]

Jun-Woo Chin, Kyoung-Soo Cha, Jin-Cheol Park, Jung-Pyo Hong and Myung-Seop Lim, Hanyang University, Korea, Republic of; Yeungnam University, Korea, Republic of

**P3123** *Winding Material Effect on High Speed Brushless Permanent Magnet Machines* [#20708]

Giuseppe Volpe, Mircea Popescu, Ian Foley and James Goss, Motor Design Ltd., United Kingdom; Motor Design Ltd., United Kingdom; Equipmake Ltd., United Kingdom

### Poster Session: Integrated Electric Drives, Diagnostics and Prognostics

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Alberto Bellini, Rangarajan Tallam

**P3301** *A Novel Label-Free Supervision Learning Method for Lithium-ion Battery RUL Prediction* [#20362]

Zhiwu Huang, Xu Zhou, Dianzhu Gao, Xiaoyong Zhang, Fu Jiang, Bin Chen, Yingze Yang, Mingjian Wu and Jun Peng, Central south university, China

**P3302** *Reliability Evaluation of DC-link Capacitors in Multi-drive Systems* [#19424]

Shili Huang, Haoran Wang, Dinesh Kumar, Guorong Zhu and Huai Wang, Wuhan University of Technology, China; Aalborg University, Denmark; Danfoss Drives A/S, Denmark

**P3303** *Real-time Bond Wire Lift-off Monitoring Via Module Integrated Current Sensors* [#20208]  
Minhao Sheng, Muhammad H. Alvi and Robert D. Lorenz, University of Wisconsin-Madison, WEMPEC, United States

**P3304** *3-D Point Magnetic Field Detection for Compact Current Sensing in Three-Phase Busbars and Cables* [#20202]  
Muhammad Alvi, Minhao Sheng, Robert Lorenz and Thomas Jahns, University of Wisconsin-Madison WEMPEC, United States

**P3305** *Fault-tolerant control of Dual Three-phase PMSM Drives fed by T-type Three-level Inverters* [#19611]  
Xueqing Wang, Zheng Wang, Pengcheng Liu and Ming Cheng, Southeast University, China

**P3306** *Analytical Method for Extraction of Stray Capacitance in Single-Layer CM Chokes* [#19081]  
Guangdong Dong, Fanghua Zhang, Yan Liu, Wuji Meng and Ce Xu, Nanjing University of Aeronautics & Astronautic, China

**P3307** *DC Bus Utilization Analysis with Bootstrap Based Power Supply* [#19757]  
Willy Sedano, Peizhong Yi, Brian Brown and Lixiang Wei, Intern Electrical Engineering, United States; Project Hardware Engineer, United States; SR.Hardware Development Engineer, United States; Principal Engineer, United States

**P3308** *Magnetic Model Identification for Synchronous Reluctance Motors Including Transients* [#20621]  
Ludovico Ortombina, Dario Pasqualotto, Fabio Tinazzi and Mauro Zigliotto, University of Padova, Italy

**P3309** *Back-to-back Starting of Large-capacity Synchronous Condenser with Virtual Synchronous Generator* [#19129]  
Liang Tao, Jianjun Sun, Qian Tao, Yibo Cui and Xiaoming Zha, Wuhan University, China; Hubei Electric Power Research Institute, China

**P3310** *DC-link Capacitor Reduction in Low Voltage and High Power Integrated Modular Motor Drives* [#19966]  
Andrew Hopkins, Bernhard Hopfensperger and Phil Mellor, University of Bristol, United Kingdom; OTH Regensburg, Germany

**P3311** *Power Routing to Enhance the Lifetime of Multiphase Drives* [#19877]  
Victor Ferreira, Rodrigo Bastos, Tamires Souza, Marco Liserre and Braz Cardoso, University of Kiel, Germany; Federal University of Minas Gerais, Brazil

**P3312** *Comparative Analysis of Static Eccentricity Faults of Double Stator Single Rotor Axial Flux Permanent Magnet Motors* [#20764]  
Md Tawhid Tarek, Shuvajit Das and Yilmaz Sozer, University of Akron, United States

### Poster Session: Advanced Power Devices, Modules and Gate Drives

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Jun Wang, Ahmed Elasser

**P3501** *Turn-off Period Improved Switching Model of SiC Devices with Stray Capacitances and Inductances* [#19977]  
Yue Xie, Yiyang Yan, Shaokang Luan, Cai Chen and Yong Kang, Huazhong University of Science and Technology, China

**P3502** *Voltage Balancing Control with Active Gate Driver for Series Connected SiC MOSFETs* [#20420]  
Inhwan Lee, Lu Yue and Xiu Yao, University at Buffalo, United States

**P3503** *A High Power Density Two-Stage GaN-Based Isolated Bi-Directional DC-DC Converter* [#19919]  
Shaokang Luan, Zongheng Wu, Zhiwei Wang, Xinmin Liu, Cai Chen and Yong Kang, Huazhong University of Science and Technology, China

**P3504** *Paralleling GaN switches for low voltage high current half-bridges* [#19621]  
Johannes Burkard and Juergen Biela, ETH Zurich, Switzerland

**P3505** *Si and GaN Devices in Quasi Resonant Flyback converters for Wall Charger Applications* [#19933]  
Giovanni Susinni, Giuseppe Mauromicale, Angelo Raciti, Santi Agatino Rizzo, Filadelfo Fusillo, Agatino Palermo, Rosario Scollo and Filippo Scrimizzi, University of Catania, Italy; STMicroelectronics, Italy

**P3506** *Review and Bandwidth Measurement of Coaxial Shunt Resistors for Wide-Bandgap Devices Dynamic Characterization* [#20382]  
Wen Zhang, Zheyu Zhang and Fred Wang, University of Tennessee, United States; Clemson University Restoration Institute, United States

**P3507** *Condition Monitoring the Forced Air Cooling System Using the Natural Frequency of Thermal Network* [#19255]  
Jun Zhang, Xiong Du, Rui Du and Pengju Sun, Chongqing University, China

**P3508** *Investigation of Performance Degradation in Power MOSFET under OFF-State Avalanche Breakdown Test* [#20233]

Chi Xu, Yang Fei, Bilal Akin and Yogesh Ramadass, The University of Texas at Dallas, United States; Texas Instruments, United States

**P3509** *Active Switching with SiC MOSFETs* [#20533]

Patrick Palmer, Jin Zhang and Edward Shelton, Simon Fraser University, Canada; University of Cambridge, United Kingdom

**P3510** *Design of Drive Parameters Considering Crosstalk Suppression in SiC MOSFETs Application* [#20472]

Shengsheng Liu, Hua Lin, Tao Wang and Chunhui Liu, Huazhong University of Science and Technology, China; Arizona State University, United States

**P3511** *High-isolation low-coupling-capacitance standalone gate drive power supply for SiC-based medium-voltage power electronic systems* [#20599]

Srdjan Srdic, Fei Teng and Srdjan Lukic, North Carolina State University, United States

**P3512** *Load Current and Temperature Dependent Optimization of Active Gate Driving Vectors* [#20642]

Toru Sai, Koutaro Miyazaki, Hidemine Obara, Tomoyuki Mannen, Keiji Wada, Ichiro Omura, Makoto Takamiya and Takayasu Sakurai, The University of Tokyo, Japan; Yokohama National University, Japan; Tokyo Metropolitan University, Japan; Kyushu Institute Technology, Japan

**P3513** *A Circuit for Testing dv/dt Immunity of Isolated Drivers and Current Sense Amplifiers* [#19711]

Tanya Gachovska, Gabriel Scarlatescu and Jerry Hudgins, Solantro Semiconductors Corp, Canada; University of Nebraska Lincoln, United States

**P3514** *Closed Loop dv/dt Control for Equal Voltage Sharing Between Series Connected SiC MOSFETs* [#19660]

Vaibhav Pawaskar and Ghanshyamsinh Gohil, The University of Texas at Dallas, United States

**P3515** *A Method to Contain the Temperature Rise of a Press Pack Thyristor during a Short Circuit Protection Operation* [#19849]

Erfan Bashar, Ruizhu Wu, Li Ran, Jose Ortiz Gonzalez, Arne Benjamin Renz, Guy Baker, Mike Jennings, Philip Mawby, Tim Green and Dan Rogers, University of Warwick, United Kingdom; Swansea University, United Kingdom; Imperial College London, United Kingdom; University of Oxford, United Kingdom

**P3516** *A Method to Minimize Junction Temperature Difference of Dies in Multichip Power Modules* [#19774]

Cheng Zhao, Laili Wang, Yunfei Xu, Fengtao Yang, Jianpeng Wang, Zhiyuan Qi and Zhizhao Niu, Xi'an Jiaotong University, China; State Key Laboratory of APTT Beijing 102209, China

**P3517** *Designing Power Modules for Degradation Sensing* [#19564]

Timothy Polom, Christoph van der Broeck, Rik De Doncker and Robert Lorenz, University of Wisconsin-Madison, United States; RWTH Aachen University, Germany; University of Wisconsin-Madison, United States

## Poster Session: Wireless Power Transfer 1

Tuesday, October 1, 10:30AM-12:10PM, Room: Exhibit Hall, Chair: Mohamed Badawy, Shuvajit Das

**P3701** *Multi-layer Non-uniform Series Self-resonant Coil for Wireless Power Transfer* [#19345]

Ruiyang Qin and Daniel Costinett, The University of Tennessee, United States

**P3702** *A 22 kW-85 kHz Three-phase Wireless Power Transfer System with 12 coils* [#20189]

Keisuke Kusaka, Rintaro Kusui, Jun-ichi Itoh, Daisuke Sato, Shuichi Obayashi and Masaaki Ishida, Nagaoka University of Technology, Japan; Nagaoka Motor Development Co., Ltd., Japan; Toshiba Corporation, Japan

**P3703** *An Optimal Driving Strategy for Maximum Electro-optical Conversion Efficiency of Laser Diode in Laser Power Transmission System* [#19131]

Siyu Feng, Ke Jin, Qi Hui and Li Wang, Nanjing University of Aero. and Astronautics, China

**P3704** *Analyzing Resonant Points of SLLD Circuit to Achieve MPPT for Capacitive-Coupling Wireless Power Transfer* [#20033]

Yashwanth Bezawada, Fu Ruiyun and Zhang Yucheng, Old Dominion University, United States; Mercer University, United States

**P3705** *Efficiency Optimization of Series/Series-Parallel IPT System with Load-Independent Output Voltage and Zero Input Phase Angle* [#19175]  
Zhicong Huang, Zhijian Fang, Chi-Seng Lam, Pui-In Mak and Rui Paulo Martins, University of Macau, Macau; China University of Geosciences (Wuhan), China

**P3706** *A New Bi-directional Wireless EV Charging Controller Tolerant to Large Pad Misalignments* [#19707]  
Yeran Liu, Udaya Madawala, Ruikun Mai and Zhengyou He, Southwest Jiaotong University, China; University of Auckland, New Zealand

**P3707** *Double-side Phase Shift Control for Impedance Matching in Wireless High Power Transfer* [#20010]  
Yongbin Jiang, Min Wu, Zexian Zeng, Jing Sun, Yonghui Liu, Laili Wang and Yue Wang, Xi'an Jiaotong University, China

**P3708** *General Analysis of LC Resonance Principles for Inductive Power Transfer Systems* [#19416]  
Yang Chen, Naijian Yang, Qiao Li, Ruimin Dai, Zhengyou He and Ruikun Mai, Southwest Jiaotong University, China

### Special Session: Empower Billion Lives

Tuesday, October 1, 10:30AM-12:10PM, Room: 328, Chair: Deepak Divan, Szilard Liptak

## Tuesday, October 1, 2:00PM-3:40PM

### Poster Session: Solar Energy Systems

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Ahmed Elasser, Yongheng Yang

**P3901** *A Novel Solar Harvesting Wireless Sensor Node with Energy Management System: Design & Implementation* [#19104]  
Jordan Henry, Dhimiter Qendri, Mohamed Youssef and Rudy Lang, University of Ontario Institute of Technology, Canada

**P3902** *A Study of Partially-Shaded PV Modules with Overlapping Diodes* [#19119]  
Zaid Alqaisi and Yousef Mahmoud, Student, United States; Professor, United States

**P3903** *A CMOS-Based Energy Harvesting Approach for Laterally-Arrayed Multi-Bandgap Concentrated Photovoltaic Systems* [#19126]  
Haoquan Zhang, Konstantin Martynov, Duanhui Li and David J. Perreault, Massachusetts Institute of Technology, United States; Analog Devices Inc., United States

**P3904** *Direct Frequency Control Based MPPT Algorithm of LLC Resonant Converter for Photovoltaic System* [#19154]  
Yizhan Zhuang, Fei Liu, Xiangjing Zhang, Xiaoguang Diao, Jianbo Jiang and Jianjun Sun, Wuhan University, China

**P3905** *Distributed Maximum Power Point Tracking Control under Sudden Partial Shade Using an Isolated Modular Boost Converter for Automotive Application* [#19165]  
Yusuke Zushi, Yoshiyuki Nagai, Tsutomu Tanimoto and Yosuke Tomita, Nissan Motor Co., Ltd., Japan

**P3906** *Updated Electrochemical Model of Micro Photosynthetic Power Cells* [#19250]  
Tamanwe Payarou, Pragasen Pillay and Muthukumaran Packirisamy, Concordia University, Canada

**P3907** *Grid Integration of a Three Phase Multifunctional SECS Using Lorentzian Adaptive Filter Based Control with Impulsive Disturbance Rejection Capability* [#19391]  
Syed Bilal Qaiser Naqvi, Shailendra Kumar, Bhim Singh and Yashi Singh, Indian Institute of Technology Delhi, India

**P3908** *Analysis of solar panel's lumped equivalent circuit parameters using LASSO* [#19731]  
Martin Garaj, Shu-hung Henry Chung, Alan Wai-lun Lo and Huai Wang, City University of Hong Kong, Hong Kong; Chu Hai College of Higher Education, Hong Kong; Aalborg University, Denmark

**P3909** *An Integrated PV-Battery Soft-switched Power Converter with MPPT and Voltage Regulation* [#20330]  
Sanjida Moury and John Lam, York University, Canada

**P3910** *Dimension and Mechanical Structure Design of Low-Cost Heliostats in Concentrated Solar Power Plants* [#20685]

Shen Zhang, Abdulaziz M. Qwbaiban, Jeongmin Huh and Thomas G. Habetler, Georgia Institute of Technology, United States

**P3911** *Differential Power Processing Architecture with Virtual Port in Series and MPPT in Submodule Level* [#19335]

Lyuyi Lin, Junming Zhang and Yan Deng, Zhejiang University, China

### Poster Session: Power and Energy Management for Smart Grids

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Christina DiMarino, Jin Ye

**P4101** *Event-Triggered based Distributed Secondary Control for Islanded AC Microgrids Considering Unreliable Communications* [#19636]

Meng Xiaoxiao, Zhou Niancheng, Wang Qianggang and Liao Jianquan, Chongqing University, China

**P4102** *Multi-Agent System-based Distributed Energy Management in Smart Grid Under Uncertainty* [#19271]

Md Habib Ullah, Anas Alseyat and Jae-Do Park, University of Colorado Denver, United States

**P4103** *Distributed Event-Driven Power Sharing Control for CCVSI-Based Distributed Generators in AC Islanded Microgrids* [#19282]

Jingang Lai, Xiaoqing Lu, Antonello Monti and Rik W. De Doncker, RWTH Aachen University, Germany; Wuhan University, China

**P4104** *Optimal WT, PV and BES based Energy Systems for Standalone Households in South Australia* [#19512]

Rahmat Khezri, Amin Mahmoudi and Mohammed Haque, Flinders University, Australia; University of South Australia, Australia

**P4105** *Optimal Capacity of PV and BES for Grid-connected Households in South Australia* [#19511]

Rahmat Khezri, Amin Mahmoudi and Mohammed Haque, Flinders University, Australia; University of South Australia, Australia

**P4106** *An Advanced Framework for Electric Vehicles Interaction with Distribution Grids Based on Q-Learning* [#20527]

Qiyun Dang, Di Wu and Benoit Boulet, McGill University, Canada

**P4107** *Networked Control and Optimization for Widescale Integration of Power Electronic Devices in Residential Homes* [#20139]

Michael Starke, Mahdu Chinthavali, Chris Winstead, Zeng Sheng, Teja Kuruganti, Steven Campbell, Rong Zeng, Xue Yaosuo and Chuck Thomas, Oak Ridge National Lab, United States; Electric Power Research Institute, United States

**P4108** *Generalized Energy Storage Configuration Method Based on Bi-level Optimization for Distribution Power System with High Penetration of Renewable Energy* [#20465]

Meiqin Mao, Xun Jiang, Yunhui Liu, Liuchen Chang and Yangyang Wang, Hefei University of Technology, China

**P4109** *Secondary Control for DC Microgrids with Optimal Sparse Feedback* [#20482]

Jianzhe Liu, Xiaonan Lu and Chen Chen, Argonne National Laboratory, United States; Temple University, United States

**P4110** *High-Performance Adaptive Control for Inverter-Based Residential Microgrids* [#19529]

Cheng Wang and Liqun He, Nanjing University of Science and Technology, China; Soochow University, China

### Poster Session: Electric Propulsion & Other E-transportation Applications

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Tausif Husain, Mohammad Islam

**P4301** *A Stabilization Method of the Current Controller in the Over-modulation Region for NEV Traction Motor* [#19428]

Sang Min Kim, Hyundai Mobis, Korea (South)

**P4302** *Performance of a Hybrid Powertrain Employing a Magnetic Power Split Device* [#19565]

Khoa Dang Hoang, Kais Atallah, Milijana Odavic, Jeff Birchall and Stuart Calverley, The University of Sheffield, Sheffield, United Kingdom; Magnomatics Limited, Sheffield, United Kingdom

**P4303** *Design of Multi-layer IPMSM using Ferrite PM Considering Mechanical and Electrical Characteristics* [#19841]

Young-Hoon Jung, Ki-O Kim and Jung-Pyo Hong, Hanyang University, Korea (South)

**P4304** *A Temperature-Suppression Power Allocation Strategy for Hybrid Energy Management of EVs* [#19955]

Zhiwu Huang, Yinhui Le, Hongtao Liao, Yanhui Zhou, Yue Wu, Heng Li, Shuo Li, Xianqi Lu and Jun Peng, Central south university, China; Central South University, China; Changsha University of Science & Technology, China

**P4305** *Suppressing gate voltage oscillation in paralleled SiC MOSFETs for HEV/EV traction inverter application* [#19071]

Fan Xu and Lihua Chen, Ford Motor Company, United States

### Poster Session: AC-AC and Multilevel Power Converters

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Lixiang Wei, Stefano Bifaretti

**P4501** *A Novel Space Vector Overmodulation Strategy Based on the Rectifier Stage for Indirect Matrix Converter* [#19289]

Zhaoyang Jin, Shanhu Li, Wensheng Wang, Xu Liu, Yiping Liu and Bingnan Ji, Hebei University of Technology, China; Tianjin Power Street Light Management Department, China; Zhengzhou Yutong Bus. CO.,LTD, China

**P4502** *A Predictive-Control-Based Over-Modulation Method for Third-Harmonic Injection Two-Stage Matrix Converter* [#19554]

Xida Chen, Hui Wang, Yao Sun, Mei Su and Wenjing Xiong, Central South University, China

**P4503** *A Single-Phase Hybrid Six-Leg AC-DC-AC Multilevel Converter* [#19655]

Andre Elias Lucena Costa, Cursino Brandao Jacobina and Nady Rocha, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil

**P4504** *A Single-Phase AC-DC-AC Five-leg Multilevel Converter* [#19656]

Andre Elias Lucena Costa, Cursino Brandao Jacobina, Nady Rocha and Phelipe Leal Serafim Rodrigues, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil

**P4505** *Three-Phase Hybrid AC-DC-AC Voltage/Current Source Converter for Wind Energy Conversion Systems* [#20090]

Nayara Santos, Mauricio Correa, Montie Vitorino and Louelson Costa, Federal University of Campina Grande, Brazil

**P4506** *Expand Output Voltage Range of AC/AC Converter Using Reversible Indirect Matrix Converter (R-IMC)* [#20236]

Kodai Okuzono, Sho Tomita and Hitoshi Haga, Nagaoka University of Technology, Japan

**P4507** *Three-Phase Four-Wire AC-DC-AC Converter With Shared Legs* [#20576]

Alan Felinto, Cursino Jacobina, Edgard Fabricio and Lacerda Rodrigo, Federal University of Campina Grande, Brazil; Federal Institute of Paraiba, Brazil

**P4508** *New Two-to-Three-Phase AC-AC Indirect Matrix Converter with Open-end Rectifier Stage* [#20636]

Andre Ramalho, Montie Vitorino, Mauricio Correa and Edgar Braga-Filho, Federal University of Campina Grande, Brazil

**P4509** *A Dual Mode 5-Level Inverter with Wide Input Voltage Range* [#19786]

Yam Siwakoti, Teng Long, Reza Barzegarkhoo and Frede Blaabjerg, University of Technology Sydney, Australia; University of Cambridge, United Kingdom; Aalborg University, Denmark

**P4510** *Cascaded Multilevel Rectifiers with Reduced Number of Controlled Switches for Open-End Winding PMSM* [#20059]

Amanda Pereira Monteiro, Cursino Brandao Jacobina, Filipe Antonio Da Costa Bahia and Reuben Palmer Rezende de Sousa, Federal University of Campina Grande, Brazil

**P4511** *A novel Three Phase Multilevel Inverter Topology with Reduced Device Count for Open End Winding Motor Drives* [#20221]

Salvatore Foti, Antonio Testa, Giacomo Scelba, Tommaso Scimone, Salvatore De Caro, Luigi Danilo Tornello and Giuseppe Scarcella, University of Messina, Italy; University of Catania, Italy

**P4512** *Novel Active Nested Neutral-Point Piloted Nine-level Converter* [#20568]

Ahmed Hussein and Amer Ghias, Nanyang Technological University, Singapore



**P4513** *Comparison of PIR and MPC Control Schemes to Reduce Circulating Currents in a Modular Multilevel Converter Terminal* [#20259]

Ana Julieth Marin-Hurtado, Walter Julian Gil-Gonzalez, Andres Escobar-Mejia and Cheng Deng, Universidad Tecnologica de Pereira, Colombia; Xiangtan University, China

**P4514** *A New DC Fault Blocking Capability Technique for Modular Multilevel Converters* [#19450]

Iman Aghabali and Mehdi Narimani, McMaster University, Canada

**P4515** *A New 7-Level Voltage Source Converter for Medium-Voltage Application* [#19498]

Niloufar Keshmiri and Mehdi Narimani, McMaster University, Canada

## Poster Session: Converter Modeling, Control and Design 2

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Meiqin Mao, Raja Ayyanar

**P4701** *Multifrequency Impedance Model for Parallel Single-phase Grid-connected Parallel Inverters for Analysis on Circulating Resonant Current* [#19928]

Miao Liu, Qi Wei, Shaojun Xie, Qiang Qian, Xu Jinming and Zhang Zhao, Nanjing University of Aeronautics and Astronauts, China

**P4702** *Common Mode Voltage Reduction of Single-Phase Quasi-Z-Source Inverter Based Photovoltaic System* [#19851]

Yushan Liu, Yaosuo Xue and Hexu Sun, Beihang University, China; Oak Ridge National Laboratory, United States; Hebei University of Technology, China

**P4703** *Quasi-Two-Level Flying-Capacitor-Converter for Medium Voltage Grid Applications* [#19993]

Stefan Mersche, Daniel Bernet and Marc Hiller, Karlsruher Institut fuer Technologie, Germany

**P4704** *Parameter Optimization Based on the Minimum Peak Current Curve for LCC Resonant Converters Operating in DCM* [#19779]

