

2024 IEEE Energy Conversion Congress and Exposition (ECCE 2024)

**Phoenix, Arizona, USA
20-24 October 2024**

Pages 1-552



**IEEE Catalog Number: CFP24ECD-POD
ISBN: 979-8-3503-7607-4**

**Copyright © 2024 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

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

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

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

IEEE Catalog Number:	CFP24ECD-POD
ISBN (Print-On-Demand):	979-8-3503-7607-4
ISBN (Online):	979-8-3503-7606-7
ISSN:	2329-3721

Additional Copies of This Publication Are Available From:

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

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

Topic A: Sustainable Energy, Energy Storage and Power-to-X Technologies

Oral Session 1: Converters for Renewable Grid Integration

Chair(s): Vikram Roy Chowdhury, Rahul Mallik

High Gain Single-Phase Three-Level Boost AC-DC Converter with Inherent Output Voltage Balancing [#353]	1
The Tien Nguyen ¹ , Caisheng Wang ¹ , Yuqi Wang ¹ , Jianghai (Ocean) Xiao ² ¹ Wayne State University, United States; ² The ISF Academy, Hong Kong	
A Novel Transformer-Less Buck-Boost Inverter with Coupled Inductor for Photovoltaic Systems [#371]	6
Yunfeng Xu ¹ , Weimin Wu ² , Houqing Wang ³ , Frede Blaabjerg ⁴ , Mohamed Orabi ⁵ , Liang Yuan ² ¹ Shanghai Maritime University, China; ² Anhui University of Science & Technology, China; ³ University of Arkansas, United States; ⁴ Aalborg University, Denmark; ⁵ Aswan University, Egypt	
A SHE-TPWM Scheme for High-Power Medium-Voltage Current Source Converters [#447]	12
Martti Muzyka ¹ , Zijian Wang ¹ , Qiang Wei ¹ , Navid Zargari ² ¹ Lakehead University, Canada; ² Rockwell Automation, Canada	
Novel Single-Phase High Boost Common-Ground Inverter [#456]	17
Frederick Nana Oppong ¹ , Ashraf Ali Khan ¹ , Hafiz Furqan Ahmed ² , John Quaicoe ¹ ¹ Memorial University of Newfoundland, Canada; ² National Sun Yat-sen University, Taiwan	
Soft-Switched Single-Stage Single-Phase Resonant DC-AC Converter Operated at Fixed Switching Frequency [#1400]	23
Sanjeet Singh ¹ , Anirban Pal ² , Kaushik Basu ¹ ¹ Indian Institute of Science, India; ² GE Aerospace, India	

Oral Session 12: Control for Renewable Energy Systems

Chair(s): Jinia Roy, Dinesh Kumar

A Coordinated Start-Up Strategy for the DR-MMC based Offshore Wind Power Transmission System [#53]	28
Lu Chen, Wenjie Chen, Zhixiang Li, Jinyu Wang, Chenyu Guo, Mengjie Qin, Bobo Zhang, Wenjie Du Xi'an Jiaotong University, China	

Design and Control of a 2-kV/5.5-kVA Three-Phase Four-Level Flying Capacitor Power Factor Correction using 1.2-kV SiC MOSFETs [#457]	34
Van-Quy Le ¹ , Chi-Yuan Feng ² , Yao-Cheng Tien ² , Teng-Qi You ³ , Yun-Yen Chen ¹ , Yu-Chen Chang ¹ , Huang-Jen Chiu ¹	
¹ National Taiwan University of Science & Techno, Taiwan; ² LITEON Technology, Taiwan; ³ Delta Electronics, Taiwan	
Droop-Based Decentralized Input Voltage Sharing Control Method for Input-Series Output-Parallel DC-DC Converter Station [#1559]	42
InJe Park ¹ , Dong Dong ² , Sungmin Kim ¹	
¹ Hanyang University, Korea ² Virginia Polytechnic Institute & State University, Electrical & Computer Engineering, United States	
Adaptive Current Control in a Multi-Port Converter for Reduced Current Ripple and Improved System Performance in Wave Energy Generation [#1044]	50
Al Raji Billah, Muhammad Abdelraziq, Zeljko Pantic, Iqbal Husain North Carolina State University, United States	
Active Power Decoupling to Minimize Module Capacitance and Circulating Current in Modular Multilevel Converters [#331]	57
Rafael Castillo-Sierra ¹ , Jinia Roy ²	
¹ Universidad del Norte, Colombia; ² University of Wisconsin-Madison, United States	
 Poster Session 1: Renewable Energy Integration	
Chair(s): Bowen Yang	
Lifespan Dependence of Power Converters in Wind Energy Systems [#90]	65
Matias Parra ¹ , Carlos A. Reusser ¹ , Samir Kouro ² , Abraham M. Alcaide ³	
¹ Pontifical Catholic University of Valparaiso, Chile; ² Federico Santa María Technical University, Chile; ³ Universidad de Sevilla, Chile	
DMROGI-mEPLL based Position Sensorless Disturbance Immune Control of a Wind and Solar Energy Driven Microgrid amidst Abnormal Grid [#339]	73
Subhadip Chakraborty, Bhim Singh, B.K. Panigrahi, Souvik Das, Suvom Roy Indian Institute of Technology Delhi, India	
Practical Design and Implementation of PV AC Module based on Hybrid Microinverter [#899]	81
Mohammad Nilian, Reza Rezaii, Issa Batarseh University of Central Florida, United States	
Photovoltaic Array Mismatch Analysis for Differential Power Processing Systems using Real-World Data [#1490]	86
Kai En Loo, Katherine A. Kim National Taiwan University, Taiwan	
Parameter Extraction Algorithm for PV Panel using Mid Frequency Data Points [#1128]	93
Kallol Biswas, Iram Sifat, Sung-Yeul Park, John Ayers, Alexander Agrios University of Connecticut, United States	

A GaN based Microinverter with a Hard Switched Full Bridge Sinusoidal Pulse Width Modulated DC-AC Stage [#536]	97
Harsha Ademane, Rosario Attanasio, Gianni Vitale <i>STMicroelectronics, United States</i>	
Power Balancing Strategy for Cascaded H-Bridge PV Inverter with an Auxiliary Module [#1360]	105
Saleh Farzamkia, Houshang Salimian Rizi, Alex Q. Huang <i>The University of Texas at Austin, United States</i>	
An Optimal Control Strategy for Single-Stage Dual-Bridge Series Resonant Microinverters [#448]	111
Lei Wang, Jinghang Li, Hangyu Wang, Sinan Li <i>University of Sydney, Australia</i>	
Single-Phase Grid Forming Control Strategy with Offset Elimination for V2X Implementation in Smart EV Battery Chargers [#529]	116
Erick Pantaleon