Zhigang Chen, Jun Liu, Shengwen Fan, Chaonan Tong and Shuo Liu, University of Science and Technology Beijing, China; North China University of Technology, China

**P4705** *Digital Interleaving Control for Two-Phase TCM GaN Totem-Pole PFC to Reduce Current Distortion* [#19740]

Qingxuan Ma, Qingyun Huang, Ruiyang Yu, Tianxiang Chen and Alex Huang, University of Texas at Austin, United States

**P4706** *Average Modeling of Active Neutral Point Clamped Inverter* [#19866]

Jagath Vallabhai Missula, Ravindranath Adda and Praveen Tripathy, IIT Guwahati, India

**P4707** *A Lifetime-Aware Control Strategy for Parallel Charging Systems of Energy Storage Light Rail* [#19944]

Yongjie Liu, Zhiwu Huang, Hongtao Liao, Heng Li, Yue Wu, Yanhui Zhou, Fu Jiang and Jun Peng, Central south university, China

**P4708** *Auto-tuned Model Parameters in Predictive Control of Power Electronics Converters* [#20485]

Mitchell Easley, Amin Yousefzadeh Fard, Fariba Fateh, Mohammad B Shadmand and Haitham Abu-Rub, Kansas State University, United States; Texas A and M University at Qatar, Qatar

**P4709** *Switching Transient Analysis of SiC MOSFET based MMC Motor Drive Systems* [#20529]

Xiao Li, Yue Zhang, Ziwei Ke, Jianyu Pan, Niu Jia, Risha Na, Longya Xu and Jin Wang, The Ohio State University, United States

**P4710** *Control Strategies For Parallel Connected IGBT Modules* [#20241]

Tianqi Zhang, Patrick Palmer, Edward Shelton, Xueqiang Zhang and Teng Long, University of Cambridge, United Kingdom; Simon Fraser University, Canada

**P4711** *Reachability Analysis of Dual Active Bridge DC - DC Converters* [#19971]

Heqiang Wang, Zefan Tang, Yan Li and Peng Zhang, University of Connecticut, United States

**P4712** *Real-time Identification Method for LCL Filters Used With Grid Converters* [#19393]

Ville Pirsto, Jarno Kukkola, F. M. Mahafugur Rahman and Marko Hinkkanen, Aalto University, Finland

**P4713** *Impacts of Switched-Diode Capacitor Stages on the Flying Capacitor Multilevel Flyback Converter* [#19227]

Santino Graziani and Brandon Grainger, University of Pittsburgh, United States

**P4714** *Interactions of Capacitor Voltage Ripple with the Circulating Current and Output Current Controllers in Low-Capacitance Modular Multilevel Converters* [#19322]

Sumeet Singh Thakur, Milijana Odavic and Zhu Zi-Qiang, University of Sheffield, United Kingdom

**P4715** *Modelling of Bidirectional CLLC Resonant Converter Operating under Frequency Modulation* [#19229]

Lais Farias Martins, David Andrew Stone and Martin Paul Foster, University of Sheffield, England

**P4716** *A Model Predictive Control Scheme Formulation for Active Rectifiers with LCL Filter* [#20596]

Joseph Benzaquen, Aswad Adib, Fariba Fateh and Behrooz Mirafzal, Kansas State University, United States

**P4717** *An approach to increase the bandwidth of current controllers for grid-tied converters with LCL filter* [#19965]

Marcos Assuncao, Luiz Ribeiro, Jose Matos and Francisco Freijedo, UFMA/Brazil, Brazil; Ecole Polytechnique Federale de Lausanne, Switzerland

**P4718** *Deep Learning Neural Networks for Heat-Flux Health Condition Monitoring Method of Multi-Device Power Electronics System* [#20122]

Borong Hu, Zedong Hu, Li Ran, Phil Mawby, Chunjiang Jia, Chong Ng and Paul McKeever, University of Warwick, United Kingdom; Offshore Renewable Energy Catapult, United Kingdom

**P4719** *Leakage Current Mitigation in Current-Source Converter based Transformerless Photovoltaic System using Optimized Space Vector Modulation* [#20264]

Hang Gao, Shuai Wang, Dewei Xu, Bin Wu and Navid R. Zargari, Ryerson University, Canada; Rockwell Automation Canada, Canada

**P4720** *Dealing with Sub-optimality in Multistep Model Predictive Control for Transient Operations* [#20430]

Roky Baidya, Ricardo Aguilera, Pablo Acuna, Petros Karamanakos, Tobias Geyer, Christian Rojas Monroy and Dylan Lu, Chittagong University of Eng & Technology, Bangladesh; University of Technology Sydney, Australia; RMIT University, Australia; Tampere University of Technology, Finland; ABB Corporate Research, Switzerland; Universidad Tecnica Federico Santa Maria, Chile

### Poster Session: Transportation, Application, NVH and Diagnosis of Electrical Machines

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Pinjia Zhang, Grant Pitel

**P4901** *Asymmetrical Design in Electrical Machines* [#19369]

Xikai Sun, Gennadi Sizov and Mike Melfi, Rockwell Automation, China; Rockwell Automation, United States

**P4902** *Visualization of Multi-Objective Switched Reluctance Machine Optimization under Multiple Operating Conditions with t-SNE* [#20579]

Shen Zhang, Shibo Zhang, Sufei Li, Liang Du and Thomas G. Habetler, Georgia Institute of Technology, United States; Northwestern University, United States; Ansys Inc., United States; Temple University, United States

**P4903** *Partitioned Stator- Flux Switching Machine Utilizing Different Magnet Grades* [#20689]

Ali Al-Qarni and Ayman EL-Refaie, Marquette University, United States

**P4904** *MTPA Control Strategy for Six-phase DC-biased Hybrid Excitation Vernier Reluctance Machines* [#19178]

Zhiyue Yu, Huida Gao, Liang Chang, Wubin Kong, Chun Gan and Ronghai Qu, Huazhong University of Science and Technology, China

**P4905** *Design and Evaluation of Single-Layer Dual-Stator 6/4 FSPM Machine with Toroidal Winding* [#20299]

Mingda Liu, William Sixel, Yingjie Li, Jagadeesh Tangudu, Vladimir Blasko and Bulent Sarioglu, University of Wisconsin-Madison, United States; United Technology Research Center, United States

**P4906** *CFD Based Design of an Impeller for a Novel Integrated Motor-Compressor System* [#20757]

Abdul Wahab Bandarkar, Yilmaz Sozer and J. Alex De Abreu-Garcia, University of Akron, United States

**P4907** *Carrier Electromagnetic Vibration of DC Voltage Difference in Permanent Magnet Synchronous Motor with Distributed Winding* [#19035]

Takafumi Hara, Toshiyuki Ajima, Katsuhiko Hoshino and Akihiro Ashida, Hitachi, Ltd., Japan; Hitachi Automotive Systems Ltd., Japan

**P4908** *Lifetime of Machines Undergoing Thermal Cycling Stress* [#19203]

Antonio Griffio, Igor Tsyokhla and Jiabin Wang, The University of Sheffield, United Kingdom; Sphere Fluidics, United Kingdom

**P4909** *Comparative Study of Electromagnetic Force Characteristics of Flux Reversal PM Machines with Asymmetrical and Symmetrical Stators* [#19211]  
Wei Liu, Hui Yang, Heyun Lin, Shukang Lyu and Ya Li, Southeast University, China

**P4910** *A Comprehensive Analysis of the Acoustic Noise in an Interior Permanent Magnet Traction Motor* [#19233]  
Jianbin Liang, Yihui Li, Christopher Mak, Berker Bilgin, Dhafar Al-Ani and Ali Emadi, McMaster University, Canada

**P4911** *The Influence of Flux-Barriers Distribution on Vibrations in Synchronous Reluctance Machine* [#19342]  
Emanuel Castagnaro and Nicola Bianchi, University of Padova, Italy

**P4912** *A novel monitoring technique using common-mode voltages for the transformer energized by VSCs* [#19491]  
Geye Lu and Pinjia Zhang, Tsinghua University, China

**P4913** *Misalignment and rotor fault severity indicators based on the transient DWT analysis of stray flux signals* [#19547]  
Pedro A. Pastor-Osorio, Jose Antonino-Daviu and Alfredo Quijano-Lopez, Universitat Politecnica de Valencia, Spain

**P4914** *Vibration Analysis of Internal Permanent Magnet Synchronous Machines Under Asymmetric Three-Phase Current Condition* [#19958]  
Guo Jiaxiong, Fang Haiyang, Li Dawei, Qu Ronghai, Xu Yunsong, Pei Tonghai and Zhao Yu, Huazhong University of Science and Technology, China

**P4915** *Rotor UMP & Mechanical Response in HSPMSM in Typical Running Conditions* [#20041]  
Yu-Ling He, Gaurang Vakil, Xiao-Chen Zhang, Peng Gao, David Gerada and Chris Gerada, North China Electric Power University, China; University of Nottingham, United Kingdom; Tianjin University, China

**P4916** *Bearing Fault Detection Using Low-Frequency Total Components in phase current* [#20061]  
Jun-Hyuk Im, Jun-Kyu Park and Jin Hur, Incheon National University, Korea (South); University of Padova, Italy

**P4917** *Flexibility of Remediation Methods for Winding Open Circuit Faults in a Multiphase PM Machine Considering Iron Losses Minimization* [#20155]  
Fan Wu and Ayman EL-Refaie, Marquette University, United States

**P4918** *Robust Inter-turn Short-circuit Detection in PMSMs with Respect to Current Controller Bandwidth* [#20200]  
Shaopo Huang, Elias G. Strangas, Anmol Aggarwal, Kui Li and Feng Niu, Hebei University of Technology, China; Michigan State of University, United States

**P4919** *A Multi-sensor Fusion Scheme for Broken Rotor Bar and Air-gap Eccentricity Detection of Induction Machines* [#20477]  
Genyi Luo, Thomas Habetler and Jed Hurwitz, Georgia Institute of Technology, United States; Analog Devices, United Kingdom

**P4920** *Fault Diagnosis and Isolation of an Electro-Pump using Neural Data Fusion* [#20592]  
Saeid Jorkesh, Javad Poshtan and Majid Poshtan, IUST, Iran; California Polytechnic State University(Calpoly), United States

**P4921** *Design and Experimental Validation of a Delta Connected 36-Slot 28-Pole Permanent Magnet Machine for Hybrid Traction Applications* [#19009]  
Boris Dotz and Dieter Gerling, Valeo Siemens eAutomotive Germany GmbH, Germany; Universitaet der Bundeswehr Muenchen, Germany

**P4922** *A Copper Rotor Induction Motor Solution for Electrical Vehicles Traction System* [#19065]  
Mircea Popescu, Nicolas Riviere, Marco Villani, Giuseppe Fabri, Lino Di Leonardo and Giuseppe Volpe, Motor Design Ltd., United Kingdom; University of Aquila, Italy; Motor Design Ltd., United Kingdom

**P4923** *Comparison of Bar-Wound Windings Permanent Magnet Machine with Different Cross-Sectional Shape for Hybrid Electric Vehicle* [#19152]  
Yu Zhao, Dawei Li, Tonghao Pei, Jiaxiong Guo and Ronghai Qu, Huazhong University of Science & Technology, China

**P4924** *Improvement of Field-Weakening Performance of IPM Machines with Salient Pole Shoe Rotors* [#19364]  
Nan Zhao and Nigel Schofield, University College Dublin, Ireland; University of Huddersfield, United Kingdom

**P4925** *Electro-Mechanical Challenges in the Design of a High-Speed-High-Power-PMSM Rotor for an Aerospace Application* [#19423]  
Nicola Chiodetto, Barrie Mecrow, Rafal Wrobel and Timothy Lisle, Newcastle University, United Kingdom; Newcastle University, United Kingdom

**P4926** *Performance comparison of Rare earth and Non-Rare Earth based SPM machines with High Silicon Steel* [#20174]

Zhentao Stephen Du and Jagadeesh K. Tangudu, United Technologies Research Center, United States

**P4927** *Modeling, Design and Control of Wound-Field Synchronous Motor for High Energy Efficiency of Electric Vehicle* [#20188]

Min-Ro Park, Dong-Min Kim, Young-Hoon Jung, Myung-Seop Lim and Jung-Pyo Hong, Hanyang University, Korea, Republic of; Yeungnam University, Korea, Republic of

**P4928** *Non-Dominated Sorting Genetic Algorithm Based Investigation of Optimal Odd Slot Numbers for Stator Shifted Fractional-Slot Wound PMSMs* [#20537]

Shruthi Mukundan, Himavarsha Dhulipati, Eshaan Ghosh, Guodong Feng, Jimi Tjong and Narayan Kar, University of Windsor, Canada

**P4929** *Rotor configuration comparison for the design of a PM conical machine* [#20606]

Sara Roggia, Gaetano Roggia, Francesco Cupertino and Galea Michael, SAFRAN Tech, France; IDIADA, Spain; Politecnico di Bari, Italy; University of Nottingham, United Kingdom

### Poster Session: Integrated Electric Drives and Control

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Fernando Briz, Mahesh Swamy

**P5101** *Silicon Carbide JFET Super-Cascodes for Normally-On Current Source Inverter Switches in Medium Voltage Variable Speed Electrostatic Drives* [#19681]

Peter Killeen, Aditya N. Ghule and Daniel C. Ludois, University of Wisconsin - Madison, United States

**P5102** *High Temperature Design of a GaN Based Modular Integrated Drive with Natural Cooling Using Metal Clad PCBs* [#20379]

Yousef Abdullah, Xiao Li, Ke Wang, Jin Wang, Liming Liu and Sandeep Bala, The Ohio State University, United States; ABB, United States

**P5103** *The Optimal Direct Torque Control Strategy for Open-Winding Permanent Magnet Synchronous Motor in Variable DC Voltage Conditions* [#19865]

Wenjie Tao, Jiadan Wei, Jianhao Ji, Zhuoran Zhang and Xianghao Kong, Nanjing University of Aeronautics and Astronauts, China

**P5104** *Analytical Formulation of a Maximum Torque per Ampere (MTPA) Technique for SynRMs Considering the Magnetic Saturation* [#19213]

Angelo Accetta, Maurizio Cirrincione, Maria Carmela Di Piazza, Giuseppe La Tona, Massimiliano Luna and Marcello Pucci, INM-CNR, Italy; University of the South Pacific (USP), Fiji

**P4930** *Design of a Highly Integrated Electric-Hydraulic Machine for Electrifying Off-Highway Vehicles* [#20760]

Fnu Nishanth, Garrett Bohach, James Van de Ven and Eric Severson, University of Wisconsin - Madison, United States; University of Minnesota - Twin Cities, United States

**P4931** *Finite Element Simulation based method for Design and Optimization of Flux Switching Motor for EV/HEV Traction Application* [#20717]

Krishan Kant, Lakshmi Varaha Iyer, James Kirtley and Gerd Schlager, Massachusetts Institute of Technology, United States; Magna International Inc., United States

**P4932** *Motor Trends: Effects of Era, Age, and Maintenance on Failure Rates* [#19432]

Andrew Stringer, Christopher Thompson and Carolina Barriga, U.S. Army Corps of Engineers, United States

**P5105** *A Generalized Self-Sensing Method for Induction Machines Based on Vector Tracking Using Deadbeat-Direct Torque and Flux Control* [#20180]

Yang Xu, Chikara Morito and Robert Lorenz, University of Wisconsin-Madison, United States; Toshiba Mitsubishi-Electric Industrial Sys Corp, Japan

**P5106** *Sliding Mode Speed Estimators for the Induction Motor - a Performance Comparison at Low Speed* [#19582]

Mihai Comanescu, Penn State Altoona, United States

**P5107** *A Real-time sinusoidal voltage-adjustment power supply based on wide-band-gap devices for linear power amplifier* [#19323]

Xiaofeng Ding and Jiawei Cheng, Beihang University, China

**P5108** *Comprehensive Analysis of Extended Electro Motive Force Observers for Position Estimation in Interior Permanent Magnet Synchronous Machines* [#20088]

Abdelrahman Elsmann, Fabio Giulii Capponi and Federico Caricchi, University of Roma "La Sapienza", Italy

**P5109** *SiC Inverter for Electric Vehicles with Improved Trade-off between Reduced Switching Losses and Increased Radiation Noise* [#19828]

Emori Kenta, Jumpei Niida, Takuya Hara, Akinori Okubo, Keiichiro Numakura and Tetsuya Hayashi, NISSAN Motor Co., Ltd., Japan; Nissan Motor Co., Ltd., Japan

**P5110** *Design of a SiC-based 5-Level Stacked Multicell Converter for High Speed Motor Drives* [#20494]

Jianghui Yu, Rolando Burgos, Qiong Wang and Ismail Agirman, CPES, Virginia Tech, United States; CPES, Virginia Tech, United States; United Technologies Corporation, United States

**P5111** *Adaptive H-Infinity-Based Variable Structure Control for Permanent-Magnet Synchronous Motor-Driven Uncertain Linear Stage via Self-Learning Recurrent*

*Fuzzy-Wavelet-Neural-Network* [#20355]

Fayez EL-Sousy, Mahmoud Amin and Osama Mohammed, Prince Sattam bin Abdulaziz University, Saudi Arabia; Manhattan College, United States; Florida International University, United States

**P5112** *Improved Self-Sensing Estimation Accuracy and System Bandwidth via Negative Sequence Image Tracking* [#20439]

Timothy Slininger, Huthaifa Flieh, Chien Shao-Chuan, Li-Hsing Ku and Robert Lorenz, WEMPEC - University of Wisconsin - Madison, United States; Motor Drive Solution BU, Delta Electronics, Inc, Taiwan

**P5113** *Model Predictive Speed Control with Dynamic Reference for Electric Drive of Permanent Magnet Synchronous Machine* [#20081]

Luocheng Wang, Tao Han and Tiefu Zhao, University of North Carolina at Charlotte, United States

**P5114** *Phase Delay Analysis of Current Sampling in Inverter-Fed Induction Machines* [#19148]

Lei Jin, Haihui Lu, Zhendong Zhang and Timothy Rowan, Rockwell Automation, Inc., China; Rockwell Automation, Inc., United States

## Poster Session: Material, Passive Devices and Packaging

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Fang Luo, Cai Chen

**P5301** *Industrial 650V 4-Pack Super-Junction MOSFET Module using Transfer Molding Process* [#20352]

Jangmuk Lim, Jihwan Seong, Sang Won Yoon, You Suk Kim, Hun-chang Im and Won Sik Hong, Hanyang University, Korea (South); IA powertron, Korea (South); Korea Electronics Technology Institute(KETI), Korea (South)

**P5302** *Loss Prediction of Medium Voltage Power Modules: Trade-offs between Accuracy and Complexity* [#19927]

Jannick Kjaer Jorgensen, Nicklas Christensen, Dipen Narendra Dalal, Asger Bjorn Jorgensen, Hongbo Zhao, Stig Munk-Nielsen and Christian Uhrenfeldt, Aalborg University, Denmark

**P5303** *GaN Module Design Recommendations Based on the Analysis of a Commercial 3-Phase GaN Module* [#20112]

John Brothers and Troy Beechner, Mainstream Engineering Corporation, United States

**P5304** *Accurate Characterization and Emulation of Active Bridge Magnetic Efficiencies with Novel Excitation Circuit* [#19340]

Richard Beddingfield, Subhashish Bhattacharya and Paul Ohodnicki, Jr., ORISE Fellow, National Energy Technology Lab, United States; North Carolina State University, United States; National Energy Technology Lab, United States

**P5305** *Comparative Analysis of Magnetic Core Loss Measurement Methods with Arbitrary Excitations* [#19405]

Zhedong Ma, Juntao Yao, Yiming Li and Shuo Wang, University of Florida, United States

**P5306** *Filter Design for AFE Rectifier using SiC MOSFET* [#19379]

Xikai Sun and Lixiang Wei, Rockwell Automation, China; Rockwell Automation, United States

**P5307** *Investigation of Design Methodology of Planar Transformers for EV On Board Chargers* [#19573]

Zhengda Zhang, Chunhui Liu, Yunpeng Si, Yifu Liu, Qin Lei and Sheng Ai, Arizona State University, United States; Huanzhong University of Science and Technology, China

**P5308** *Novel PCB Integrated Magnetic Component Design for Reduced AC Power Losses [#20540]*  
Gennadi Sizov, Zoran Vrankovic and Gary Skibinski, Rockwell Automation, United States

**P5309** *Shielding of Leakage Flux Induced Losses in High Power, Medium Frequency Transformers [#19338]*  
Richard Beddingfield, Subhashish Bhattacharya and Paul Ohodnicki, Jr., ORISE Fellow, National Energy Technology Lab, United States; North Carolina State University, United States; National Energy Technology Lab, United States

**P5310** *Electrical Insulation Packaging for a 20 kV High Density Wide Bandgap Power Module [#20504]*  
Maryam Mesgarpour Tousi and Mona Ghassemi, Virginia Tech, United States

**P5311** *50kW Nano-Crystalline Core Based Three Port Transformer for Triple Active Bridge Converter [#20659]*  
Ritwik Chattopadhyay, Srinivas Guler, Viju Nair, Subhashish Bhattacharya and Paul R. Ohodnicki, NC State University, United States; National Energy Technology Laboratory, United States

**P5312** *Lifetime Estimation of DC-Link Electrolytic Capacitor for Smart Transformer LV Side Inverter [#19956]*  
Rongwu Zhu and Marco Liserre, Kiel University, Germany

**P5313** *A High Power Density Thermal Management Approach Using Multi-PCB Distributed Cooling (MPDC) Structure [#20673]*  
Wenbo Liu, Andrew Yurek, Yang Chen, Bo Sheng, Xiang Zhou and Yan-Fei Liu, Queen's University, Canada

**P5314** *A Novel Digital Active Gate Driver For High-Power IGBT To Reduce Switching Losses And Stresses [#19723]*  
Yatao Ling, Zhengming Zhao and Yicheng Zhu, Tsinghua University, Beijing, China, China

### Poster Session: Wireless Power Transfer 2

Tuesday, October 1, 2:00PM-3:40PM, Room: Exhibit Hall, Chair: Choi Uimin, Okan Boler

**P5501** *Design of a Downscaled Dynamic Wireless EV Charging System for Traffic Intersection Application [#20186]*  
Qingwei Zhu, Yanjie Guo, Lifang Wang and Chenglin Liao, The University of Manchester, United Kingdom; Institute of Electrical Engineering, China

**P5502** *Induction Application to Aircraft Ice Protection System [#20692]*  
Irma Villar, Ugaitz Iruretagoyena, Ana Cardenas and Francisco Redondo, IKERLAN, Spain; AIRBUS D&S, Spain

**P5503** *A Novel Self-adaptive Wireless Power Transfer System to Cancel the Reactance of the Series Resonant Tank and Deliver More Power [#19367]*  
Lixin Shi, Pedro Alou, Jesus A. Oliver and Jose A. Cobos, Universidad Politecnica de Madrid, Spain

**P5504** *Impacts of the Detuning of Compensation Inductances to the Performance of a Double-Sided LC-Compensated CPT System [#19420]*  
Hua Zhang, Chong Zhu and Fei Lu, Drexel University, United States; Shanghai Jiao Tong University, China

**P5505** *Load Estimation of A Series-Series Tuned Wireless Power Transfer System [#19818]*  
Sangmin Lee, Jaehong Lee, Eunhong Noh, Tae-Ik Gil and Seung-Hwan Lee, University of Seoul, Korea (South)

**P5506** *The High Order Harmonic Distortion Phenomenon in the Strongly Coupled IPT System and Its Reduction Method [#19108]*  
Hua Zhang, Yao Wang, Chong Zhu, Ying Mei, Teng Xu and Fei Lu, Drexel University, United States; Shanghai Jiao Tong University, China; Zhejiang University, China; LG Electronics, Shanghai, China

### Special Session: Empower Billion Lives - C

Tuesday, October 1, 2:00PM-3:40PM, Room: 328, Chair: Deepak Divan, Szilard Liptak

**Tuesday, October 1, 4:00PM-5:40PM****Special Session: Empower Billion Lives - D**

Tuesday, October 1, 4:00PM-5:40PM, Room: 327, Chair: Deepak Divan, Szilard Liptak

**Wednesday, October 2, 8:30AM-10:10AM****PV Systems 2**

Wednesday, October 2, 8:30AM-10:10AM, Room: 344, Chair: Rangarajan Tallam, Mehdi Narimani

**8:30AM** *Single-Stage Common-Ground Boost Inverter (S2CGBI) for Solar Photovoltaic Systems* [#19179]

Sze Sing Lee, Chee Shen Lim, Yam P. Siwakoti and Kyo-Beum Lee, Newcastle University in Singapore, Singapore; University of Southampton Malaysia Campus, Malaysia; University of Technology Sydney, Australia; Ajou University, Korea, Republic of

**8:55AM** *Dual-Input Single-Stage Inverter for Photovoltaic-Battery Applications* [#19352]

Khalil Alluhaybi, Issa Batarseh and Haibing Hu, University of Central Florida, United States; Nanjing university of Aeronautics and Astronautic, China

**9:20AM** *Operating Mode and Coordinated Power Control for PV Battery Hybrid System Using Cascaded Multilevel Inverter* [#19834]

Junmou Feng, Zhao Liu, Jianshou Kong, Yue Zhang, Shanshan Zhao, Liang Dong, Qian Ma and Jian Ma, Nanjing University of Science and Technology, China

**9:45AM** *A High-Gain, Soft-switched PV Micro-Converter Using a Single Switch with A Low Switch-Voltage-to-Output-Bus-Voltage Ratio* [#20127]

Kajanan Kanathipan and John Lam, York University, Canada

**Converters for DC Microgrids**

Wednesday, October 2, 8:30AM-10:10AM, Room: 343, Chair: Marco Liserre, Giovanna Oriti

**8:30AM** *Hybrid Modulated Bidirectional Resonant DC/DC Converter for High-Voltage Bus-Based Energy Storage Systems* [#19882]

Junyun Deng and Haoyu Wang, ShanghaiTech University, China

**8:55AM** *Adaptive Current Sharing of Distributed Battery Systems in DC Microgrids Using Adaptive Virtual Resistance-Based Droop Control* [#19508]

Yajie Jiang, Yun Yang, Siew Chong Tan and Shu Yuen Ron Hui, The University of Hong Kong, Hong Kong

**9:20AM** *Virtual Transformer Control for DC-DC Interlinking Converters in DC Microgrids* [#19264]

Haixu Shi, Kai Sun, Yunwei (Ryan) Li and Hongfei Wu, Tsinghua University, China; University of Alberta, Canada; Nanjing University of Aeronautics and Astronauti, China

**9:45AM** *Efficiency Evaluation for DAB Converter with Reactive Power Minimization Strategy and Full ZVS Operation* [#19426]

Yan Hu, Yu Zhang, Qing Chen, Tianhui Zhang, Qingxin Guan, Yang Liu, Yongyong Jia and Jiexin Yu, Huazhong University of Science and Technology, China; State Grid Jiangsu Electric Power Co.,LTD., China; State Grid Jiangsu Electric Power Co.,LTD. Reser, China

**Power Quality in Power Systems**

Wednesday, October 2, 8:30AM-10:10AM, Room: 346, Chair: Norma Anglani, Ali Bazzi

**8:30AM** *Comparative Analysis on Performance of Power Quality Improvement of Grid-Connected Inverters* [#19589]

Wooyoung Choi and Bulent Sarlioglu, University of Wisconsin-Madison, United States

**8:55AM** *A Hybrid Front-end for Multi-Generator Power System Harmonic Elimination* [#20649]

Jongwan Kim and Jih-Sheng Lai, Virginia Tech, United States

**9:20AM** *A Double Reduced Order Generalized Integrator based Algorithm for Control of Four-leg Converter to Enhance Power Quality* [#19105]

Shilei Jiao, Kaushik Rajashekara, Krishna Raj Ramachandran Potti, Lazhar Ben-Brahim and Adel Gastli, University of Houston, United States; Qatar University, Qatar

**9:45AM** *Power Quality Enhancement by SiC Active Power Filters in Oil and Gas Platforms* [#20724]

Lais Vitoi, Danilo Brandao and Elisabetta Tedeschi, Federal University of Minas Gerais, Brazil; Norwegian University of Science and Technology, Norway

### Grid-Converter Interactions

Wednesday, October 2, 8:30AM-10:10AM, Room: 342, Chair: Grant Pitel, Qin Lei

**8:30AM** *Synchronous Frequency Support of Photovoltaic Power Plants with Inertia Emulation* [#20042]

Cristian Verdugo, Andres Tarraso, Jose Ignacio Candela, Joan Rocabert and Pedro Rodriguez, Polytechnic University of Catalonia, Spain; Loyola University Andalusia, Spain

**8:55AM** *Transient Stability Impact of Reactive Power Control on Grid-Connected Converters* [#19665]

Donghua Pan, Xiongfei Wang, Fangcheng Liu and Rongliang Shi, Aalborg University, Denmark; Huawei Technologies Co., Ltd., China

**9:20AM** *Grid-Tied Inverter with Simplified Virtual Synchronous Compensator for Grid Services and Grid Support* [#19667]

Fabio Mandrile, Enrico Carpaneto and Radu Bojoi, Politecnico di Torino, Italy

**9:45AM** *Improved Transient Frequency Stabilization of Grid Feeding Distributed Generation Systems Using Active Damping Control* [#20763]

Salman Harasis and Yilmaz Sozer, University of Akron, United States

### DC-AC – Single-Phase

Wednesday, October 2, 8:30AM-10:10AM, Room: 349, Chair: Daniel Costinett, Zhiliang Zhang

**8:30AM** *A Single-Phase PV Inverter with Swinging Bus Controller to Eliminate Electrolytic Capacitor and Achieve Reactive Power Generation Capability* [#20541]

Xinmin Zhang, Mahshid Amirabadi and Brad Lehman, Northeastern University, United States

**8:55AM** *An Isolated Single-Stage Single-Phase Micro-Inverter Topology with Integrated Magnetic Components* [#20277]

Hafis Umar-Lawal, Carl Ngai Man Ho and Ken King Man Siu, University of Manitoba, Canada

**9:20AM** *Improvements on Harmonic Current Distortion for MHz-Operated Discontinuous Current Mode Single Phase Grid-Tied Inverter with GaN-HEMT Device* [#19994]

Jiantao Zhang, Takanori Isobe and Hiroshi Tadano, University of Tsukuba, Japan

**9:45AM** *A Family of Enhanced Voltage Gain Switched-Boost Impedance-Source Inverter Topologies for Renewable Energy Resources* [#20449]

Anish Ahmad, Rajeev Kumar Singh and Vivek Nandan Lal, IIT Patna, India; IIT(BHU) VARANASI, India

### DC-DC Non-Isolated Converter 3

Wednesday, October 2, 8:30AM-10:10AM, Room: 347, Chair: Jen-Hung (Peter) Huang, Li Zhang

**8:30AM** *Analysis of Hybrid SiC IGBT Based Resonant Switched Capacitor Converter with Circuit Parasitics Consideration* [#19149]

Piao Wen, Xiaofeng Yang, Chengzhang Yan, Trillion Q Zheng and Seiki Igarashi, Beijing Jiaotong University, China; Fuji Electric Co., Ltd., Japan

**8:55AM** *A 3L Capacitor Clamping Converter with Low Current Ripple and High Voltage Gain* [#20561]

Hong Li, Wencai Wang, Yangbin Zeng, Yangyang Zhao and Yanfeng Jiang, Beijing Jiaotong University, China



**9:20AM** *Fault Tolerance Analysis of Non-isolated High Gain Boost Converter* [#20283]  
Ankul Gupta, Raja Ayyanar and Sombuddha Chakraborty, Arizona State University, United States; Texas Instruments, United States

**9:45AM** *A Resonant Cockcroft-Walton Switched-Capacitor Converter Achieving Full ZCS and >10kW/inch<sup>3</sup> Power Density* [#19261]  
Nathan Ellis and Rajeevan Amirtharajah, University of California Davis, United States

### PWM and Harmonic Reduction 1

Wednesday, October 2, 8:30AM-10:10AM, Room: 350, Chair: Sewan Choi, Toshihisa Shimizu

**8:30AM** *Power Quality Optimization of Post-Fault Reconfigured Multi-Level Inverter* [#20246]  
Weiqiang Chen and Ali Bazzi, University of Connecticut, United States

**8:55AM** *Optimized Digital Implementation of Carrier-based Randomized Discontinuous PWM Technique for Active Front End (AFE) Drives* [#19605]  
Zhe Zhang, Lixiang Wei, Peizhong Yi, Puneeth Srikanta Murthy and Yujia Cui, University of Connecticut, United States; Rockwell Automation, Inc, United States

**9:20AM** *An Asymmetric Selective Harmonic Current and Voltage Modulation-PWM Technique for Electric Vehicle Charging Stations with Cascaded H-Bridge Converters to Meet Power Quality Standards* [#20384]  
Amirhossein Moeini and Shuo Wang, University of Florida, United States

**9:45AM** *Discontinuous Modulation of Interleaved Parallel NPC Inverters with Reduced Circulating Current* [#19657]  
Anatolii Tcai, Sante Pugliese and Marco Liserre, Chair of Power Electronics. Kiel University, Germany

### Steady State Modeling

Wednesday, October 2, 8:30AM-10:10AM, Room: 340, Chair: Huai Wang, Dong Jiang

**8:30AM** *Resolving Loss Discrepancy between Calculation and Measurement in a 4.5 kW GaN-based Inverter* [#19704]  
Zhe Yang, Paige Williford, Edward Jones, Jianliang Chen, Fred Wang, Sandeep Bala and Jing Xu, University of Tennessee, Knoxville, United States; ABB Corporate Research, United States

**8:55AM** *The Principle and Calculation of AC-side Grounding Resistance of Three-phase Converter through DC Insulation Monitoring* [#19106]  
Jifei Du, Trillion Q Zheng, Hong Li, Yangbin Zeng and Hongyan Zhao, Beijing Jiaotong University, China

**9:20AM** *Analysis of a GaN-Based CRM Totem-Pole PFC Converter Considering Current Sensing Delay* [#20443]  
Jingjing Sun, Nathan Strain, Daniel Costinett and Leon Tolbert, University of Tennessee, United States

**9:45AM** *Comparison between Different Analysis Methodologies for LLC Resonant Converter* [#19190]  
Yuqi Wei, Quanming Luo, Zhiqing Wang, Alan Mantooth and Xingchen Zhao, The University of Arkansas, United States; Chongqing University, China

### Grid Synchronization

Wednesday, October 2, 8:30AM-10:10AM, Room: 348, Chair: Xinke Wu, Vito Giuseppe Monopoli

**8:30AM** *Re-synchronization of Universal Droop Control Distributed Generation Inverter to the Grid* [#19663]  
Mohammad Amin and Qing-Chang Zhong, Norwegian University of Science and Technology, Norway; Illinois Institute of Technology, United States

**8:55AM** *Adaptive Synchronization Technique for Single-phase Inverters in AC Microgrid* [#19768]  
Animesh Sahoo, Khizir Mahmud and Jayashri Ravishankar, University of New South Wales, Sydney, Australia

**9:20AM** *Series Harmonic Voltage Cancellor for Mitigating Effect of Grid Impedance on the Stability of Microgrids* [#19315]  
Chun-tak Lai, Henry Shu-hung Chung and Weimin Wu, City University of Hong Kong, Hong Kong; Shanghai Maritime University, China

**9:45AM** *Observer Based Admittance Shaping for Resonance Damping in Voltage Source Converters with LCL Filter* [#20672]  
Ma Awal, Hui Yu, Leandro Della Flora, Wensong Yu, Srdjan Lukic and Iqbal Husain, North Carolina State University, United States; Danfoss Drives, United States

**Electric Machines for Transportation 1**

Wednesday, October 2, 8:30AM-10:10AM, Room: 337, Chair: Takashi Kato, Ayman El-Refaie

**8:30AM** *Synchronous reluctance motors with asymmetric rotor shapes and epoxy resin for electric vehicles* [#19646]

Andrea Credo, Marco Villani, Mircea Popescu and Nicolas Riviere, University of L'Aquila, Italy; Motor Design Ltd., United Kingdom

**8:55AM** *Addressing the challenges of lightweight aircraft electric propulsion through electrical machines with air-gap windings* [#20326]

Philip Henry Mellor, Callum Heath, Suzanne Collins, Nick Simpson and Ian Bond, University of Bristol, United Kingdom; National Composites Centre, United Kingdom

**9:20AM** *Systematic Comparison of Two Axial Flux PM Machine Topologies: Yokeless and Segmented Armature versus Single Sided* [#20421]

Narges Taran, Greg Heins, Vandana Rallabandi, Dean Patterson and Dan M. Ionel, University of Kentucky, United States; Regal Beloit Corporation, Australia

**9:45AM** *Analytical Design of an Easily Manufacturable, Air-Cooled, Toroidally Wound Permanent Magnet Ring Motor with Integrated Propeller for Electric Rotorcraft* [#20698]

Max Liben and Daniel C. Ludois, University of Wisconsin -Madison, United States

**Electric Machines: Diagnostics, Noise and Vibration 1**

Wednesday, October 2, 8:30AM-10:10AM, Room: 338, Chair: Rakib Islam, Shanelle Foster

**8:30AM** *Detection and Classification of Damper Bar and Field Winding Faults in Salient Pole Synchronous Motors* [#19026]

Yonghyun Park, Sang Bin Lee, Mladen Sasic, Greg Stone and Jangho Yun, Korea University, Korea, Republic of; Quaitrol - Iris Power, Canada; Hyundai Electric, Korea, Republic of

**8:55AM** *Comparison of Fault Characteristics for Dual Three-Phase Synchronous Reluctance Motor* [#19917]

JunKyu Park, Cristian Babetto, Berardi Grazia, Jin Hur and Nicola Bianchi, University of Padova, Italy; Incheon National University, Korea (South)

**9:20AM** *Analysis of Unbalanced Magnetic Pull in PMSM Due to Static Eccentricity* [#20156]

Anmol Aggarwal, Elias Strangas and John Agapiou, Michigan State University, United States; General Motors, United States

**9:45AM** *Radial Force Reduction in SRMs using Partial Teeth Insertion on Stator and Rotor Poles* [#20773]

Lavanya Vadamodala, Omer Gundogmus, Abdul Wahab Bandarkar and Yilmaz Sozer, University of Akron, United States

**Prof. Manfred Depenbrock Memorial Session**

Wednesday, October 2, 8:30AM-10:10AM, Room: 339, Chair: Mario Pacas, Volker Staudt

**8:30AM** *In Memoriam Manfred Depenbrock* [#20778]

Mario Pacas, Volker Staudt and Andreas Steimel, University of Siegen, Germany; Ruhr-University Bochum, Germany

**8:55AM** *Zero Voltage Vector Selection in a Saturation Controller-Based Direct Torque Control for Permanent-Magnet Synchronous Motors* [#19164]

Lizhi Qu, Wei Qiao, Liyan Qu and Zhe Zhang, University of Nebraska-Lincoln, United States; Eaton Corporation, United States

**9:20AM** *A Very Simple and Practical Deadbeat Direct Torque and Flux Control for IPMSM* [#19153]

Xiaogang Lin, Wenxin Huang, Yong Zhao, Wen Jiang, Ning Su and Shanfeng Zhu, Nanjing University of Aeronautics and Astronautics, China

**9:45AM** *A High Frequency Signal Injection based Optimum Reference Flux Searching for Direct Torque Control of A Three-Level Traction Drive* [#20146]

Mohammad Hazzaz Mahmud, Yuheng Wu, Waleed Alhosaini, Fei Diao and Yue Zhao, University of Arkansas, United States

**High Power Switching Devices and Application**

Wednesday, October 2, 8:30AM-10:10AM, Room: 341, Chair: Ramanujam Ramabhadran, Xiu Yao

**8:30AM** *A 20 kV, 125 kHz Photonically Driven Power MOSFET-like Device* [#19674]

Kristin Sampayan and Stephen Sampayan, Opcondys, Inc., United States

**8:55AM** *Integrator Design of the Rogowski Current Sensor for Detecting Fast Switch Current of SiC Devices* [#19225]

Lei Ming, Zhen Xin, Yin Changqing, Chen Manxin and Loh Poh Chiang, The Chinese University of Hong Kong, Hong Kong

**9:20AM** *Multi-Objective Optimization Control for SiC/Si Hybrid Switch* [#20085]

Zhizhi He, Zongjian Li, Jiajun Yu, Xi Jiang and Jun Wang, Hunan University, China, China

**9:45AM** *SiC MOSFETs Modeling Considering Characteristics Variation for Module Parallel Applications* [#19304]

David Hongfei Lu, Hiromu Takubo, Motohito Hori and Akio Toba, Fuji Electric Co., Ltd., Japan; Fuji Electric Co., Ltd., Japan

### **Wireless Power Transfer 1**

Wednesday, October 2, 8:30AM-10:10AM, Room: 345, Chair: Fuxin Liu, Daniel Ludois

**8:30AM** *Design of Loosely Coupled Transformer of Wireless Power Transfer for Higher Misalignment Tolerance of System Efficiency* [#19143]

Haisen Zhao, Yufei Wang, Hassan H. Eldeeb, Yang Zhan, Guorui Xu and Osama A. Mohammed, North China Electric Power University, China; Florida International University, United States

**8:55AM** *Magnetic Stray Field Attenuation in High-Power WPT Systems based on a Modular Concept* [#19500]

Abubakar Uba Ibrahim, Wenxing Zhong, Hongzhi Cui, Hao Li and Dehong Xu, Zhejiang University, Hangzhou, China

**9:20AM** *Interoperability Evaluation of Wireless Electric Vehicle Charging Systems Based on Impedance* [#19623]

Kai Song, Guang Yang, Ruizhi Wei, Xiaohua Huang, Qian Zhang and Chunbo Zhu, Harbin Institute of Technology, China; China Electric Power Research Institute, China; State Grid Beijing Power Research Institute, China

**9:45AM** *Automatic Active Compensation Method of Cross-Coupling in Multiple-receiver Resonant Inductive Coupling Wireless Power Transfer Systems* [#19733]

Masataka Ishihara, Keita Fujiki, Kazuhiro Umetani and Eiji Hiraki, Okayama University, Japan

### **Special Session: Challenges and Successes in Accelerating the Adoption of Wide Bandgap Power Electronics**

Wednesday, October 2, 8:30AM-10:10AM, Room: 327, Chair: Victor Veliadis

### **Special Session: Go Real: Power Electronics from Simulations to Experiments in Hours - A**

Wednesday, October 2, 8:30AM-10:10AM, Room: 336, Chair: Qing-Chang Zhong, Beibei Ren

### **Special Session: Cyber and Hardware Security for Power Electronics in a Changing World - A**

Wednesday, October 2, 8:30AM-10:10AM, Room: 329, Chair: Somasundaram Essakiappan, Alan Mantooth

### **Special Session: DC Circuit Protection - A**

Wednesday, October 2, 8:30AM-10:10AM, Room: 328, Chair: John Shen

### Wednesday, October 2, 10:30AM-12:10PM

#### Multi Level PV Systems

Wednesday, October 2, 10:30AM-12:10PM, Room: 344, Chair: Elisabetta Tedeschi, Mohammad B Shadmand

**10:30AM** *Three-Phase Transformer-less Hybrid-Bypass Inverter* [#20159]  
Zhou Liwei and Preindl Matthias, Columbia University, United States

**10:55AM**  
*Multilevel-Boost-Converter-Neutral-Point-Clamped-Inverter Photovoltaic System with MPPT Based on Fibonacci Search* [#20435]  
Ronnan Cardoso, Edison da Silva and Darlan Fernandes, Federal University of Paraiba, Brazil; Federal University of Paraiba and Federal, Brazil

**11:20AM** *Design Optimization of a 1500 V GaN-Based Solar Inverter Using Flying Capacitor Multi-Level Converter Stages* [#20447]  
Andrew Stillwell and Robert Pilawa, University of Illinois at Urbana-Champaign, United States; University of California, Berkeley, United States

**11:45AM** *Switched-Capacitor-Inductor-based Differential Power Converter for Solar PV Modules* [#19914]  
Kamran Ali Khan Niazi, Yongheng Yang, Jinkui He, Akif Zia Khan and Dezso Sera, Aalborg University, Denmark; The Hong Kong Polytechnic University, Hong Kong, Hong Kong

#### Solid State Transformers 1

Wednesday, October 2, 10:30AM-12:10PM, Room: 343, Chair: Subhadeep Bhattacharya, Ghanshyamsinh Gohil

**10:30AM** *Implementation of Flexible Large Power Transformers Using Modular Solid State Transformer Topologies Enabled by SiC Devices* [#20671]  
Venkat NagSomeswar Rao Jakka, Harshit Nath, Subhashish Bhattacharya and Acharya Sayan, NC State University, United States

**10:55AM** *Discrete State Event-Driven Approach for High-Power Converter Simulations* [#19162]  
Bochen Shi, Zhengming Zhao, Yicheng Zhu, Zhujun Yu, Jiahe Ju, Liqiang Yuan and Kainan Chen, Tsinghua University, China

**11:20AM** *Modified Feedforward Control to Suppress DC Voltage Disturbances for Three-Stage MMC-PET* [#19533]  
Yaqian Zhang, Jianzhong Zhang, Jin Zhao and Fujin Deng, Southeast University, China

**11:45AM** *Intelligent Transformer Unit Topology Using Additional Small Power Converter Based on Conventional Distribution Transformer* [#20423]  
Hyun-Jun Lee and Young-Doo Yoon, Hanyang University, Korea (South)

#### Synchronization of Grid Converters

Wednesday, October 2, 10:30AM-12:10PM, Room: 342, Chair: Dong Dong, Brian Johnson

**10:30AM** *Self-Synchronising Stationary Frame Current Regulation for Grid-Connected LCL Converters Under Unbalanced Grid Voltage Conditions* [#19748]  
Afif Nazib, Grahame Holmes and Brendan McGrath, RMIT University, Australia

**10:55AM** *Wind power system control based on the self\_synchronized universal droop controller* [#20332]  
Yang Ruan and Qing-Chang Zhong, Illinois Institute of Technology, United States

**11:20AM** *Synchronous Power Controller for Distributed Generation Units* [#20017]  
Andres Tarraso, Cristian Verdugo, Ngoc Bao Lai, Jose Ignacio Candela and Pedro Rodriguez, SEER - UPC, Spain; Loyola University, Spain

**11:45AM** *A single-phase synchronization technique for grid-connected RESS under distorted grid conditions* [#20406]  
Komal Saleem, Zunaib Ali and Kamyar Mehran, Queen Mary University of London, United Kingdom

**Dr. Milan M. Jovanovic Memorial Session**

Wednesday, October 2, 10:30AM-12:10PM, Room: 349, Chair: Dushan Borojevic, Fred Lee

**10:30AM** *Review of Milan M. Jovanovic's work and impact on the power electronics industry [#19365]*  
Laszlo Huber, Yungtaek Jang and Panov Yuri, Delta Electronics (Americas) Ltd., United States

**10:55AM** *A Two-stage Universal Input Charger with Wide Output Voltage Range [#19360]*  
Mike K. Ranjram, Cheng Zhang and David J. Perreault, Massachusetts Institute of Technology, United States

**11:20AM** *A Reverse-Feeding Hold-up Time Strategy for Two-Stage Grid-Interface PFC with a Rectifier-Coupled Boost Inductor [#20060]*  
Jaeil Baek, Gun-Woo Moon and Minjie Chen, Princeton University, United States; KAIST, Korea (South)

**11:45AM** *Wide Voltage Range High-Efficiency Sigma Converter 48V VRM With Integrated Magnetics [#20478]*  
Mohamed H. Ahmed, Fred C. Lee and Qiang Li, CPES - Virginia Tech, United States

**Multilevel Converters Voltage Balancing**

Wednesday, October 2, 10:30AM-12:10PM, Room: 346, Chair: Thomas Podlesak, Brendan McGrath

**10:30AM** *Capacitor Voltage Balancing Control Strategy For Single Phase Five-Level ANPC Photovoltaic Inverter [#19706]*  
Haihua Xue, Deqiang Zhang, Xi Liu, Alian Chen and Chenghui Zhang, Shandong University, China

**10:55AM** *Hybrid DC Link Voltage Balancing For a Two-Leg Five-Level Neutral Point Clamped Inverter [#19525]*  
Eshet Wodajo, Malik Elbuluk, Seungdeog Choi and Haitham Abu-Rub, University of Akron, United States; Mississippi State University, United States; Texas A & M University - Qatar, Qatar

**11:20AM** *Balancing Average Capacitor Voltages in Neutral-Point-Clamped Converters Using Band-Limited Three-Level Modulation [#19501]*  
Neha Beniwal, Christopher David Townsend, Glen Farivar, Josep Pou and Salvador Ceballos, Nanyang Technological University, Singapore, Singapore; University of Western Australia, Australia, Australia; Tecnalia Research and Innovation, Spain, Spain

**11:45AM** *New Active Capacitor Voltage Balancing Method for Seven-Level Full-Bridge Flying-Capacitor-Multicell (FCM) Inverters [#20526]*  
Arash Khoshkbar-Sadigh, Vahid Dargahi and Keith Corzine, Penn State University, United States; University of California Santa Cruz, United States

**DC-DC Non-Isolated Converter 4**

Wednesday, October 2, 10:30AM-12:10PM, Room: 347, Chair: Pradeep Shenoy, Michael Gonzalez

**10:30AM** *Light-Load Switching-Loss Elimination Utilizing Pulse Density Modulation for Switched-Capacitor-Based Resonant Converters [#20434]*  
Hadi Setiadi and Hideaki Fujita, Tokyo Institute of Technology, Japan

**10:55AM** *Synthesizing a Family of Converters for a Specified Conversion Ratio Using Flux Balance Principle [#20157]*  
Ramanuja Panigrahi, Santanu K. Mishra and Avinash Joshi, Indian Institute of thechnology, Kanpur, India

**11:20AM** *A modular DC-DC converter topology based on a three-level DC-DC converter for distributed fuel cell architecture [#20559]*  
Mohammad Afkar, Roghayeh Gavagsaz-Ghoachani, Apinya Siangsanoh, Matheepot Phattanasak, Jean-Philippe Martin and Serge Pierfederici, Shahid Beheshti University, Iran; King Mongkut's University of Technology NB, Thailand; Universite de Lorraine, France

**11:45AM** *Non-isolated High Gain Boost Converter Operating in Critical Conduction Mode [#20279]*  
Ankul Gupta, Raja Ayyanar and Sombuddha Chakraborty, Arizona State University, United States; Texas Instruments, United States

**PWM and Harmonic Reduction 2**

Wednesday, October 2, 10:30AM-12:10PM, Room: 350, Chair: Sewan Choi, Toshihisa Shimizu

**10:30AM** *Interharmonics Reduction in Photovoltaic Systems with Random Sampling MPPT Technique* [#19569]

Ariya Sangwongwanich and Frede Blaabjerg, Aalborg University, Denmark

**10:55AM** *A Phase-Shifted-Among-Legs PWM Scheme for the Hybrid Cascaded Converter based STATCOM* [#19559]

Yu-chen Su, Jing-syuan Wang and Po-tai Cheng, National Tsing Hua University, Taiwan

**11:20AM** *Multifunctional Grid-Tied PV System Using Modified KLMS Control* [#19899]

Abhishek Kumar, Seema Kewat, Bhim Singh, Rashmi Jain and Anjeet Verma, JC Bose University Of Science & Technology, YMCA, India; Indian Institute of Technology, Delhi, India

**11:45AM** *Design Considerations of DSP-based SiC-MOSFET SAPF with 100kHz Sampling and Switching Frequency* [#19580]

Yuxiao Zhang, Ke Dai, Hongwei Xu, Haitao Lin, Debin Zhang and Qin Lei, Huazhong University of Science and Technology, China; Arizona State University, United States

**Control of MMC**

Wednesday, October 2, 10:30AM-12:10PM, Room: 340, Chair: Xiaonan Lu, Hanchao Liu

**10:30AM** *Control and Design of Mission Profile Emulator for Sub-modules in Modular Multilevel Converter* [#19747]

Yunxiao Yang, Ke Ma, Yubo Song and Weiyao Wang, Shanghai Jiao Tong University, China

**10:55AM** *Accurate Control of Neutral Current for Neutral Point Voltage Balancing in Three-Level Inverters Considering Digital Control and PWM Delay* [#20437]

Hyun-Jun Lee, Sungmin Kim and Young-Doo Yoon, Hanyang University, Korea (South)

**11:20AM** *Comparison of Phase-Shifted Carrier PWM Schemes for Modular Multilevel Converter* [#19067]

Qian Cheng and Chenchen Wang, Beijing Jiaotong University, China

**11:45AM** *Thermal Loading and Analysis of Modular Multilevel Converters Using Injection Control of Circulating Current and Common-mode Voltage* [#19167]

Deepak Ronanki and Sheldon Williamson, University of Ontario Institute of Technology, Canada

**AC-DC Converter Control**

Wednesday, October 2, 10:30AM-12:10PM, Room: 348, Chair: Sheng Zheng, John Lam

**10:30AM** *DCM Buck-Buck/Boost PFC Converter with Segmented Fixed Duty-Cycle Control* [#19130]

Chengjian Wu, Kai Yao, Zhen Zhang, Chunwei Ma, Jienan Chen, Lingge Li and Chanbo Guan, Nanjing University of Science and Technology, China

**10:55AM** *A SVPWM Method With Reduced Switching Frequency Suitable for High Power Three-level NPC Rectifiers* [#19138]

Zhan Gao, QiongXuan Ge, YaoHua Li, Lu Zhao and Bo Zhang, Institute of Electrical Engineering, China

**11:20AM** *Single DC-link AC-DC-AC converter with shared legs* [#20572]

Alan Felinto, Cursino Jacobina, Edgard Fabricio and Lacerda Rodrigo, Federal University of Campina Grande, Brazil; Federal Institute of Paraiba, Brazil

**11:45AM** *Grid Impedance Identification and Structured-h2 Optimization Based Controller Design of Active Front-end in Embedded AC Networks* [#19664]

Kang Li, Andrea Formentini, David Dewar, Pericle Zanchetta and Patrick Wheeler, The University of Nottingham, United Kingdom

**Electric Machines: Loss Analysis 2**

Wednesday, October 2, 10:30AM-12:10PM, Room: 337, Chair: Franco Leonardi, Julia Zhang

**10:30AM** *Efficiency Maps Computation and Comparison Including Thermal Limits* [#19835]  
Giacomo Bacco, Cristian Babetto, Michele Bonfante, Matteo Carbonieri and Nicola Bianchi, University of Padova, Italy

**10:55AM** *Electrical Machine Loss Distribution and Thermal Parameter Identification through Experimentally Informed Virtual Prototyping* [#20230]  
Dominic North, Suzanne Collins, Nick Simpson and Philip H Mellor, University of Bristol, United Kingdom

**11:20AM** *Efficient Multidisciplinary Modeling and Simulation of a Washing Machine Motor Duty Cycle* [#20270]

Martin Ortega, Anqi Sun, Manoj Kandukuri, Tan Pham and Wendling Philippe, MABE, Mexico; Altair Product Design, United States; Altair Engineering, United States; Solar Turbines, United States; Altair, United States

**11:45AM** *A Hybrid Analytical and FE-based Method for Calculating AC Eddy Current Winding Losses Taking 3D Effects into Account* [#20658]  
Narges Taran and Dan M. Ionel, University of Kentucky, United States

### IPMSM and Synchronous Reluctance Machines

Wednesday, October 2, 10:30AM-12:10PM, Room: 338, Chair: Tsarafidy Raminosoa, Julia Zhang

**10:30AM** *Reduction of Cross Magnetization in Interior Permanent Magnet Synchronous Motors with V-Shape Magnet Configurations by Optimizing Rotor Slits* [#19283]  
Katsumi Yamazaki and Ryota Kondo, Chiba Institute of Technology, Japan

**10:55AM** *Optimal Design and Experimental Validation of a Synchronous Reluctance Machine for Fault-Tolerant Applications* [#19822]  
Cristian Babetto, Nicola Bianchi, Torreggiani Ambra, Davoli Matteo, Bianchini Claudio and Bellini Alberto, University of Padova, Italy; University of Modena and Reggio Emilia, Italy; Raw Power, Italy; University of Bologna, Italy

**11:20AM** *Standstill Determination of PM Flux Linkage Based on Minimum Saliency Tracking for PM-SyR Machines* [#20142]

Paolo Pescetto and Gianmario Pellegrino, Politecnico di Torino, Department of Energy, Italy

**11:45AM** *Torque Ripple Minimization of PM-assisted Synchronous Reluctance Machines via Asymmetric Rotor Poles* [#20622]

Simone Ferrari, Eric Armando and Gianmario Pellegrino, Politecnico di Torino, Italy

### Control of Electric Drives

Wednesday, October 2, 10:30AM-12:10PM, Room: 339, Chair: Wei Xu, Michael Harke

**10:30AM** *Decoupled Torque Control of Multiple Three-Phase Induction Motor Drives* [#19863]  
Sandro Rubino, Radu Bojoi, Davide Cittanti and Luca Zarri, Politecnico di Torino, Italy; Politecnico di Torino, Italy; University of Bologna, Italy

**10:55AM** *Modulated Model Predictive Control for Induction Motor Drives with Sequential Cost Function Evaluation* [#20741]  
Valerio Vodola, Shafiq Ahmed Odhano, Cristian Garcia, Margarita Norambuena, Silvio Vaschetto, Pericle Zanchetta, Jose Rodriguez and Radu Bojoi, Politecnico di Torino, Italy; The University of Nottingham, United Kingdom; Universidad de Talca, Curico, Chile; Universidad Tecnica Federico Santa Maria Valpara, Chile; Universidad Andres Bello, Santiago, Chile

**11:20AM** *Predictive Current Control of Mutually Coupled Switched Reluctance Motors Using Net Flux Method* [#20746]

Siddharth Mehta, Iqbal Husain and Prerit Pramod, North Carolina State University, United States; Nexteer Automotive, United States

**11:45AM** *Levitation Control for a Double-Sided Bearingless Linear Motor Based on Feedback Linearization* [#19422]

Seppo E. Saarakkala, Maksim Sokolov, Reza Hosseinzadeh and Marko Hinkkanen, Aalto University, Finland

### Thermal Management

Wednesday, October 2, 10:30AM-12:10PM, Room: 341, Chair: Francesco Iannuzzo, Lauren Boteler

**10:30AM** *Two-Dimensional Thermal Modeling and Parametric Optimization of Printed Circuit Board Vias* [#20731]

Yanfeng Shen, Hui Zhao, Teng Long, Huai Wang and Frede Blaabjerg, University of Cambridge, United Kingdom; Aalborg University, Denmark

**10:55AM** *Thermal Buffering Effect of Phase Change Material on Press-pack IGBT during Power Pulse* [#19051]

Hai Ren, Gaofeng Hao, Weihua Shao, Li Ran, Lin Zhou, Philip Mawby and Huaping Jiang, Chongqing University, China; Chongqing University; The University of Warwick, United Kingdom; The University of Warwick, United Kingdom

**11:20AM** *Thermal characterization of SiC modules for variable frequency drives* [#20619]

Marzieh Karami and Rangarajan Tallam, Rockwell Automation, United States

**11:45AM** *A High-Accuracy, Low-Order Thermal Model of SiC MOSFET Power Modules Extracted from Finite Element Analysis via Model Order Reduction* [#20737]

Cameron Entzminger, Wei Qiao, Liyan Qu and Jerry Hudgins, University of Nebraska-Lincoln, United States

## **Wireless Power Transfer 2**

Wednesday, October 2, 10:30AM-12:10PM, Room: 345, Chair: David Dorrell, Omer Onar

**10:30AM** *Communication-Free Control Scheme for Qi-Compliant Wireless Power Transfer Systems* [#19248]

Yun Yang, Siew-Chong Tan and Ron Hui, The University of Hong Kong, Hong Kong

**10:55AM** *A Square-Shaped Omnidirectional Wireless Charging Bowl with a Double Layer Electromagnetic Shield for Portable Device Applications* [#20345]

Junjie Feng, Qiang Li and Fred Lee, Center for power Electronics Virginia Tech, United States

**11:20AM** *Inductive Wireless Power Transfer at 100 MHz with Wide Load Range and Constant Output Current* [#20629]

Xin Zan, Zizhen Guo and Al-Thaddeus Avestruz, University of Michigan, Ann Arbor, United States; Tsinghua University, China

**11:45AM** *A Wireless Power Transfer System with Multiple Constant Current and Constant Voltage Outputs* [#19228]

Zhe Zhou, Zhanfeng Deng, Chenwen Cheng, Weiguo Li, Fangyi Li and Chris Mi, Global Energy Interconnection Research Institute, China; San Diego State University, United States

## **Special Session: Go Real: Power Electronics from Simulations to Experiments in Hours - B**

Wednesday, October 2, 10:30AM-12:10PM, Room: 336, Chair: Qing-Chang Zhong, Beibei Ren

## **Special Session: Cyber and Hardware Security for Power Electronics in a Changing World - B**

Wednesday, October 2, 10:30AM-12:10PM, Room: 329, Chair: Somasundaram Essakiappan, Alan Mantooth

## **Special Session: DC Circuit Protection - B**

Wednesday, October 2, 10:30AM-12:10PM, Room: 328, Chair: John Shen

## **Special Session: Improved SiC and GaN Device and Module Performance, Packaging, Reliability**

Wednesday, October 2, 10:30AM-12:10PM, Room: 327, Chair: Victor Veliadis



## Wednesday, October 2, 2:00PM-3:40PM

### Wave and Ocean Energy Systems

Wednesday, October 2, 2:00PM-3:40PM, Room: 344, Chair: Elisabetta Tedeschi, Yongheng Yang

**2:00PM** *An Experimental Investigation into the Wave Power Extraction of a Small-Scale Fixed Multi-Chamber OWC Device* [#19609]

Shalby Mohammad, Walker Paul, Dorrell David and Elhanafi Ahmed, University of Technology Sydney, Australia; University of KwaZulu-Natal, South Africa; National Centre for Maritime Engineering and Hyd, Australia

**2:25PM** *Damping Selection Strategy for Maximum Energy on Wave Energy Power Converters* [#20320]  
Chen Chien-An and Zuo Lei, Virginia Tech, United States

**2:50PM** *Adaptive Control of a Hybrid Energy Storage System for Wave Energy Conversion Application* [#20375]

Apoorv Agarwal, Vishnu Mahadeva Iyer, Anup Anurag and Subhashish Bhattacharya, North Carolina State University, United States

**3:15PM** *Investigating the Performance of a Variable Stiffness Magnetic Spring for Resonant Ocean Power Generation* [#20486]

Md Emrad Hossain and Bird Jonathan, Portland State University, United States

### Solid State Transformers 2

Wednesday, October 2, 2:00PM-3:40PM, Room: 343, Chair: John Shen, Enrico Santi

**2:00PM** *A Decoupled Control Scheme of Four-Port Solid State Transformer* [#19695]

Necmi Altin, Saban Ozdemir, Ahmad El Shafei, Adel Nasiri and Mohammad Rashidi, University of Wisconsin-Milwaukee, United States; Eaton Corporation, United States

**2:25PM** *Hybrid Multiple-Active Bridge for Unequal Power Flow in Smart Transformers* [#19884]

Victor Ferreira, Nimrod Vazquez, Braz Cardoso and Marco Liserre, University of Kiel, Germany; Instituto Tecnológico de Celaya, Mexico; Federal University of Minas Gerais, Brazil

**2:50PM** *Estimation of Eddy Current Winding Losses in Soft-Switching Solid-State Transformer* [#20674]

Xiwei Zheng, Xiangyu Han, Mickael Mauger, Prasad Kandula, Karthik Kandasamy and Deepak Divan, Georgia Institute of Technology, United States

**3:15PM** *AC-DC Converter with Hybrid Three-Level and Two-Level Legs Using Space Vector Modulation for Medium-Voltage SST Applications* [#20550]

Dakai Wang, Wensong Yu, Siyuan Chen and David Philpott, North Carolina State University, United States

### Inverter Control

Wednesday, October 2, 2:00PM-3:40PM, Room: 342, Chair: Brendan McGrath, Leon M Tolbert

**2:00PM** *Evaluation of Voltage Regulators for Dual-Loop Control of Voltage-Controlled VSCs* [#19560]

Yicheng Liao and Xiongfei Wang, Aalborg University, Denmark

**2:25PM** *A Modified Lyapunov-function based Control Scheme for Three-phase UPS with a Load Estimator in Synchronous Rotating Frame* [#20329]

Jinsong He, Qingsong Ran, Fanfan Lin and Xin Zhang, Nanyang Technological University, Singapore; Powerchina Resources LTD., China

**2:50PM** *Grid Tied Wind Energy Generating System Incorporating an Observer Based Nonlinear Control Exhibiting Robustness* [#20589]

Subarni Pradhan, Shadab Murshid, Bhim Singh and Bijaya Ketan Panigrahi, Indian Institute of Technology, Delhi, India

**3:15PM** *Inverter Output Current Overshoot Suppression during Fault Ride-through Operation for Three-phase Grid-tied Inverter with Minimized Inductor* [#20001]

Satoshi Nagai, Hiroki Watanabe and Jun-ichi Itoh, Nagaoka University of Technology, Japan

**Batteries and Battery Management 1**

Wednesday, October 2, 2:00PM-3:40PM, Room: 340, Chair: Mohammed Alam, Arash Nassiri Bavili

**2:00PM** *Simplified control strategy for an inhomogeneous series-connected battery string* [#20110]

Rishab Anand and B. G. Fernandes, IIT Bombay, India

**2:25PM** *High-dimensional Data Abnormity Detection Based on Improved Variance-of-Angle (VOA) Algorithm for Electric Vehicles Battery* [#19760]

Peng Liu, Jin Wang, Zhenpo Wang, Zhaosheng Zhang, Shuo Wang and David Dorrell, Beijing Institute of Technology, China; University of Kwa-Zulu-Natal, South Africa

**2:50PM** *A Single-Capacitor Equalizer Using Optimal Pairing Algorithm for Series-Connected Battery Cells* [#20388]

Puong-Ha La, Hong-Hee Lee and Sung-Jin Choi, University of Ulsan, Korea (South)

**3:15PM** *Optimized Design of an Onboard Resonant Self-Heater for Automotive Lithium-Ion Batteries at Cold Climates* [#20469]

Chong Zhu, Yunlong Shang, Fei Lu and Hua Zhang, Shanghai Jiao Tong University, China; Shandong University, China; Drexel Univerisity, United States

**Multilevel Converters Modulation**

Wednesday, October 2, 2:00PM-3:40PM, Room: 346, Chair: Roberto Petrella, Lee Empringham

**2:00PM** *Unfolder Operation and Modulation Strategy of Paralleled Current-source Converters* [#19587]

Yuzhuo Li, Nie Hou, Li Ding and Yunwei Li, University of Alberta, Canada

**2:25PM** *Three-phase Multilevel Asymmetric Current Source Converter* [#19690]

Nayara Lisboa, Montie Vitorino, Louelson Costa and Mauricio Correa, Federal University of Campina Grande, Brazil

**2:50PM** *An Optimized Phase Shifted PWM for Flying Capacitor Multilevel Converter* [#20759]

Waqar A. Khan, Sina Vahid, Md Rakib-Ur Rahman, Ramin Katebi, Ayman EL-Refaie and Nathan Weise, Marquette University, United States

**3:15PM** *Model Predictive Control for Three Level Neutral Point Clamped Inverter With Reduced Numbers of Switching State Combinations* [#20035]

Ritwik Ghosh, Narsa Reddy Tummuru and Bharat Singh Rajpurohit, IIT Mandi, India

**DC-DC Non-Isolated Converter 5**

Wednesday, October 2, 2:00PM-3:40PM, Room: 349, Chair: Sombuddha Chakraborty, Junichi Itoh

**2:00PM** *A Bidirectional LLC Converter Enabled by Common-Mode and Differential-Mode Operation* [#19412]

Jessica D. Boles, Seungbum Lim, Juan A. Santiago-Gonzalez, David M. Otten and David J. Perreault, Massachusetts Institute of Technology, United States

**2:25PM** *A 99.7% Efficient 300 W Hard Disk Drive Storage Server with Multiport Ac-Coupled Differential Power Processing (MAC-DPP) Architecture* [#20164]

Ping Wang, Yenan Chen, Parker Kushima, Youssef Elasser, Ming Liu and Minjie Chen, Princeton University, United States; Princeton Unverisity, United States

**2:50PM** *Multi-objective Design of LC Filter for High-efficiency, High-power-density and High-performance Buck Converter* [#20288]

Xinze Li, Fanfan Lin, Xin Zhang, Meng Huang and Huai Wang, Nanyang Technological University, Singapore; Wuhan University, China; Aalborg University, Denmark

**3:15PM** *Generalized Multilevel Converter in DC/DC Application* [#20185]

Hao Hu, Saikat Ghosh, Yam Siwakoti and Teng Long, University of Cambridge, United Kingdom; University of Technology Sydney, Australia

**DC-DC Isolated Converter 1**

Wednesday, October 2, 2:00PM-3:40PM, Room: 347, Chair: Jianwu Zeng, Burgos Rolando

**2:00PM** *Real-Time Modeling and HIL Simulation of Stacked Low-Inertia Converters with Soft-Switching and Fast Dynamic Control* [#20670]

Xiangyu Han, Liran Zheng, Karthik Kandasamy, Prasad Kandula, Maryam Saeedifard and Deepak Divan, Georgia Institute of Technology, United States

**2:25PM** *A Novel Modulation Method of LLC Resonant Converter with Linear Model and High Efficiency* [#19262]

Zhijian Fang, Zhicong Huang, Hang Jing, Guozhen Hu, Junhua Wang and Liang Tao, China University of Geosciences (Wuhan), China; University of Macau, Macau; Wuhan University, China; Hubei Polytechnic University, China

**2:50PM** *LEGO-MIMO Architecture: A Universal Multi-Input Multi-Output (MIMO) Power Converter with Linear Extendable Group Operated (LEGO) Power Bricks* [#20114]

Yenan Chen, Ping Wang, Youssef Elasser and Minjie Chen, Princeton University, United States

**3:15PM** *High Efficiency High Power Density Bidirectional DC-DC Converter for Photovoltaic Energy Storage System Utilization* [#19528]

Fangyuan Shi and Rui Li, Shanghai Jiao Tong University, China

### Converter Stability Analysis

Wednesday, October 2, 2:00PM-3:40PM, Room: 350, Chair: Harish Krishnamoorthy, Chi Kong Tse

**2:00PM** *Stability Analysis of Grid-Connected VSCs Based on S-parameters and Reflection Coefficient* [#19558]

Shih-Feng Chou, Xiongfei Wang and Frede Blaabjerg, Aalborg University, Denmark

**2:25PM** *Stability Analysis of MMC under Grid Voltage Phase Change* [#19461]

Yushuang Liu, Meng Huang, Xiaoming Zha, Chi K. Tse and Zhihong Yan, Wuhan University, China; Hong Kong Polytechnic University, China

**2:50PM** *Stability Analysis of Grid-Connected Inverters during the Transient of Grid Voltage Fluctuations in Weak Grid Cases* [#19986]

Jinming Xu, Shenyiyang Bian, Miao Liu, Zhang Zhao and Shaojun Xie, Nanjing University of Aeronautics & Astronautics, China

**3:15PM** *Systematic Approach for Transient Stability Evaluation of Grid-Tied Converters during Power System Faults* [#19515]

Mads Graungaard Taul, Xiongfei Wang, Pooya Davari and Frede Blaabjerg, Dept. of Energy Technology, Aalborg University, Denmark

### DAB Converter Control

Wednesday, October 2, 2:00PM-3:40PM, Room: 348, Chair: Hui Li, Leila Parsa

**2:00PM** *An Analog-based, Duty Cycle Modulation Method to Remove the DC Bias in the Transformer for a Dual Active Bridge Converter* [#19385]

Bocheng Zhang, Shuai Shao, Naipeng Yu, Xinke Wu and Junming Zhang, Zhejiang University, China

**2:25PM** *An Uncertainty and Disturbance Estimator Based Voltage Control for Dual-Active-Bridge Converters* [#19673]

Yuheng Wu, Mohammad Hazzaz Mahmud, Waleed Alhosaini, Yue Zhao, Alan Mantooth and Yuzhi Zhang, University of Arkansas, United States; ABB US Corporate Research Center, United States

**2:50PM** *Instantaneous Start-Up and Shutdown Method for Three-Phase Dual-Active Bridge DC-DC Converters* [#20019]

Daniel von den Hoff and Rik W. De Doncker, PGS, E.On ERC, RWTH Aachen University, Germany

**3:15PM** *Dual Switching Frequency Operation of Dual Active Bridge Converter* [#20603]

Changjiang Sun, Xin Zhang and Xu Cai, Nanyang Technological University, Singapore; Shanghai Jiao Tong University, China

### Switched Reluctance and Flux Switching Machines 1

Wednesday, October 2, 2:00PM-3:40PM, Room: 337, Chair: Rajesh Deodhar, Akira Chiba

**2:00PM** *Analysis of Novel Consequent Pole Flux Reversal Permanent Magnet Machine* [#19242]  
Huan Qu, ZiQiang Zhu and HuaYang Li, The University of Sheffield, United Kingdom

**2:25PM** *Improved Current Profile for Noise Reduction of Switched Reluctance Motor at Middle Speed* [#19281]  
Candra Adi Wiguna, Jihad Furqani and Akira Chiba, Tokyo Institute of Technology, Japan

**2:50PM** *Design Considerations and Performance Analysis of a Super High-Speed Switched Reluctance Motor for Electric Supercharger* [#19292]  
Grace Firsta Lukman, Kwang-II Jeong, Jin-Woo Ahn and Do-Kwan Hong, Kyungsoong University, Korea (South); Korea Electrotechnology Research Institute, Korea (South)

**3:15PM** *A Phase Current Peak Prediction Technique to Increase the Output Power of Switched Reluctance Generators for Wind Turbines* [#19758]  
Prashant Carl Buck, Babak Fahimi and Poras Balsara, The University of Texas at Dallas, United States

### High Speed and Bearingless Machines 1

Wednesday, October 2, 2:00PM-3:40PM, Room: 338, Chair: Iqbal Husain, Eric Severson

**2:00PM** *Very-High-Speed Miniaturized Permanent Magnet Motors: Modeling and Experimental Validation* [#19183]  
Guillaume Burnand and Yves Perriard, Ecole Polytechnique Federale de Lausanne, Switzerland

**2:25PM** *Very-High-Speed Miniaturized Permanent Magnet Motors: Design and Optimization* [#19184]  
Guillaume Burnand and Yves Perriard, Ecole Polytechnique Federale de Lausanne, Switzerland

**2:50PM** *Optimal Design of the Bearingless Induction Motor for Industrial Applications* [#20593]  
Jiahao Chen and Eric Severson, University of Wisconsin-Madison, United States

**3:15PM** *Design of a Miniaturized Single-Drive Bearingless Motor* [#19497]  
Guilherme Cavalcante Rubio, Hiroya Sugimoto and Akira Chiba, Tokyo Institute of Technology, Japan

### Induction Motor Drives 1

Wednesday, October 2, 2:00PM-3:40PM, Room: 339, Chair: Alireza Fatemi, Xuechao Wang

**2:00PM** *Fault-tolerant DTC Technique for Five-phase Three-level NPC Inverter fed Induction Motor Drive with an Open-phase Fault* [#19883]  
Bheemaiah Chikondra, Utkal Ranjan Muduli and Ranjan Kumar Behera, Indian Institute of Technology Patna, India

**2:25PM** *Rotor Resistance Estimation for Sensorless Induction Motor Drives with A Torque Ripple Reduction Method* [#19044]  
Cheng Luo, Bo Wang, Yong Yu, Tianqing Wang, Zhixin Huo and Dianguo Xu, Harbin Institute of Technology, China

**2:50PM** *A General Coordinate Transformation Based on Fourier Matrices for Modelling Space Harmonics in Induction Machines* [#20129]  
Julien Cordier, Stefan Klass and Ralph Kennel, Technische Universitaet Muenchen, Germany

**3:15PM** *Active and Reactive Power Control of the Rotor Loads in a Five-Phase Wound Rotor Induction Motor Drive* [#19839]  
Gabriele Rizzoli, Angelo Tani, Mengoni Michele, Luca Vancini and Luca Zarri, University of Bologna, Italy

### High Power SiC Packaging

Wednesday, October 2, 2:00PM-3:40PM, Room: 341, Chair: Christina DiMarino, Ariunbolor Purvee

**2:00PM** *Novel SiC Power Module for Traction Power Inverters with Low Parasitic Inductances* [#19727]  
Marko Jaksic, Ajay Patwardhan, John Czubay, Constantin Stancu, Terence Ward, Dawud Abu-Zama, Sung Chung, Ioan Suci, Mehrdad Teimorzadeh and Brian Peaslee, General Motors, United States

**2:25PM** *Enhanced Over-current Capability and Extended SOA of Power Modules Utilizing Phase Change Material* [#19197]  
Weihua Shao, Ruizhu Wu, Li Ran, Huaping Jiang, Tom Combs, Kieran Yardley, Philip Mawby, Prabodh Bajpai and Debaprasad Kastha, Chongqing University, China; University of Warwick, Great Britain; Indian institution of technology Kharagpur, India

**2:50PM** *Current Sharing Behavior and Characterization of a 1200 V, 6.5 mOhm SiC Half-Bridge Power Module with Flexible PCB Gate Loop Connection* [#19697]  
Grace Watt, Slavko Mocevic, Amy Romero, Rolando Burgos, Marko Jaksic and Mehrdad Teimor, Center for Power Electronics Systems (CPES), United States; Wolfspeed, A Cree Company, United States; General Motors - Global Propulsion Systems, United States

**3:15PM** *A Highly-Integrated SiC Power Module for Fast Switching DC-DC Converters* [#19231]  
Alexander Stippich, Tobias Kamp, Alexander Sewergin, Lukas Fraeger, Arne Hendrik Wienhausen, David Buendgen and Rik W. De Doncker, RWTH Aachen University, Germany

### **Wireless Power Transfer 3**

Wednesday, October 2, 2:00PM-3:40PM, Room: 345, Chair: Xin Dai, Jason Pries

**2:00PM** *Precise General Modeling of Windings for Wireless Power Transfer* [#19561]  
Xinhe Liu, Wenxing Zhong, Hongzhi Cui, Ping Lin and Dehong Xu, Zhejiang University, China

**2:50PM** *A Novel Hinge-Joint Structure for Wireless Power Transfer System* [#19962]  
Mohamad Abou Houran, Xiaoteng Li, Xu Yang and Wenjie Chen, Xi'an Jiaotong University, China; State Grid Shaanxi Electric Power Company, China

**2:25PM** *A Novel Soft-Switching Dual-Side Phase Shift Circuit for Wireless Power Transfer* [#19709]  
Chu Wang, Min Chen, Hongzhi Cui, Xinhe Liu, Wenxing Zhong and Fangyuan Shi, Zhejiang University, China; Shanghai Jiao Tong University, China

**3:15PM** *Low-Cost, Printed Circuit Board Construction, Capacitively Coupled Excitation System for Wound Field Synchronous Machines* [#19989]  
Skyler Hagen, Jiejian Dai, Ian P. Brown and Daniel C. Ludois, University of Wisconsin -Madison, United States; Illinois Institute of Technology, United States

### **Special Session: Evolution of the EV Powertrain**

Wednesday, October 2, 2:00PM-3:40PM, Room: 336, Chair: Lakshmi Varaha Iyer

### **Special Session: Integrated Storage and Power Electronics**

Wednesday, October 2, 2:00PM-3:40PM, Room: 328, Chair: Issa Batarseh

### **Special Session: Aircraft Hybridization and Electrification Roadmap**

Wednesday, October 2, 2:00PM-3:40PM, Room: 327, Chair: Sara Roggia

### **Special Session: Grid-Forming Inverters in Modern Power Grids: Modeling, Control and Advanced Testing - A**

Wednesday, October 2, 2:00PM-3:40PM, Room: 329, Chair: Xiaonan Lu, Xiongfei Wang

## **Wednesday, October 2, 4:00PM-5:40PM**

### **Energy Storage Systems**

Wednesday, October 2, 4:00PM-5:40PM, Room: 344, Chair: Wasi Uddin, Alex De Abreu-Garcia

**4:00PM** *Improved Modular Multilevel Converter with Symmetrical Integrated Super Capacitor Energy Storage System for Electrical Energy Router Application* [#19111]

Zejie Li, Xiaofeng Yang, Haibo Tao, Trillion Q. Zheng, Xiaojie You and Pavel Kobrle, Beijing Jiaotong University, China; Czech Technical University, Czech Republic

**4:25PM** *Current Controlled Operation of Cascaded H-Bridge Converter for Fast SoC Balancing in Grid Energy Storage* [#19676]

Amir Hussain, Krishna Raj Ramachandaran Potti, Kaushik Rajashekara, Harish Krishnamoorthy and Stanley Atcitty, University of Houston, United States; Sandia National Laboratories, United States

**4:50PM** *SoH-Aware Charging of Supercapacitor with Lifetime Maximization* [#20378]

Fu Jiang, Cheng Jin, Yongjie Liu, Heng Li, Xiaoyong Zhang, Yingze Yang, Jun Peng and Zhiwu Huang, Central south university, China; Central South University, China

**5:15PM** *Architecture for Utility-Scale Multi-Chemistry Battery Energy Storage* [#20458]

Mitchell Smith, Michael Starke, Leon Tolbert and Madhu Chinthavali, University of Tennessee: Knoxville, United States; Oak Ridge National Laboratory, United States

### AC Microgrids

Wednesday, October 2, 4:00PM-5:40PM, Room: 343, Chair: Johan HR Enslin, Rob Cuzner

**4:00PM** *Decentralized Reactive Power Sharing Among Parallel Inverters Through Inherent Dead-time Effect* [#19746]

Yang Qi and Yi Tang, Nanyang Technological University, Singapore

**4:25PM** *On the Effect of Line Dynamics in Multi-inverter Systems with Generalized Droop Control* [#20697]

Gurupraanesh Raman, Sidhaarth Venkatachari and Jimmy Chih-Hsien Peng, National University of Singapore, Singapore; National Institute of Technology Tiruchirappalli, India

**4:50PM** *A Common Second Frequency Control of Island Cascaded-type Microgrid* [#20364]

Guangze Shi, Hua Han, Yao Liu, Mei Su, Zhangjie Liu and Yao Sun, Central South University, China; China Southern Power Grid, China

**5:15PM** *Leader Selection in Robust Pinning-based Distributed Control for Islanded Microgrids* [#20487]

Jianzhe Liu, Xiaonan Lu, Chen Chen and Bo Chen, Argonne National Laboratory, United States; Temple University, United States

### Dynamics of Inverter-Based Resources

Wednesday, October 2, 4:00PM-5:40PM, Room: 342, Chair: Yunwei Li, Robert S. Balog

**4:00PM** *Model Predictive Current Control of Active Distribution Transformer With Consideration of Its Stability Analysis Based on AC-AC Matrix Converter* [#19205]

Yougui Guo, Bowen Yang, Chuyun Li, Wenlang Deng and Blaabjerg Frede, Xiangtan university, China; Aalborg university, Denmark

**4:25PM** *Passivity Analysis and Enhancement of Voltage Control for Voltage-Source Converters* [#19562]

Yicheng Liao and Xiongfei Wang, Aalborg University, Denmark

**4:50PM** *Interactions Between Phase-locked Loop Synchronized Grid Converters With Different Bandwidths and Power Ratings* [#19639]

Zhixiang Zou, Behnam Daftary, Roberto Rosso and Marco Liserre, University of Kiel, Germany

**5:15PM** *A Reduced-order Model of PMSG for the Low Frequency Oscillation Analysis of Power Systems* [#19887]

Xianzhe Li, Shuhan Liao and Xiaoming Zha, Wuhan University, China

### Battery and Charging Infrastructure

Wednesday, October 2, 4:00PM-5:40PM, Room: 340, Chair: Rashmi Prasad, Babak Nahid-Mobarakeh

**4:00PM** *Control and Implementation of Renewable Energy Based Smart Charging Station Beneficial for EVs, Home and Grid* [#19612]  
Anjeet Verma and Bhim Singh, IIT DELHI, India; IIT Delhi, India

**4:25PM** *High Voltage Resolution Auxiliary Power Converter for Online Battery Impedance Measurement* [#19895]  
Shimul K Dam and Vinod John, Indian Institute of Science, India

**4:50PM** *Multi-port, Bi-directional Contactless Connector for the Interface of Modular Portable Battery System* [#19336]  
Masanori Ishigaki, Keisuke Ishikawa, Kosuke Tahara and Makoto Kusakabe, TOYOTA CENTRAL R&D LABS, Japan; Toyota Central R&D Labs, Japan

**5:15PM** *A Novel Systematic Approach to Construct and Assess Power Electronic Conversion Architectures Using Graph Theory and Its Application in Battery Systems* [#19896]  
Wenping Zhang, Liuchen Chang and Riming Shao, University of New Brunswick, Canada

### AC-AC Converters

Wednesday, October 2, 4:00PM-5:40PM, Room: 349, Chair: Mahshid Amirabadi, Maurizio Cirrincione

**4:00PM** *Three-Phase to Single-Phase Multi-Resonant Direct AC-AC Converter for Metal Hardening High-Frequency Induction Heater* [#19127]  
Tomokazu Mishima, Ryosuke Kawashima and Chiaki Ide, Kobe University, Japan; Fuji Electronics Industry co, Japan

**4:25PM** *Single-Phase Five-Leg AC-DC-AC Multilevel Converter to Enhance Power Quality* [#20057]  
Rodrigo Pereira de Lacerda, Cursino Brandao Jacobina and Edgard L. L. Fabricio, Federal University of Campina Grande, Brazil; Federal Institute of Paraiba, Brazil

**4:50PM** *A Hybrid 4-quadrant Switch for AC Power Conversion* [#20769]  
Giri Venkataramanan and Namrata Kogalur, University of Wisconsin-Madison, United States

**5:15PM** *Modular Capacitive-Link-Based Three-Phase AC-AC Power Converter* [#20196]  
Afshari Ehsan and Amirabadi Mahshid, Northeastern University, United States

### Multilevel Converters Applications 1

Wednesday, October 2, 4:00PM-5:40PM, Room: 346, Chair: Yongsug Suh, Madhav Manjrekar

**4:00PM** *An Open-Circuit Fault Diagnosis Method for T-type Three-Level Rectifiers* [#19169]  
Jie Chen, Chenghui Zhang, Xiangyang Xing, Alian Chen and Chunshui Du, Shandong University, China

**4:25PM** *A Novel Hybrid N Level T Type Inverter Topology* [#19400]  
Salvatore Foti, Antonio Testa, Luigi Danilo Tornello, Giacomo Scelba, Tommaso Scimone, Giuseppe Scarcella and Salvatore De Caro, University of Messina, Italy; University of Catania, Italy

**4:50PM** *Theoretical Analysis and Comparison of Capacitor Requirement in Modular Converters for Grid Integration of High Power Solar PV* [#20066]  
Shambhu Sau, Arun Chandrasekharan Nair and B.G. Fernandes, Indian Institute of Technology Bombay, India

**5:15PM** *Thermal and Performance Comparison of Active Neutral-Point-Clamped (ANPC) and Dual Flying-Capacitor ANPC (DFC-ANPC) Inverters* [#20624]  
Arash Khoshkbar-Sadigh, Roozbeh Naderi, Vahid Dargahi and Keith Corzine, Penn State University, United States; TAE Technologies, United States; University of California-Santa Cruz, United States

### DC-DC Isolated Converter 2

Wednesday, October 2, 4:00PM-5:40PM, Room: 347, Chair: Diego G. Lamar, Jaclyn Lynch

**4:00PM** *A Comparison of DC and AC Output Inductors in Tunable Piezoelectric Transformer Based DC/DC Converters* [#20531]

Le Wang, Qiong Wang, Rolando Burgos, Khai Ngo and Alfredo Carazo, Virginia Tech - CPES, United States; Micromechatronics Inc, United States

**4:25PM** *Adaptive Resonant Energy Realization in FB-ZCS DC-DC Converter Using Dual-Capacitor Circuit* [#20601]

Rohit Suryadevara and Leila Parsa, Rensselaer Polytechnic Institute, United States; University of California Santa Cruz, United States

**4:50PM** *A New Fully Magnetically Coupled SiC-Based DC/DC Step-up LLC Resonant Converter with Inherent Balanced Voltage Sharing for Renewable Energy Systems with a Medium Voltage DC Grid* [#20483]

Mehdi Abbasi, Reza Emamalipour, Muhammad Ali Masood Cheema and John Lam, York University, Lassonde School of Engineering, Canada; Northern Transformer, Canada

**5:15PM** *A Parallel-Resonant Isolated Bidirectional DC-DC Converter with Low Current Ripple for Battery Storage Systems* [#20457]

Yangbin Zeng, Hong Li, Zhi Zhang, Trillion Q. Zheng, Zhan Shang, Zhidong Qiu, Lutian Yuan and Yuhang Ding, Beijing Jiaotong University, China

### Small-Signal Modeling for Stability

Wednesday, October 2, 4:00PM-5:40PM, Room: 350, Chair: Khurram Afridi, Paolo Mattavelli

**4:00PM** *Generalized Average Model of Triple Active Bridge Converter* [#20720]

Shota Okutani, Pin-Yu Huang and Yuichi Kado, Kyoto Institute of Technology, Japan

**4:25PM** *Small Signal Dynamic Model and Stability Analysis of a Self-Synchronizing Grid-Tied Current Regulated Inverter* [#20321]

Brendan McGrath, Peishuo Mu, Afif Nazib, Donald Grahame Holmes and Carlos Teixeira, RMIT University, Australia

**4:50PM** *Impedance Modeling and Stability Analysis of Grid-tied Universal Droop Control Inverter* [#20004]

Mohammad Amin and Qing-Chang Zhong, Norwegian University of Science and Technology, Norway; Illinois Institute of Technology, United States

**5:15PM** *Analysis of an Impedance Modeling Approach for Droop-Controlled Inverters in System DQ Frame* [#20647]

Francesco Cavazzana, Aram Khodamoradi, Hossein Abedini and Paolo Mattavelli, DTG-University of Padova, Italy

### Model Predictive Control

Wednesday, October 2, 4:00PM-5:40PM, Room: 348, Chair: Rostan Rodrigues, Ralph Kennel

**4:00PM** *Model Predictive Control of PWM Rectifier under Unbalanced and Distorted Network Without AC Voltage Sensor* [#19494]

Yongchang Zhang, Jian Jiao, Jie Liu, Haitao Yang, Qingzhu Wan and Wei Xu, North China University of Technology, China; Huazhong University of Science and Technology, China

**4:25PM** *A Vector Analysis Based Model Predictive Control Method for Four-State Converters* [#19551]

Sai Tang, Xin Yin, Daming Wang, Chao Zhang, Kun Xiong, Ruqiang Zhen, Z. John Shen and Jun Wang, Hunan University, China; Illinois Institute of Technology, United States

**4:50PM** *High Frequency Bidirectional Isolated Matrix Converter for AC-Motor Drives with Model Predictive Control* [#19668]

Shuai Wang, Hang Gao, Jahangir Afsharian and Dewei Xu, Ryerson University, Canada; Murata Power Solutions, Canada

**5:15PM** *Model Predictive Control without Weighting Factors for T-type Multilevel Inverters with Magnetic-Link and Series Stacked AC-DC Modules* [#20356]

Shakil Ahamed Khan, Youguang Guo, Noman Habib Khan, Yam Siwakoti and Jianguo Zhu, University of Technology Sydney, Australia

### Permanent Magnet Machines 1

Wednesday, October 2, 4:00PM-5:40PM, Room: 337, Chair: Nicola Bianchi, Sara Roggia



**4:00PM** *A Closed-Loop Magnetization State Controller For Variable-flux IPMSMs* [#19020]  
Akrem Mohamed Aljehaimi and Pragasen Pillay, Misurata University, Libya; Concordia University, Canada

**4:25PM** *Analysis of Dual 3-Phase Fractional-Slot Concentrated Winding PM Synchronous Machines with Different Angle Displacements* [#19145]  
Peilin Xu, Z.Q. Zhu, B. Shao, S.S. Wang, S. Cai, J.H. Feng, S.Y. Guo, Y.F. Li and S. Z. Feng, University of Sheffield, United Kingdom; CRRC Zhuzhou Institute Co. Ltd, China

**4:50PM** *Dynamic Modeling of Surface-Mounted Permanent Magnet Motors Considering Saturation* [#20312]

Li Zhaokai, Chen Yuzheng, Huang Xiaoyan, Li Xinru, Ying Wucheng, Shen Boyang, Wu Lijian, Fang Youtong and Long Teng, Zhejiang University, China; University of Nottingham, United Kingdom; University of Cambridge, United Kingdom; University of Cambridge, China

**5:15PM** *Correction of Finite-Element Calculated Efficiency Map using Experimental Measurements* [#19891]

Solmaz Kahourzade, Amin Mahmoudi, Wen Soong, Simone Ferrari and Gianmario Pellegrino, University of Adelaide, Australia; Flinders University, Australia; Politecnico di Torino, Italy

### Thermal Analysis of Electric Machines

Wednesday, October 2, 4:00PM-5:40PM, Room: 338, Chair: Mircea Popescu, Nick Simpson

**4:00PM** *Direct Air Cooling of High-Power Permanent Magnet Machines* [#19683]

Xiang Shen, Barrie Mecrow, Xu Deng, Christopher Donaghy-Spargo, Richard Whalley and Nilanjan Chakraborty, Newcastle University, United Kingdom; Durham University, United Kingdom

**4:25PM** *Direct Oil Cooling of End-Windings in Torus-Type Axial-Flux Permanent-Magnet Machines* [#20065]

Federico Marcolini, Giulio De Donato and Federico Caricchi, University of Rome "La Sapienza", Italy

**4:50PM** *Design Considerations of Windings formed with Hollow Conductors Cooled with Phase Change Material* [#20216]

Sabrina Ayat, Benjamin Daguse and Rabih Khazaka, Safran Tech, France

**5:15PM** *Resource Efficient Determination of Electrical Machine Thermal Parameters* [#20287]

Suzanne Collins, Dominic North, Philip H Mellor and Nick Simpson, University of Bristol, United Kingdom

### PM Motor Drives

Wednesday, October 2, 4:00PM-5:40PM, Room: 339, Chair: Lei Hao, Wu Lijian

**4:00PM** *Design Criteria for Flux-Weakening Control Bandwidth and Voltage Margin in IPMSM Drives Considering Transient Conditions* [#20752]

Jose Jacob, Omar Bottesi, Sandro Calligaro and Roberto Petrella, Free University of Bolzano, Italy; University of Udine, Italy

**4:25PM** *Study of Copper Loss by Inter Turn short fault of Interior Permanent Magnet Synchronous Motor* [#19284]

Seong-Hwan Im and Bon-Gwan Gu, Kyungpook National University, Korea (South)

**4:50PM** *A speed and current cascade Continuous Control Set Model Predictive Control architecture for synchronous motor drives* [#19556]

Paolo Carlet, Francesco Toso, Andrea Favato and Silverio Bolognani, University of Padova, Italy

**5:15PM** *Resolver Emulation for PMSMs Using Low Cost Hall Effect Sensors* [#19833]

Daniel Fernandez, Diego Fernandez, Maria Martinez, David Reigosa, Alberto B. Diez and Fernando Briz, University of Oviedo, Spain

### Gate Drive and Auxiliary Circuit

Wednesday, October 2, 4:00PM-5:40PM, Room: 341, Chair: Mark J Scott, Zheyu Zhang

**4:00PM** *A High Speed SiC Thyristor Gate Driver for Pulse Power Applications* [#20163]

Mohammed Agamy, Fengfeng Tao and Ahmed Elasser, University at Albany - SUNY, United States; Tesla, United States; GE Global Research Center, United States

**4:25PM** *Optimized method for protection of SiC JFET based converters against failure of auxiliary power supply* [#19719]

Rostan Rodrigues and Utkarsh Raheja, ABB Inc, United States; ABB INC., United States

**4:50PM** *Output-Current Measurement of a PWM Inverter with a Tiny PCB Rogowski Sensor Integrated into an IGBT Module* [#20373]

Kazunori Hasegawa, Shun Sho, Tohru Kato, Mao Ichiki, Masanori Tsukuda and Ichiro Omura, Kyushu Institute of Technology, Japan; National Institute of Advanced Industrial Scienc, Japan

**5:15PM** *Design of Modular Auxiliary Gate Driver Power Supply for medium voltage converter system* [#20646]

Sanket Parashar, RajKumar Kokkonda and Subhashish Bhattacharya, NCSU (POWER AMERICA), India; NCSU, India

**Wireless Power Transfer 4**

Wednesday, October 2, 4:00PM-5:40PM, Room: 345, Chair: Zhonghui Bing, Burak Ozpineci

**4:00PM** *Three-Phase Integrated PFC AC-AC Resonant Inverter with Weak Coupled Coils for Induction Heating Application* [#20126]

Ruan Gomes, Montie Vitorino, Diego Acevedo-Bueno and Mauricio Correa, Federal University of Campina Grande, Brazil

**4:25PM** *A Multi-MHz Large Air-gap Capacitive Wireless Power Transfer System Utilizing an Active Variable Reactance Rectifier Suitable for Dynamic Electric Vehicle Charging* [#20348]

Sreyam Sinha, Brandon Regensburger, Ashish Kumar and Khurram Afridi, Cornell University, United States; University of Colorado Boulder, United States

**4:50PM** *Comparison of Leakage Magnetic Field from Matched and Mismatched Double-D Coil based Wireless Charging System for Electric Vehicles* [#20614]

Mostak Mohammad, Jason Pries, Omer Onar, Saeed Anwar, Veda Galigekere, Gui-Jia Su and Jonathan Wilkins, University of Akron, Ohio, United States; Oak Ridge National Laboratory, United States; University of Tennessee - Knoxville, United States

**5:15PM** *A 2m Quasi-Wireless Capacitive Power Transfer System Using Earth Ground as the Current-Returning Path* [#19059]

Hua Zhang and Fei Lu, Drexel University, United States

**Special Session: The Trend, Requirement and Development of DC Technologies for Medium and Low Voltage DC Grids**

Wednesday, October 2, 4:00PM-5:40PM, Room: 336, Chair: Jun Liang

**Special Session: Electrification of Aircraft - From More Electric to All Electric Propulsion**

Wednesday, October 2, 4:00PM-5:40PM, Room: 328, Chair: Bulent Sarlioglu, Kaushik Rajashekara

**Special Session: Current Status and Future Prospects of GaN Power HEMTs**

Wednesday, October 2, 4:00PM-5:40PM, Room: 327, Chair: Tanya Gachovska

**Special Session: Grid-Forming Inverters in Modern Power Grids: Modeling, Control and Advanced Testing - B**

Wednesday, October 2, 4:00PM-5:40PM, Room: 329, Chair: Xiaonan Lu, Xiongfei Wang

**Thursday, October 3, 8:30AM-10:10AM****Hybrid Energy Storage Systems**

Thursday, October 3, 8:30AM-10:10AM, Room: 344, Chair: Wasi Uddin, Akanksha Singh

**8:30AM** *A Series-Parallel Switched-Capacitor Equalizer for the Hybrid Energy Storage System* [#19258]

Liu Lizhou, Han Peibang, Sun Wenbin, Mai Ruikun, He Zhengyou and Wu Dong, Southwest Jiaotong University, China

**8:55AM** *Energy Management of Multi-energy Storage Systems Using Energy Path Decomposition* [#19456]

Sima Aznavi, Poria Fajri, Arash Asrari and Reza Sabzehgar, University of Nevada, Reno, United States; Southern Illinois University, United States; San Diego State University, United States

**9:20AM** *An Improved Feed-Forward Load Compensation Method for Hybrid Energy Storage Systems* [#19902]

Yue Wu, Zhiwu Huang, Hongtao Liao, Yanhui Zhou, Yongjie Liu, Heng Li, Xiaoyong Zhang and Jun Peng, Central south university, China

**9:45AM** *An Integrated State of Health (SOH) Balancing Method for Lithium-Ion Battery Cells* [#20774]

Sifat Chowdhury, Mohammad Noor Shaheed and Yilmaz Sozer, University of Akron, United States

**Power and Energy Management in Smart Grid and Microgrid Systems**

Thursday, October 3, 8:30AM-10:10AM, Room: 343, Chair: Youim (Kelly) Tray, Zeljko Pantic

**8:30AM** *Reconfigurable and Dynamic Distribution Systems Enabled Using Self-Sustainable Minimal-Microgrids with Region Based Stability Guarantees* [#20328]

Yuxi Men, Xiaonan Lu, Jianzhe Liu, Chen Chen and Bo Chen, Temple University, United States; Argonne National Laboratory, United States

**8:55AM** *Coordinated Power and Energy Management Using Cluster of Microgrids to Improve Grid Availability and Resiliency* [#20549]

Somasundaram Essakiappan, Rasik Sarup, Ndeye Mbacke, Madhav Manjrekar, Stuart Laval and Kevin Schneider, University of North Carolina at Charlotte, United States; Duke Energy, United States; Pacific Northwest National Laboratory, United States

**9:20AM** *Stability Analysis for Power Management Between Standalone DC Microgrids with Constant Power Loads* [#19600]

Bhanu Babaiahgari, Yeonho Jeong and Jae Do Park, University of Colorado Denver, United States

**9:45AM** *A Partial Power Converter Interface for Battery Energy Storage Integration with a DC Microgrid* [#20327]

Vishnu Mahadeva Iyer, Srinivas Gulur, Subhashish Bhattacharya and Ramanujam Ramabhadran, NC State University, United States; GE Aviation, United States

**Power Converters for Solid State Transformers**

Thursday, October 3, 8:30AM-10:10AM, Room: 345, Chair: Alex Huang, Hui Li

**8:30AM** *Design of A Medium Voltage Solid-State Transformer based on Modular AC-AC Resonant Converter and an Input-Series-Output-Parallel Architecture* [#20693]

Xin Zhao, Yang Lei, Haoming Wang, Xiangjun Quan and Alex Q. Huang, ECE, University of Texas at Austin, United States

**8:55AM** *Voltage Balancing of Series Connected Clamping Diodes in Medium Voltage NPC Converter enabled by Gen-3 10 kV SiC MOSFETs for Asynchronous Micro-Grid Power Conditioning System* [#20422]

Venkat Nag Someswar Rao Jakka, Ashish Kumar, Sanket Parashar, Sagar Kumar Rastogi, Nithin Kolli, Ronak Jaiswal and Subhashish Bhattacharya, NC State University, United States

**9:20AM** *Solid State Transformer for Low-Voltage Distribution System with DC/DC Stage-Controlled Split-Capacitor* [#19557]  
Shaodi Ouyang, Jinjun Liu, Shuguang Song, Xingxing Chen, Yue Yang and Hongda Wu, Xi'an Jiaotong University, China

**9:45AM** *Circulating Current Suppression in Multi-cell Series-parallel Converter for Cost-effective Medium-voltage Solid-state transformer* [#20386]  
Jehyuk Won, Hao Feng, Xinyu Liang, Srdjan Srdic and Srdjan Lukic, North Carolina State University, United States

### Renewable Energy Integration

Thursday, October 3, 8:30AM-10:10AM, Room: 342, Chair: Jason Lai, Paolo Mattavelli

**8:30AM** *Active Harmonic Filtering in STATCOMs for Enhanced Renewable Energy Integration* [#19089]  
Juan Carlos Perez Campion, Eneko Olea Oregi and Colin Edward Thomas Foote, Electric Utility, Spain; Converter Design Company, Spain; Electric Utility, Scotland

**9:20AM** *Voltage and Power Balancing in Solar and Energy Storage Converters* [#19003]  
Emanuel Serban, Martin Ordonez, Cosmin Pondiche and Dan Hulea, University of British Columbia, Canada; Schneider Electric Solar Canada, Canada; University Politehnica of Timisoara, Romania

**8:55AM** *A Medium Voltage DC Collection Grid for Large Scale PV Power Plant with SCR Converter and Integrated Solid-State Transformer (SST)* [#20436]  
Salwan Sabry, Erick I. Pool-Mazun and Prasad Enjeti, Texas A&M University, United States

**9:45AM** *Artificial Neural Network-Based Adaptive Voltage Regulation in Distribution Systems using Data-Driven Stochastic Optimization* [#20383]  
Krishna Sandeep Ayyagari, Reynaldo Gonzalez, Yufang Jin, Miltiadis Alamaniotis, Sara Ahmed and Nikolaos Gatsis, University of Texas at San Antonio, United States

### Electric Drivetrains

Thursday, October 3, 8:30AM-10:10AM, Room: 340, Chair: Subrata Saha, Sabrina Ayat

**8:30AM** *Development of a 100 kW SiC Switched Tank Converter for Automotive Applications* [#19406]  
Ze Ni, Yanchao Li, Chengkun Liu, Mengxuan Wei and Dong Cao, North Dakota State University, United States

**9:20AM** *High-density High-power DC-to-DC Converter Architectures for Future Electrified Transportation Applications* [#20575]  
Suman Dwari, Zhentao Stephen Du, Parikshith Channegowda and Parag Kshirsagar, United Technologies Research Center, United States

**8:55AM** *A Fault Tolerant Modulation Strategy for Dual Inverter Traction Drives* [#20239]  
Rishi Menon, Sheldon Williamson, Najath Abdul Azeez and Arvind Kadam, UOIT, Canada

**9:45AM** *Evaluation of Posicast Compensator Robustness for the Reduction of Torsional Vibrations* [#20395]  
Constanza Ahumada and Patrick Wheeler, Universidad de Chile, Chile; University of Nottingham, United Kingdom

### Single Phase Multilevel Converters

Thursday, October 3, 8:30AM-10:10AM, Room: 349, Chair: Petar Grbovic, Marco di Benedetto

**8:30AM** *Multilevel Single-Phase PWM Converters with Shared Legs and Cascaded Transformers* [#19722]  
Joao Paulo Ramos Agra Mello, Cursino Bradao Jacobina and Amanda Pereira Monteiro, Federal University of Campina Grande, Brazil

**8:55AM** *Single-Phase AC-DC-AC Multilevel Converter Based on Parallel-/Series-Connected Three-Leg Modules* [#20058]  
Rodrigo Pereira de Lacerda, Cursino B. Jacobina and Edgard L. L. Fabricio, Federal University of Campina Grande, Brazil; Federal Institute of Paraiba, Brazil

**9:20AM** *A Single Phase Nine Level Multi Level Inverter for PV Applications* [#20212]  
Sreekanth T., Abhijit Kshirsagar, Sanchit Mishra and Ned Mohan, University of Minnesota, United States

**9:45AM** *A Single-Phase to Single-Phase Three-Wire Power Converter Based on Two-Level and Three-Level Legs* [#20266]

Bruna Seibel Gehrke, Cursino Brandao Jacobina,

Reuben Palmer R. Sousa, Italo Roger F. M. P. da Silva, Joao Paulo R. A. Mello and Nayara Brandao de Freitas, Federal University of Campina Grande, Brazil; Federal Rural University of Pernambuco, Brazil

## Modular Multilevel Converters 2

Thursday, October 3, 8:30AM-10:10AM, Room: 346, Chair: Xiaofeng Yang, Qin Lei

**8:30AM** *Impact of the Circulating Current Control on Transient Submodule Voltage Stresses for Grid-Tied Modular Multilevel Converters During Grid Faults* [#20322]

Zhijian Yin, Huan Qiu, Yongheng Yang, Yi Tang and Huai Wang, Aalborg University, Denmark; Nanyang Technological University, Singapore

**8:55AM** *A multilevel chain-link topology for low voltage, variable frequency applications* [#20371]

Luca Tarisciotti, Alessandro Costabeber, Francesco Tardelli and Roberto Cardenas, Universidad Andres Bello, Chile; University of Nottingham, United Kingdom; Amantys Power Electronics Limited, United Kingdom; University of Chile, Chile

**9:20AM** *Integration of Coupled Inductors for Compact Design of Flying-Capacitor Modular Multilevel Converters* [#20381]

DucDung Le and Dong-Choon Lee, Yeungnam University, Korea, Republic of

**9:45AM** *The Current Shaping Modular Multilevel DC/DC Converter with Current Doubling* [#19125]

Philippe Gray and Peter Lehn, University of Toronto, Canada

## DC-DC Isolated Converter 3

Thursday, October 3, 8:30AM-10:10AM, Room: 347, Chair: Yan Xing, Martin Ordonez

**8:30AM** *Ultra-Wide Output Voltage Range DC Power Supply with Multiple Power Modules Series/Parallel Variable Structure and Automatic Voltage/Current Sharing* [#19530]

Mengxi Li, Hongfei Wu, Chengzhi Qu, Yuhui Ji, Yangjun Lu, Yan Xing and Kai Sun, Nanjing University of Aeronautics and Astronauts, China; Shanghai Institute of Space Power-Sources, China; Tsinghua University, China

**8:55AM** *Multi-cell Multi-port Bidirectional Flyback based on GaN devices* [#19816]

Ander Avila, Asier Garcia-Bediaga, Alberto Rodriguez, Luis Mir and Alejandro Rujas, IKERLAN TECHNOLOGY RESEARCH CENTRE, Spain; Universidad de Oviedo, Spain; IKERLAN Technology Research Centre, Spain

**9:20AM** *Design and Implementation of an Interleaved Forward Converter with Magnetizing Energy Recycled* [#19306]

Chuan Min Ke, Tsorng Juu Liang, Wei Jing Tseng and Guo Lung Jiang, National Cheng Kung University, Taiwan

**9:45AM** *Modal Analysis Method of DAB Based on Phase Shift Control* [#19150]

Liang Guan, Fan Xiao, Chunming Tu and Zheng Lan, Hunan University, China; Hunan University of Technology, China

## Modulation 2

Thursday, October 3, 8:30AM-10:10AM, Room: 350, Chair: Liuchen Chang, Santanu Kapat

**8:30AM** *A Modulation method for DCX LLC Converter to Achieve Fixed Voltage Gain and Bidirectional Power Transfer with Power Limitation Capability* [#19596]

Chen Xiaoying, Guo Xu, Xie Shiming, Su Mei, Wang Hui, Liu Yonglu and Dan Hanbing, Central South University, China

**8:55AM** *New commutation method based on state machine for three-phase HF ac link inverter with passive loads* [#20098]

Minjeong Kim, Taoufik Sekkat, Michael Hornick, Kraig Orcutt and Robert Balog, Texas A&M University, United States

**9:20AM** *A Carrier-Based Discontinuous PWM for Three-Level T-type Converters with Neutral-Point Potential Balancing* [#20070]

Jiayu Zhou, Olorunfemi Ojo, Fen Tang, Josiah Haruna and Poh Chiang Loh, BeiJinng Jiaotong University, China; Tennessee Tech University, United States; BeiJing Jiaotong University, China; Chinese University of Hong Kong, Hong Kong

**9:45AM** *Low Harmonic Loss PWM for a Dual Inverter Drive using a Floating Capacitor Inverter* [#20325]

Sukhjit Singh, Perera Chatumal, Greg Kish and John Salmon, University of Alberta, Canada

### Reliability Modeling and Monitoring

Thursday, October 3, 8:30AM-10:10AM, Room: 328, Chair: Frede Blaabjerg, Tomoyuki Mannen

**8:30AM** *Thermal Monitoring of Power Electronic Modules with Minimal Sensing Effort* [#19652]

Christoph van der Broeck and Rik De Doncker, RWTH Aachen University, Germany

**9:20AM** *Real-Time Grid Impedance Estimation Using a Converter* [#19625]

Jarno Kukkola, Mikko Routimo and Marko Hinkkanen, Aalto University, Finland

**8:55AM** *Overload Operation of LV-Side Inverter in Smart Transformer* [#19968]

Rongwu Zhu, Raveendran Vivek and Marco Liserre, Kiel University, Germany

**9:45AM** *A Carrier-based Modulation Method for the NPC Wind Power Converter Thermal Management During Low-Voltage Ride-Through* [#19913]

Jiuyang Zhou and Po-tai Cheng, National Tsing Hua University, Taiwan

### Energy Storage System Control

Thursday, October 3, 8:30AM-10:10AM, Room: 348, Chair: Qin Lei, Jason Lai

**8:30AM** *Virtual Synchronous Machine Control for Low-Inertia Power System Considering Energy Storage Limitation* [#19752]

Chu Sun, Syed Qaseem Ali, Geza Joos and Francois Bouffard, McGill University, Canada; OPAL-RT TECHNOLOGIES Inc., Canada

**9:20AM** *Cooperative Charging of Supercapacitor Trams with Current Ripple Suppression* [#19910]

Zhiwu Huang, Xianqi Lu, Hongtao Liao, Heng Li, Yongjie Liu, Fu Jiang, Yingze Yang and Jun Peng, Central south university, China; Central South University, China

**8:55AM** *Power Distribution and Individual Phase Control of Asymmetrical Three-Phase Cascaded Multilevel Hybrid Energy Storage System in Star Configuration* [#19784]

Yue Zhang, Zhao Liu, Jianshou Kong, Junmou Feng, Shanshan Zhao, Liang Dong, Feng Mengxuan and Qingyuan Hua, Nanjing University of Science and Technology, China; Nanjing Rail Transit Systems Co., Ltd, China

**9:45AM** *Control of Circulating Current to Minimize the Rating of the Energy Storage Device in Modular Multilevel Converters* [#20652]

Mohammed Alharbi, Semih Isik and Subhashish Bhattacharya, North Carolina State University, United States

### Electric Machines for Transportation 2

Thursday, October 3, 8:30AM-10:10AM, Room: 337, Chair: Andrea Cavagnino, Takashi Kato

**8:30AM** *Design of Hybrid Variable Flux Motors for Enhanced Wide-Speed Performance* [#19021]

Maged Ibrahim and Pragasen Pillay, National Research Council Canada, Canada; Concordia University, Canada

**9:20AM** *Design Considerations for Magnet Configurations in IPM Rotor for High Speed Traction Applications* [#20091]

Tausif Husain and Seong Taek Lee, Borgwarner PowerDrive Systems, United States

**8:55AM** *A Proposal of a Delta-Type Salient Pole Variable Flux Memory Motor Having Large Flux Barrier for Traction Applications* [#19750]

Ren Tsunata, Masatsugu Takemoto, Satoshi Ogasawara and Koji Orikawa, Hokkaido University, Japan

**9:45AM** *Design and Optimization of Synchronous Motors for Low-Voltage Electric Vehicles* [#19041]

Cristian Babetto, Grazia Berardi, Nicola Bianchi and Giorgio Benedetti, University of Padova, Italy; Askoll Holding s.r.l., Italy

**High Speed and Bearingless Machines 2**

Thursday, October 3, 8:30AM-10:10AM, Room: 336, Chair: Eric Severson, Wolfgang Gruber

**8:30AM** *Comprehension and Estimation of Windage Losses in Rotor Slotted Air Gaps of Electrical Machines using CFD-LES methods* [#19552]

Sara Sadr, Abdenour Abdelli, Ayoub Ben-Nachouane, Guy Friedrich and Stephane Vivier, IFPEN, France; VALEO, France; UTC, France

**8:55AM** *Printed Circuit Board Structural Properties and Spiral Groove Trace Conductors for Hydrodynamic Gap Maintenance in Axial Flux Rotating Machines* [#19732]

Ryan Knippel, Marisa Tisler and Daniel C. Ludois, University of Wisconsin - Madison, United States

**9:20AM** *A New Mechanical-Strength-Oriented Rotor Parametric Model Design for the Optimization of a Very-High-Speed IPMSM* [#20555]

Guoyu Chu, Alireza Pouramin, Rukmi Dutta, Faz Rahman, Howard Lovatt and Bulent Sarlioglu, University of New South Wales, Australia; CSIRO, Australia; University of Wisconsin-Madison, United States

**9:45AM** *Smart Current Limitation Technique for a Multiphase Bearingless Machine with Combined Winding System* [#20742]

Zhuang Wen, Giorgio Valente, Andrea Formentini, Luca Papini, Pericle Zanchetta and Christopher Gerada, University of Nottingham, United Kingdom

**Electric Machines: Actuators, Linear, Non-conventional and Transformers**

Thursday, October 3, 8:30AM-10:10AM, Room: 338, Chair: Bryan P. Ruddy, Jose Antonino-Daviu

**8:30AM** *Radial-Force-Based Swirling Actuator with Surface-Permanent-Magnet Structure for Low-Speed High-Torque Applications* [#19313]

Lingyu Chen, Adrien Thabuis, Akira Chiba, Masao Nagano and Kimiaki Nakamura, Tokyo Institute of Technology, Japan; EPFL, Switzerland; Honda R&D Co., Ltd., Japan

**8:55AM** *Novel Dual-Sided Permanent Magnet Machines with Different Stator Configurations* [#20640]

Hui Yang, Ya Li, Heyun Lin, Wei Liu and Xing Zhao, Southeast University, China; Hong Kong Polytechnic University, China

**9:20AM** *A Single-Phase Electromagnetic Transformer with an Adjustable Output Voltage* [#20750]

Junwei Cui, Liyan Qu and Wei Qiao, University of Nebraska-Lincoln, United States

**9:45AM** *Modeling and Design of a Linear Electric-Hydraulic Conversion Machine for Electrification of Off-Highway Vehicles* [#20761]

Anvar Khamitov, Jenny Swanson, James Van de Ven and Eric Severson, University of Wisconsin-Madison, United States; University of Minnesota, United States

**IPM Motor Drives**

Thursday, October 3, 8:30AM-10:10AM, Room: 339, Chair: David Diaz Reigosa, Giulio De Donato

**8:30AM** *Remedial Strategies of Cascaded CSIs Fed Dual Three-phase PMSM Drives under One-phase Open-circuit faults* [#20686]

Pengcheng Liu, Zheng Wang, Xueqing Wang and Ming Cheng, Southeast University, China

**8:55AM** *Implementation of Low Inductance Permanent Magnet Machine Drive with LC Filter for Field Oriented Control* [#20339]

Cheng-Chung Hsu, Jyun-You Chen and Shih-Chin Yang, National Taiwan University, Taiwan

**9:20AM** *Closed-loop Current Control of Synchronous Motor Drives with Position Sensing Harmonics* [#20701]

Prerit Pramod and Krishna MPK Namburi, Nexteer Automotive Corporation, United States

**9:45AM** *Design and Robustness Analysis of 2DOF PI Synchronous-Frame Current Regulator for Salient PMSM Drives* [#19615]

Hussain Hussain, Kuwait University, Kuwait

**SiC Reliability and Protection**

Thursday, October 3, 8:30AM-10:10AM, Room: 329, Chair: Joseph Vitale, Huai Wang

**8:30AM** *Investigation of Current Mirror Based Overcurrent Protection for 1200V 800A High Power SiC MOSFET Modules* [#19675]

Yujia Cui, Peizhong Yi, Zhe Zhang and Lixiang Wei, Rockwell Automation, United States; University of Connecticut, United States

**8:55AM** *Investigation of Aging's Effect on the Conduction and Switching Loss in SiC MOSFETs* [#20331]

Fei Yang, Enes Ugur, Shi Pu, Bilal Akin and Mrinal Das, The University of Texas at Dallas, United States; Texas Instruments, United States

**9:20AM** *Investigation on Degradation of SiC MOSFET Under Accelerated Stress in PFC Converter* [#19309]

Jianjun Chen, Xi Jiang, Zongjian Li, Hengyu Yu and Jun Wang, Hunan University, China

**9:45AM** *Current Saturation Characteristics and Single-Pulse Short-Circuit Tests of Commercial SiC MOSFETs* [#20305]

Diang Xing, Boxue Hu, Susanna Yu, Yue Zhang, Tianshi Liu, Arash Salemi, Minseok Kang, Jin Wang and Anant Agarwal, The Ohio State University, United States

### Magnetic Component Design

Thursday, October 3, 8:30AM-10:10AM, Room: 341, Chair: Xuning Zhang, Chengcheng Yao

**8:30AM** *Increase High Frequency Impedance of Ferrite Toroid Inductors Based on Electromagnetic Energy Analysis* [#19821]

Yiming Li, Juntao Yao and Shuo Wang, University of Florida, United States

**8:55AM** *Optimize the Winding Structure of Flyback Transformers with Arbitrary Phase-Shifted Current Waveforms* [#19824]

Yiming Li, Shuo Wang, Honggang Sheng and Srikanth Lakshminathan, University of Florida, United States; Google Inc., United States

**9:20AM** *An Integrated Passive Device for Multi-Channel LED Driver* [#19470]

Cheng Deng, Yun Yu and Andres Escobar Mejia, Xiangtan University, China; University Tecnology de Pereira, Colombia

**9:45AM** *Optimal Winding Layer Allocation for Minimizing Copper Loss of Secondary-Side Center-Tapped Forward Transformer with Parallel-Connected Secondary Windings* [#19973]

Tomohide Shirakawa, Umetani Kazuhiro, Hiraki Eiji, Ito Yuki and Hyodo Takashi, Okayama university, Japan; OMRON Corporation, Japan

### Special Session: The Role of Simulation Software for Power Electronics Control Design in Education - A

Thursday, October 3, 8:30AM-10:10AM, Room: 327, Chair: Tony Lennon

## Thursday, October 3, 10:30AM-12:10PM

### Systems for Renewable Energy

Thursday, October 3, 10:30AM-12:10PM, Room: 344, Chair: Alex De Abreu-Garcia, Qiang Wei

**10:30AM** *Grid-connected Inverter Impedance Estimation Considering Grid Impedance and Frequency Coupling in the Stationary Frame* [#19947]

Junliang Liu, Xiong Du, Ying Shi and Heng-Ming Tai, Chongqing University, China; University of Tulsa, United States

**10:55AM** *A Closed-loop Global Synchronous PWM Method for Immunizing Parameters Uncertainty in Distributed Parallel-Connected VSIs* [#19982]

Tao Xu, Feng Gao, Tianqu Hao, Kangjia Zhou and Futian Qin, Shandong University, China

**11:20AM** *Reduced Voltage Stress Thirteen-Level Extendable Switched Capacitor Multilevel Inverter* [#20062]

Abhinandan Routray, Kharan Shiluveru, Akash Singh, Rajeev Kumar Singh and Ranjit Mahanty, Indian Institute of Technology (BHU), Varanasi, India

**11:45AM** *Medium Voltage DC Bus Enabled by Series Connection of SiC Mosfet Based Three Port DC-DC Converters* [#20638]

Ritwik Chattopadhyay, Viju Nair, Srinivas Guler, Subhashish Bhattacharya and Paul R. Ohodnicki, NC State University, United States; National Energy Technology Laboratory, United States



**Microgrid Control 1**

Thursday, October 3, 10:30AM-12:10PM, Room: 343, Chair: Mauricio Cespedes, Thomas Podlesak

**10:30AM** *A Current Source Three-Phase AC-AC Converter using Current Unfolding and Active Damping Principles* [#20598]

N. Ha Pham, Tomoyuki Mannen and Wada Keiji, University of Technology, Sydney, Australia; University of Tsukuba, Japan; Tokyo Metropolitan University, Japan

**10:55AM** *Control Algorithms to Establish Hybrid AC/DC Distribution Systems Using Conventional Three Phase Inverters* [#20663]

Ali Elrayyah, Qatar Environment and Energy Research Institute, Qatar

**11:20AM** *Protection Coordination System Design for a Converter Dominated Standalone DC Microgrid* [#20414]

Md Rifat Kaiser Rachi, Mehnaz Akhter Khan and Iqbal Husain, North Carolina State University, United States

**11:45AM** *Enhanced Voltage Droop Control Strategy for DC Microgrid System with State Variable Feedback* [#20765]

Mohammad Noor Shaheed, Syed Mohammad Sifat Chowdhury, Yilmaz Sozer and De Abreu Garcia Alex, University of Akron, United States

**Microgrid Control 2**

Thursday, October 3, 10:30AM-12:10PM, Room: 345, Chair: Xiaoqiang Guo, Xin Zhang

**10:30AM** *Autotuning for Military Microgrids* [#19362]

Frank Bohn, Richard Bosse, Michael Gonzalez, Jaclyn Lynch, Thomas Podesak, Blane Wilson, Joseph Vitale, Stefan Siegfried and William Barnhill, U.S. Army C5ISR Center, United States; Parsons Alpha Advanced Systems, United States

**10:55AM** *A Distributed Economic Dispatch Algorithm for Islanding Microgrid Considering Unreliable Communication Links* [#20274]

Meiqin Mao, Chengqi He, Liuchen Chang and Yunhui Liu, Hefei University of Technology, China

**11:20AM** *Islanding of a Microgrid Using a Distributed Multi-Agent Control System* [#19692]

Mohamad Fares Al Jajeh, Geza Joos, Syed Qaseem Ali and Ilja Novickij, McGill University, Canada; OPAL-RT TECHNOLOGIES Inc., Canada

**11:45AM** *Development of a Converter Based Microgrid Test Platform* [#20542]

Dingrui Li, Yiwei Ma, Chengwen Zhang, He Yin, Ishita Ray, Yu Su, Lin Zhu, Fred Wang and Leon M Tolbert, The University of Tennessee, Knoxville, United States

**Hybrid AC/DC Microgrids**

Thursday, October 3, 10:30AM-12:10PM, Room: 342, Chair: Tsai-Fu Wu, Kai Sun

**10:30AM** *A Virtual Inertia Control Strategy of Interlinking Converters in Islanded Hybrid AC/DC Microgrid* [#19705]

Xiao Jingyi, Chen Alian, Lin Zhengyu and Xue Haihua, Shandong University, China; Aston University, United Kingdom

**10:55AM** *Mitigating Communication Delay Impact on Microgrid Stability Using a Compensator Based on Smith Predictor* [#19691]

Hadi Akbarihaghighat, Adel Nasiri and Necmi Altin, University of Wisconsin-Milwaukee-Center for Su, United States; UW-Milwaukee, United States

**11:20AM** *An Optimal-Oriented Quasi-Droop control of Interlinking Converter in Hybrid Microgrid* [#20438]

Fanfan Lin, Xiaochao Hou, Xin Zhang and Huanyue Liao, Nanyang Technological University, Singapore; Central South University, China

**11:45AM** *A Compact Interlinking Converter Modular for Hybrid AC/DC/DS Microgrids with a Decentralized Power Management Strategy* [#19741]

Zhang Zhe, Jin Chi, Dong Chaoyu, Lin Pengfeng, Tang Yi and Wang Peng, Nanyang Technological University, Singapore; Energy Research Institute at NTU, Singapore

**Applications of Electric Traction / Propulsion**

Thursday, October 3, 10:30AM-12:10PM, Room: 340, Chair: Subrata Saha, Gilsu Choi

**10:30AM** *Reduction of AM Radio Noise of a VVVF Inverter for an Electric Railway Car and a Simulation Model of Noise Current* [#19004]

Satoshi Azuma, Daisuke Itoh, Takahito Ishida, Kengo Sugahara and Shigeo Morimoto, Mitsubishi Electric Corp., Japan; Kindai University, Japan; Osaka Prefecture University, Japan

**10:55AM** *A Partial Capacity Converter for Advanced Co-phase Traction Power Supply System* [#19979]

Yujie Hu, Zixin Li, Ming Lei, Cong Zhao, Hang Zhang, Ping Wang and Yaohua Li, Institute of Electrical Engineering, CAS, China

**11:20AM** *A Transformerless Non Cascaded Quadratic-based Step-Down Converter Without Pulsating Input Current for Automotive Applications* [#19588]

Carlos Arturo Antuna-Fiscal, Ma Guadalupe Ortiz-Lopez, Jesus Leyva-Ramos and Luis Humberto Diaz-Saldierna, IPICYT, Mexico

**11:45AM** *Traction Power Inverter Design for EV and HEV Applications at General Motors: A review* [#20777]

Mohammad Anwar, Mohammed Alam, Sean Gleason and Jeff Setting, General Motors, United States

### Multilevel Converters Control

Thursday, October 3, 10:30AM-12:10PM, Room: 349, Chair: Pericle Zanchetta, Luca Solero

**10:30AM** *Current Control of a New Five-Level Nested T-type Converter with Model Predictive Control* [#19467]

Dianxun Xiao and Narimani Mehdi, McMaster University, Canada

**10:55AM** *Hybrid Model Predictive Control of Active-Neutral-Point-Clamped Multilevel Converters* [#19368]

Dehong Zhou, Zhongyi Quan and Yun Wei Li, University of Alberta, Canada

**11:20AM** *Deadbeat Control for Circulating Harmonic Currents Suppression of a Level-Increased NLM Based Modular Multilevel Converter* [#19894]

Xingxing Chen, Jinjun Liu, Shuguang Song, Shaodi Ouyang, Di Wang and Zhifeng Deng, Xi'an Jiaotong University, China

**11:45AM** *Novel Harmonic Control Method Combining Improved Nearest Level Control and Selective Harmonic Elimination Method* [#19634]

Yu Jin, Songda Wang, Qian Xiao, Yiqi Liu, Yunfei Mu, Ji Yanchao, Sanjay Kumar Chaudhary and Remus Teodorescu, Harbin Institute of technology, China; Aalborg University, Denmark; Tianjin University, China; Northeast Forestry university, China

### Multilevel Converters Applications 2

Thursday, October 3, 10:30AM-12:10PM, Room: 346, Chair: Po Tai Cheng, Wuhua Li

**10:30AM** *A Fault-Tolerant Hybrid Cascaded H-Bridge Topology* [#19465]

Haider Mhiesan, Yam Siwakoti and Alan Mantooth, University of Arkansas, United States; University of Technology Sydney, Australia

**10:55AM** *Three-Port Full-Bridge Cell for Multilevel Converters with Battery Energy Storage* [#20103]

Sebastian Neira, Javier Pereda, Michael Merlin and Felix Rojas, Pontificia Universidad Catolica de Chile, Chile; University of Edinburgh, United Kingdom; Universidad de Santiago de Chile, Chile

**11:20AM** *Multi-port Converter with Square-wave-voltage Multilevel Converter and Active Power Filter Connected in Series* [#20365]

Jun-ichi Itoh, Mitsuru Miyashita, Keisuke Kusaka, Yuichi Noge and Masaki Ishibashi, Nagaoka University of Technology, Japan; Tokyo University of Agriculture and Technology, Japan; Tokyo Metropolitan College of Industrial Tech., Japan

**11:45AM** *Failure Mode Analysis of the 3-Phase 5-Level E-Type Converter* [#20203]

Marco di Benedetto, Alessandro Lidozzi, Luca Solero, Petar Grbovic and Fabio Crescimbin, Roma Tre University, Italy; University of Innsbruck, Austria

### DC-DC Isolated Converter 4

Thursday, October 3, 10:30AM-12:10PM, Room: 347, Chair: Wenkang Huang, Kai Sun

**10:30AM** *Design and Implementation of a Dual-Input LLC Converter with Semi-Active Rectifiers for PV Applications* [#19277]

Xi Chen, Seyed Milad Tayebi and Issa Batarseh, University of Central Florida, United States; University of Texas at Austin, United States

**10:55AM** *Design and Implementation of Three-Level Half-Bridge Bidirectional CL3C Resonant DC Converter* [#19308]

Jun Xian Huang, Tsorng Juu Liang, Wei Jing Tseng and Zhao Wei Chen, National Cheng Kung University, Taiwan

**11:20AM** *High Frequency Transformer Core Loss Analysis in Isolated Modular Multilevel DC-DC Converter for MVDC Application* [#19700]

Rachit Agarwal, Sandro Martin, Yanjun Shi and Hui Li, Center for Advanced Power Systems, FSU, United States

**11:45AM** *A Zero-Current-Switched PWM Full Bridge DC-DC Converter* [#19305]

Anirban Pal and Kaushik Basu, Indian Institute of Science, Bangalore, India

### Power Converter EMI 1

Thursday, October 3, 10:30AM-12:10PM, Room: 350, Chair: Shuo Wang, Hong Li

**10:30AM** *Common-Mode EMI Comparison of NSPWM, DPWM1, and SVPWM Modulation Approaches* [#20694]

Yichao Zhang, Cong Li, Michael Schutten, Carlos Feliz De Leon and Satish Prabhakaran, GE global research center, United States

**10:55AM** *Active EMI Reduction Technique of Active Front End (AFE) Drives Based on Randomized Switching Frequency PWM* [#19603]

Zhe Zhang, Lixiang Wei, Peizhong Yi, Srikanta Murthy Puneeth and Cui Yujia, University of Connecticut, United States; Rockwell Automation, Inc, United States; Rockwell Automation, United States

**11:20AM** *Study on EMI failure of controller area network caused by a buck converter* [#19974]

Ryo Shirai and Toshihisa Shimizu, Tokyo Metropolitan University, Japan

**11:45AM** *Spread Spectrum Technique for Current-Fed LLC Resonant Converter with Tight Output Voltage Regulation* [#19618]

Mina Kim, Hwa-Pyeong Park and Jee-Hoon Jung, UNIST, Korea (South)

### Converter Control

Thursday, October 3, 10:30AM-12:10PM, Room: 328, Chair: Katherine Kim, Seth Sanders

**10:30AM** *Application of High Performance FPGA to Boost Bandwidth of SiC Shunt Active Power Filter* [#20727]

Li Yang, Yukun Luo, M.A. Awal, Wensong Yu and Iqbal Husain, North Carolina State University, United States

**10:55AM** *Drain-Source Synchronous Rectification Efficiency and Light-Load Stability Improvement through Multi-Level Turn-Off for LLC-based DC-DC Converters* [#19146]

Oscar Yu, Chih-Shen Yeh, Moonhyun Lee and Jih-Sheng Lai, Future Energy Electronics Center, Virginia Tech, United States

**11:20AM** *A Novel Dual-input Dual-output Converter and Dynamic Energy Management for PV/Battery Systems* [#19331]

Qingxin Tian, Guohua Zhou, Minrui Leng, Xianyan Fan and Tiesheng Yan, Southwest Jiaotong University, China; Xihua University, China

**11:45AM** *Design and Implementation of a Bipolar-Unipolar Switched Boundary Current Mode (BCM) Control GaN-Based Single-Phase Inverter* [#19949]

Kamal Sabi and Daniel Costinett, University of Tennessee, United States

### Grid-Connected Converter Control 1

Thursday, October 3, 10:30AM-12:10PM, Room: 348, Chair: Brendan McGrath, Toshihisa Shimizu

**10:30AM** *On the Control of a Solid State Transformer for Multi-MW Utility-Scale PV-Battery Systems* [#20661]

Yibin Zhang, Oluwaseun Akeyo, Jiangbiao He and Dan Ionel, University of Kentucky, United States

**10:55AM** *Efficiency Improvement of a Dual-Input LLC Converter for PV Applications using Burst-mode Control Strategy* [#19278]

Xi Chen, Seyed Milad Tayebi and Issa Batarseh, University of Central Florida, United States; University of Texas at Austin, United States

**11:20AM** *Virtual Friction Control for Power System Oscillation Damping with VSC-HVDC Links* [#20210]

Alberto Rodriguez-Cabero, Javier Roldan-Perez, Milan Prodanovic, Jon Are Suul and Salvatore D'Arco, IMDEA Energy Institute, Spain; SINTEF Energy Research, Norway

**11:45AM** *Model Predictive Control of Cascaded Multilevel Battery Assisted Quasi Z-Source PV Inverter with Reduced Computational Effort* [#19472]

Abderezak Lashab, Dezso Sera and Josep Guerrero, Aalborg University, Denmark

## **PMSM and Wound Field Synchronous Machines**

Thursday, October 3, 10:30AM-12:10PM, Room: 337, Chair: Rakib Islam, Rukmi Dutta

**10:30AM** *Comparative Analysis of Novel Fractional Slot Non-overlapping Winding Hybrid Excited Machines Having Different Consequent Pole Permanent Magnet Rotor Topologies* [#19239]

Shun Cai, Zi-Qiang Zhu, Srinivas Mallampalli, Jean-Claude Mipo and Sophie Personnaz, University of Sheffield, United Kingdom; Valeo, France

**10:55AM** *Multi-Material Magneto-Structural Topological Optimization of Wound Field Synchronous Machines* [#20275]

Feng Guo and Ian P. Brown, Illinois Institute of Technology, United States

**11:20AM** *Design of a Variable-Flux Permanent Magnet Machine using Alnico 9 and Comparison with a Baseline Interior Permanent Magnet Machine* [#20385]

Peng Peng and Julia Zhang, the Ohio State University, United States; The Ohio State University, United States

**11:45AM** *Self-Excited Diode Rectifying Wound-Field Synchronous Motor Utilizing Space Harmonics and Flux-Intensifying with Carrier Harmonics* [#20590]

Masahiro Aoyama and Toshihiko Noguchi, Shizuoka University, Japan

## **Switched Reluctance and Flux Switching Machines 2**

Thursday, October 3, 10:30AM-12:10PM, Room: 338, Chair: Takashi Kosaka, Rajesh Deodhar

**10:30AM** *Analytical Derivation of Phase Current Waveform for Eliminating Torque Ripple and Input Current Ripple of Switched Reluctance Motors under Magnetically Saturated Operation* [#19852]

Takayuki Kusumi, Kosuke Kobayashi, Kazuhiro Umetani and Eiji Hiraki, Okayama University, Japan

**10:55AM** *Investigate of a Flux Switching Permanent Magnet Machine with Alternative Flux Bridges* [#19817]

Ziyi Liang, Yuting Gao, Dawei Li and Ronghai Qu, Huazhong University of Science and Technology, China

**11:20AM** *Surface-Mounted and Flux-Switching PM Structures Trade-off for Automotive Smart Actuators* [#20008]

Mostafa Ahmadi Darmani, Poskovic Emir, Gerd Bramerdorfer, Silvio Vaschetto, Andrea Cavagnino and Alberto Tenconi, Politecnico di Torino, Italy; Universita' degli Studi di Padova, Italy; Johannes Kepler University Linz, Austria

**11:45AM** *Investigation of the Self-Cooling Characteristics of a Novel Flux-Switching Permanent Magnet Machine* [#20138]

Hao Ding, William Sixel, Lewis Handycardenas and Bulent Sarlioglu, WEMPEC, UW-Madison, United States; UW-Madison, United States

## **Electric Drives for Transportation**

Thursday, October 3, 10:30AM-12:10PM, Room: 336, Chair: Jiangbiao He, Di Pan

**10:30AM** *Design and Evaluation of a 150-kVA SiC-MOSFET-based Three-Level TNPC Phase-leg PEBB for Aircraft Motor Driving Application* [#20404]  
Zhao Yuan, Amol Deshpande, Balaji Narayanasamy, Hongwu Peng, Asif Imran Emon, Reece Whitt, Bakhtiyar Mohammad Nafis, Fang Luo and David Huitink, University of Arkansas, United States

**10:55AM** *A Band-Pass Based Position Filter for Electrical Machines Against Low-Order Harmonic Distortion* [#20176]  
Annegret Klein-Hessling, Iliya Ralev and Rik W. De Doncker, RWTH Aachen University, Germany

**11:20AM** *Brushless Fast Starter for Automotive Start/Stop Application* [#20121]  
Lei Hao, Chandra Namuduri, Suresh Gopalakrishnan, Chunhao Lee and Neeraj Shidore, General Motors, United States

**11:45AM** *Advanced Control of Matrix Converter Drive with Active Damping of the Input Resonance* [#20679]

Galina Mirzaeva, Graham Goodwin, Pericle Zanchetta, Liliana De Lillo and Lee Empringham, The University of Newcastle, Australia; the University of Nottingham, United Kingdom; The University of Nottingham, United Kingdom

### Model Predictive Control for Electric Drives

Thursday, October 3, 10:30AM-12:10PM, Room: 339, Chair: Shafiq Ahmed Odhano, Yukai Wang

**10:30AM** *Sequential MPC Strategy for High Performance Induction Motor Drives: a detailed analysis* [#20740]  
Valerio Vodola, Shafiq Ahmed Odhano, Margarita Norambuena, Cristian Garcia, Silvio Vaschetto, Pericle Zanchetta, Jose Rodriguez and Radu Bojoi, Politecnico di Torino, Italy; The University of Nottingham, United Kingdom; Universidad Tecnica Federico Santa Maria, Chile; Universidad de Talca, Curico, Chile; Universidad Andres Bello, Santiago, Chile

**10:55AM** *A Modulated Model Predictive Torque and Flux Trajectories Control for IPMSM Drives* [#20481]  
S M Showybul Islam Shakib, Dan Xiao, Rukmi Dutta, Kazi Saiful Alam, Ilham Osman and M. F. Rahman, University of New South Wales (UNSW), Australia

**11:20AM** *An Error Tracking Dead-Beat Model Predictive Torque Control for Open-Winding Permanent Magnet Synchronous Motor with Common DC Bus* [#19324]

Yifei Cheng, Dan Sun, Wenhan Chen and Heng Nian, College of EE, Zhejiang University, China

**11:45AM** *On-line Continuous Control Set MPC for PMSM drives current loops at high sampling rate using qpOASES* [#19555]

Francesco Toso, Paolo Gherardo Carlet, Andrea Favato and Silverio Bolognani, University of Padova, Italy

### Magnetic Component and Modeling

Thursday, October 3, 10:30AM-12:10PM, Room: 329, Chair: Shuo Wang, Maeve Duffy

**10:30AM** *Integrated Matrix Transformer with Optimized PCB Winding for High-Efficiency High-Power-Density LLC Resonant Converter* [#20405]  
Shuo Wang, Hongfei Wu, Fred Lee and Qiang Li, Virginia Tech, United States; Nanjing Univ. of Aeronautics and Astronautics, China

**10:55AM** *Soft Magnetic Materials Characterization for Power Electronics Applications and Advanced Data Sheets* [#19946]  
Seung Ryul Moon, Paul Ohodnicki, Kevin Byerly and Richard Beddingfield, National Energy Technology Laboratory, United States; ORISE fellow at NETL, United States

**11:20AM** *Improved Inductance Calculation in Variable Power Inductors by Adjustment of the Reluctance Model through Magnetic Path Analysis* [#20152]

Sarah Saeed, Jorge Garcia, Marina S. Perdigao, Valter S. Costa, Bruno Baptista and Andre M. S. Mendes, University of Oviedo, Spain; Instituto de Telecom., Polytechnic - ISEC, Portugal; Instituto de Telecom., Universidade de Coimbra, Portugal; WEGeuro - Industria Electrica, Portugal

**11:45AM** *Data-driven Leakage Inductance Modeling of Common Mode Chokes* [#19579]

Zhou Dong, Ren Ren, Bo Liu and Fred Wang, University of Tennessee, United States

### Gate Drive for Wide Band Gap Device 2

Thursday, October 3, 10:30AM-12:10PM, Room: 341, Chair: Maja Harfman Todorovic, Dong Jiang

**10:30AM** *Gate Drive for Very Fast Resonant Conversion using SiC Switch [#19483]*

Zikang Tong, Lei Gu, Kawin Surakitbovorn and Juan Rivas-Davila, Stanford University, United States

**10:55AM** *Variable voltage smart gate driver for fast switching and cross-talk suppression of SiC MOSFET [#20295]*

Chunhui Liu, Zhengda Zhang, Yunpeng Si, Yifu Liu and Qin Lei, Arizona State University, United States

**11:20AM** *Development and Verification of Protection Circuit for Hard Switching Fault of SiC MOSFET by Using Gate-Source Voltage and Gate Charge [#19419]*

Shinya Yano, Yusuke Nakamatsu, Takeshi Horiguchi and Shinnosuke Soda, Mitsubishi Electric Corp., Japan

**11:45AM** *Voltage Balancing of Four Series-Connected SiC MOSFETs under 2 kV Bus Voltage using Active dv/dt Control [#20410]*

Emma Raszmann, Keyao Sun, Rolando Burgos, Igor Cvetkovic, Jun Wang and Dushan Boroyevich, Virginia Tech, United States

**Special Session: The Role of Simulation Software for Power Electronics Control Design in Education - B**

Thursday, October 3, 10:30AM-12:10PM, Room: 327, Chair: Tony Lennon

**Thursday, October 3, 2:10PM-3:50PM****Topics in PV-Battery Systems**

Thursday, October 3, 2:10PM-3:50PM, Room: 344, Chair: Rangarajan Tallam, Hengzhao Yang

**2:10PM** *Robust Allocation of Residential Solar Photovoltaic Systems Paired with Battery Units in South Australia [#19333]*

Mehrdad Aghamohamadi, Amin Mahmoudi and Mohammed Hamidul Haque, Flinders University, Australia; University of South Australia, Australia

**2:35PM** *A Symmetric Transformerless Hybrid Converter with Leakage Current Suppression [#19519]*

Zhongting Tang, Yongheng Yang, Mei Su, Hua Han and Frede Blaabjerg, Central South University, China; Aalborg University, Denmark

**3:00PM** *Flexible Control for PV Integrated Battery Energy Storage System [#19608]*

Yashi Singh, Bhim Singh and Sukumar Mishra, IIT Delhi, India; IIT DELHI, India

**3:25PM** *Battery Lifetime Analysis for Residential PV-Battery System used to Optimize the Self Consumption - A Danish Scenario [#20181]*

Didier Farinet, Mathias Maurer, Luca Vacca, Sergiu Spataru and Daniel-Ioan Stroe, Aalborg University, Denmark

**Topics in Alternative Energy Systems**

Thursday, October 3, 2:10PM-3:50PM, Room: 329, Chair: Ke Ma, David Dorrell

**2:10PM** *A Multifunctional Reduced Sensor Control for Grid-Interfaced Dual VSC Based Doubly Fed Induction Generator [#19908]*

Souvik Das, Sambasivaiah Puchalapalli and Bhim Singh, Indian Institute of Technology, Delhi, India

**2:35PM** *A Power Management Circuit for an Impact-type Piezoelectric Micro-wind Energy Harvester [#19938]*

Nan Chen, Tingcun Wei and Liu Yang, Northwestern Polytechnical University, China

**3:00PM** *Hybrid Fuel Cell/Supercapacitor using a series converter [#19804]*

Apinya Siangsanoth, Wattana Kaewmanee, Roghayeh Gavagsaz Ghoachani, Matheepot Phattanasak, Mathieu Weber, Jean-Philippe Martin, Serge Pierfederici and Sophie Didierjean, Universite de Lorraine, France; King Mongkut's University of Technology North Ba, Thailand; Shahid Beheshti University, Iran

**3:25PM** *Optimal Variable Load Scheduling for Hybrid Energy Systems [#20254]*

Avinash Rajendra, Jun Zhang and Adel Nasiri, University of Wisconsin-Milwaukee, United States

### Converters for Renewable Energy Systems

Thursday, October 3, 2:10PM-3:50PM, Room: 342, Chair: Junichi Itoh, Fei Gao

**2:10PM** *A Four-port Bidirectional DC-DC Converter for Renewable Energy-Battery-DC Microgrid System* [#20311]

Jiahong Ning, Jianwu Zeng and Xia Du, Minnesota State University, Mankato, United States

**2:35PM** *Transformerless Minimum Phase Interleaved Hybrid Converter with Low Leakage Current* [#20229]

Simanta Samal, Rajeev Kumar Singh and Ranjit Mahanty, IIT(BHU), India

**3:00PM** *A Novel Solar PV Inverter Topology Based on an LLC Resonant Converter* [#19693]

Necmi Altin, Saban Ozdemir and Adel Nasiri, University of Wisconsin-Milwaukee, United States

**3:25PM** *Grid Connection Power Converter and Speed Controller for Slip-Synchronous Wind Generators* [#19682]

Dillan Ockhuis and Maarten Kamper, University of Stellenbosch, South Africa

### V2G and G2V

Thursday, October 3, 2:10PM-3:50PM, Room: 343, Chair: Ali Emadi, Burak Ozpineci

**2:10PM** *A Day-Ahead Peak Shaving Strategy Using Aggregated Electric Vehicles* [#19769]

Khizir Mahmud, Animesh K. Sahoo and Jayashri Ravishankar, University of New South Wales, NSW 2052, Australia

**2:35PM** *DC Ripple Component Cancellation Method of Isolated AC-DC Converter with Matrix Converter for Input Current Harmonics Reduction* [#20479]

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

**3:00PM** *Analysis of Multi-Pickup Inductive Power Transfer System with LCC Compensation for Maglev Train* [#20580]

Shuo Wang, Zhenpo Wang, Junjun Deng, Ying Yang and David Dorrell, Beijing Institute of Technology, China; University of KwaZulu-Natal, South Africa

**3:25PM** *Time Synchronization and Encoded Wireless Gate Signal Transfer Method for High-power and Bi-directional Contactless Power Transfer System for V2G Application* [#19267]

Keisuke Ishikawa, Masanori Ishigaki, Kosuke Tahara, Makoto Kusakabe and Takahide Sugiyama, TOYOTA CENTRAL R&D LABS, Japan

### Modular Converters for Smart Grids

Thursday, October 3, 2:10PM-3:50PM, Room: 345, Chair: Bhim Singh, Srdjan Lukic

**2:10PM** *Tree-shaped networked control system for modular power converters with sub-us latency and ns-scale synchronization accuracy* [#19991]

Benoit Steinmann, Gabriel Fernandez and Nicolas Cherix, Development engineer, Switzerland; Senior development engineer, Switzerland

**2:35PM** *STATCOM Operation of Parallel-Hybrid Modular Multilevel Converter* [#20538]

Ibhan Chandrath, Siba Kumar Patro and Anshuman Shukla, Indian Institute of Technology Bombay, India

**3:00PM** *Low Loss Submodule Cluster for Modular Multilevel Converters Suitable for Implementation with SiC MOSFETs* [#19401]

Keijo Jacobs, Stefanie Heinig, Baris Ciftci, Norrga Staffan and Nee Hans-Peter, KTH Royal Institute of Technology, Sweden

**3:25PM** *System-Level Power Loss Evaluation of Modular Multilevel Converters* [#19645]

Yi Zhang, Huai Wang, Zhongxu Wang, Frede Blaabjerg and Maryam Saeedifard, Aalborg University, Denmark; Georgia Tech, United States

### Other Topics in Transportation Electrification Applications

Thursday, October 3, 2:10PM-3:50PM, Room: 340, Chair: Arash Nassiri Bavili, Poria Fajri

**2:10PM** *A low-inductance sectional busbar for snubberless operation of SiC-based EV traction inverters* [#20497]

Srdjan Srdic, Chi Zhang and Srdjan Lukic, FREEDM Center at NC State, United States

**2:35PM** *Optimization of DC-Link Decoupling Snubber Circuit for SiC-based EV Traction Inverters* [#20513]

Chi Zhang, Srdjan Srdic and Srdjan Lukic, FREEDM Center at NC State, United States

**3:00PM** *Optimal Blending of Regenerative and Friction Braking at Low Speeds for Maximizing Energy Extraction in Electric Vehicles* [#19455]

Shoeib Heydari, Poria Fajri, Reza Sabzehgar and Arash Asrari, University of Nevada, Reno, United States; San Diego State University, United States; Southern Illinois University, United States

**3:25PM** *FPGA Based High Bandwidth Motor Emulator for Interior Permanent Machine Utilizing SiC Power Converter* [#19536]

Yukun Luo, Ma Awal, Li Yang, Wensong Yu and Iqbal Husain, North Carolina State University, United States

### DC-DC Isolated Converter 5

Thursday, October 3, 2:10PM-3:50PM, Room: 347, Chair: Somasundaram Essakiappan, Hidemine Obara

**2:10PM** *Voltage control method with Non-linear Compensation and DC-offset Elimination for One-leg T-type Dual Active Bridge Converter using multi-operation mode* [#20427]

Hayato Higa, Hiroki Watanabe, Keisuke Kusaka and Jun-ichi Itoh, Meidensha Corporation, Japan; Nagaoka University of Technology, Japan

**2:35PM** *A Modulation Strategy Providing Efficiency Enhancement at Light Load for the DAB Converter with DC Blocking Capacitors* [#19192]

Peng Liu, Shanxu Duan and Hongsheng Hu, Huazhong University of Science and Technology, China

**3:00PM** *DCM Forward-Flyback Converter with Cockcroft-Walton Voltage Multiplier: steady-state analysis considering the influence of parasitic capacitances at very low power consumption and very high voltage gain* [#19341]

Juan A. Serrano, Pedro Alou and Jesus A. Oliver, Universidad Politecnica de Madrid, Spain

**3:25PM** *6.6 kW High-Frequency Full-Bridge LLC DC/DC Converter with SiC MOSFETs* [#19050]

Yuequan Hu, Jianwen Shao and Teik Siang Ong, Wolfspeed, A Cree Company, United States

### Modular Multilevel Converters 1

Thursday, October 3, 2:10PM-3:50PM, Room: 349, Chair: Milijana Odavic, Frank Bohn

**2:10PM** *A Hybrid Nine-arm Modular Multilevel Converter Based on Half-Bridge and Unidirectional Current Full-Bridge Submodule* [#19189]

Futian Qin, Feng Gao, Tao Xu, Decun Niu and Zhan Ma, Shandong University, China

**2:35PM** *A Novel Modular Multilevel Converter with Coupled-inductor Semi-bridge Submodules* [#19607]

Dan Lyu, Yichao Sun, Carlos Teixeira, Brendan McGrath, Grahame Holmes and Qi Wang, Nanjing Normal University, China; RMIT University, Australia

**3:00PM** *Operation Range Analysis and Capacitor Voltage Regulation of A Dual-AC-Terminal MMC based on Bifurcated-Arm Topology* [#19780]

Lin Jin, Zhiquan Dong, Yan Deng, Leyuan Zhou, Yi Lu and Yong Yang, Zhejiang University, China; State Grid Zhejiang Electric Power Research Inst, China; State Grid Zhejiang Electric Power Co. Ltd., China

**3:25PM** *On Facilitating the Modular Multilevel Converter Power Scalability Through Branch Paralleling* [#20083]

Stefan Milovanovic and Drazen Dujic, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

### Multilevel Converters

Thursday, October 3, 2:10PM-3:50PM, Room: 346, Chair: Richard Bosse, Marcello Pucci

**2:10PM** *Capacitor Voltage Balancing Control of a Modular Matrix Converter in Conditions of Startup and Low Output Frequency* [#19783]

Kota Yamamoto, Koki Muku and Takaharu Takeshita, Nagoya Institute of Technology, Japan

**2:35PM** *Circulating Currents Suppression and Neutral-Point Potential Balancing* [#20128]

Jiayu Zhou, Olorunfemi Ojo, Josiah Haruna and Fen Tang, Beijing Jiaotong University, China; Tennessee Tech University, United States; BeiJing Jiaotong University, China



**3:00PM** *A Predictive Submodule Choosing Algorithm for Soft-Switching Modular Multilevel Converters with Nearest Level Modulation Scheme* [#19477]  
Xueni Zhou, Lei Lin, Kai Hu, Chen Xu and Weihong Song, Huazhong University of Science and Technology, China

**3:25PM** *Arm-Current Sensor-less Control of MMC for Circulating Current Suppression* [#20199]  
Avinash Reddy and Anshuman Shukla, Indian Institute of Technology Bombay, India

### Grid-Connected Converter Control 2

Thursday, October 3, 2:10PM-3:50PM, Room: 348, Chair: Teuvo Suntio, Kyo-Beum Lee

**2:10PM** *An Accurate Power-flow Control Method with Harmonic Compensation in Voltage-source-inverter Grid-tied System* [#19514]  
Mingzhi Gao, Bodong Li, Bin Zhao, Yue Li and Miao Yu, Zhejiang University, China

**3:00PM** *Linear Current Controller With Fast Transient Response and Low Switching Frequency* [#20072]  
Diego Perez-Estevez and Jesus Doval-Gandoy, University of Vigo, Spain

**2:35PM** *High-Frequency Harmonic Current Control of Power Converters* [#19658]  
Sante Pugliese, Steffen Flacke, Zhixiang Zou and Marco Liserre, Kiel University, Germany

**3:25PM** *Compensation Alternatives for Power Sharing Errors in Multi-Port Converters for Hybrid DC/AC Microgrids* [#20667]  
Geber Villa, Sarah Saeed, Pablo Garcia, Carlos Gomez-Aleixandre and Ramy Georgious, University of Oviedo, Spain

### Power Converter EMI 2

Thursday, October 3, 2:10PM-3:50PM, Room: 350, Chair: Shuo Wang, Hong Li

**2:10PM** *An Improved Variable Switching Frequency Modulation Strategy for Three-Level converters with Reduced Conducted EMI* [#19034]  
Jianan Chen, Dong Jiang, Wei Sun, Zewei Shen and Yechi Zhang, Huazhong University of Science & Technology, China

**3:00PM** *Common-mode Current Analysis and Cancellation Technique for Dual Active Bridge Converter based DC System* [#20394]  
Saurabh Kumar, Sai Kiran Voruganti and Ghanshyamsinh Gohil, University of Texas at Dallas, United States

**2:35PM** *A Voltage-injected Active Gate Driver for Improving the Dynamic Performance of SiC MOSFET* [#20551]  
Hong Li, Yanfeng Jiang, Chao Feng and Zhichang Yang, Beijing Jiaotong University, China

**3:25PM** *Investigation of Radiated EMI in Non-isolated Power Converters with Power Cables in Automotive Applications* [#19825]  
Juntao Yao, Mohammed El-Sharkh, Yiming Li, Shuo Wang and Zheng Luo, University of Florida, United States; Monolithic Power Systems, Inc., United States

### Design Optimization

Thursday, October 3, 2:10PM-3:50PM, Room: 328, Chair: Sombuddha Chakraborty, Carl Ho

**2:10PM** *Optimal Design of the Resonant Tank of the Soft-Switching Solid-State Transformer* [#20255]  
Mickael J. Mauger, Prasad Kandula and Deepak Divan, Georgia Institute of Technology, United States

**2:35PM** *Levelized-Cost-of-Electricity-Driven Design Optimization for Medium-Voltage Transformerless Photovoltaic Converters* [#20401]  
Gab-Su Seo, Satyaki Mukherjee, Jinia Roy, Kyle Goodrick, Rahul Mallik, Branko Majmunovic, Soham Dutta, Dragan Maksimovic and Brian Johnson, National Renewable Energy Laboratory, United States; University of Colorado, United States; University of Washington, United States

**3:00PM** *Reduction of Low-Frequency Ripples in Single-Phase Switched Boost Inverter using Active Power Decoupling* [#19869]  
 Pramit Nandi and Ravindranath Adda, IIT Guwahati, India

**3:25PM** *An Auxiliary Resonant Switching Arm for a Buck-Boost Converter* [#20418]  
 Jose Alejandro Pichardo Iniesta, Ismael Araujo Vargas and Ilse Cervantes Camacho, Instituto Politecnico Nacional, Mexico

## Electric Machines: Diagnostics, Noise and Vibration 2

Thursday, October 3, 2:10PM-3:50PM, Room: 338, Chair: Shanelle Foster, Hamid Toliyat

**2:10PM** *On-Line Motor Insulation Capacitance Monitoring Using Low-Cost Sensors* [#19202]  
 Antonio Griffio, Igor Tsyokhla and Jiabin Wang, The University of Sheffield, United Kingdom; Sphere Fluidics, United Kingdom

**3:00PM** *An Improved Broadband Common-mode Electrical Machine Model for Online Condition Monitoring of Stator Insulation Degradation* [#19534]  
 Dayong Zheng and Pinjia Zhang, Tsinghua University, China

**2:35PM** *Remaining Useful Life Estimation of Stator Insulation Using Particle Filter* [#19371]  
 William Jensen and Shanelle Foster, Michigan State University, United States

**3:25PM** *Flux-based Detection of Non-adjacent Rotor Bar Damage in Squirrel Cage Induction Motors* [#19815]  
 Yonghyun Park, Hanchun Choi, Sang Bin Lee and Konstantinos Gyftakis, Korea University, Korea, Republic of; University of Edinburgh, Great Britain

## Permanent Magnet Machines 2

Thursday, October 3, 2:10PM-3:50PM, Room: 337, Chair: Sara Roggia, Khwaja Rahman

**2:10PM** *Line-Start Axial-Flux PM Motors: Introduction of a New Machine Topology* [#20031]  
 Solmaz Kahourzade, Amin Mahmoudi, Rahil Ravji and Wen Soong, University of Adelaide, Australia; Flinders University, Australia

**3:00PM** *Maximum Torque Per Ampere Control of Interior Permanent Magnet Synchronous Motor via Optimal Current Excitation* [#20166]  
 Taowen Chen, Pengyuan Chen, Jingchen Liang, Sen Li and Babak Fahimi, The University of Texas at Dallas, United States

**2:35PM** *Flux Weakening Surface Mounted Permanent Magnet Servo Motors Design with Enhanced Self-Sensing Properties* [#20097]  
 Huthaifa Flieh, Timothy Slininger, Shao-Chuan Chien, Li-Hsing Ku and Robert Lorenz, WEMPEC - University of Wisconsin Madison, United States; Motor Drive Solution BU, Delta Electronics, Inc, Taiwan

**3:25PM** *Multi-Harmonic Design and Optimization of PMSMs* [#20719]  
 Gerd Bramerdorfer, Stephan Lanser and Wolfgang Amrhein, Johannes Kepler University Linz, Austria; ASA Astroysteme GmbH, Austria

## Induction Motor Drives 2

Thursday, October 3, 2:10PM-3:50PM, Room: 339, Chair: Thomas Wolbank, Giacono Scelba

**2:10PM** *Torque Ripple Reduction in Stator Resistance Estimation using DC Current Injection for Induction Motor Sensorless Drives* [#19836]  
 Jiwon Yoo, Joohyun Lee, Seung-Ki Sul and Noor Aamir Baloch, Seoul National University, Korea, Republic of; Yaskawa Electric Corporation, Japan

**3:00PM** *Control of Five-Phase Open-End Induction Machine Drive Topology with Floating Capacitors at optimized DC Voltage* [#19584]  
 Xiangwen Sun, Zicheng Liu, Dong Jiang and Wubin Kong, Huazhong University of Science and Technology, China

**2:35PM** *Guidelines for Selecting Minimum Capacitance for a Floating Bridge Dual Inverter Drive* [#19234]  
 Chatumal Perera, Gregory J. Kish and John Salmon, University of Alberta, Canada

**3:25PM** *Speed Adaptive Voltage Closed-Loop Field-Weakening Control for Induction Motor Drives* [#19206]  
 Bo Wang, Jing Zhang, Yong Yu, Xu Zhang and Dianguo Xu, Harbin Institute of Technology, China

**Switched Reluctance Motor Drives**

Thursday, October 3, 2:10PM-3:50PM, Room: 336, Chair: Prerit Pramod, Zhe Zhang

**2:10PM** *Modeling of a Bearingless Synchronous Reluctance Motor With Combined Windings* [#19931]  
Maksim Sokolov, Wolfgang Gruber, Seppo Saarakkala and Marko Hinkkanen, Aalto University, Finland; Johannes Kepler University Linz, Austria

**2:35PM** *Current Harmonics Injection Method for Simultaneous Torque and Radial Force Ripple Mitigation to Reduce Acoustic Noise and Vibration in SRM* [#20772]

Omer Gundogmus, Yilmaz Sozer, Lavanya Vadamodala, John Kutz, Joshua Tylanda and Ronnie Wright, University of Akron, United States; DCS Corporation, United States; TARDEC, United States

**3:00PM** *Flux Profiling Control-Based Noise and Vibration Reduction of SR Motor for Automobile Traction Drive* [#19499]

Takashi Kosaka, Sungyong Shin, Soshi Morishita, Daisuke Mizutani, Hiroaki Matsumori and Nobuyuki Matsui, Nagoya Institute of Technology, Japan

**3:25PM** *Small Signal Model of Mutually Coupled Switched Reluctance Motors Based on Net Flux Method* [#20734]

Siddharth Mehta, Iqbal Husain, Prerit Pramod and Md Ashfanoo Kabir, North Carolina State University, United States; Nexteer Automotive, United States; ABB Corporate Research, United States

**Advanced Material and Passive Devices**

Thursday, October 3, 2:10PM-3:50PM, Room: 341, Chair: Mona Ghassemi, Jon Zhang

**2:10PM** *Loss and Thermal Modeling of Metal Oxide Varistors (MOV) Under Standard Current Surge Mission Profile* [#19923]

Ionut Vernica, Per Thastrup Jensen, Huai Wang, Francesco Iannuzzo, Susanne Otto and Frede Blaabjerg, Aalborg University, Denmark; FORCE Technology, Denmark; Aalborg University, Denmark

**2:35PM** *Computationally Efficient Estimation of the Electric-Field Maximums for the MFT Insulation Coordination* [#19399]

Marko Mogorovic and Drazen Dujic, PEL, EPFL, Switzerland

**3:00PM** *Nonlinear Resistive Electric Field Grading in High-Voltage, High-Power Wide Bandgap Power Module Packaging* [#20460]

Maryam Mesgarpour Tousi and Mona Ghassemi, Virginia Polytechnic Institute and State University, United States

**3:25PM** *Design of Low Inductance Busbar for 500 kVA Three-Level ANPC Converter* [#19585]

Handong Gui, Ruirui Chen, Jiahao Niu, Zheyu Zhang, Fred Wang, Leon M. Tolbert, Daniel Jes Costinett, Benjamin J. Blalock and Benjamin B. Choi, University of Tennessee, Knoxville, United States; Clemson University, United States; NASA Glenn Research Center, United States

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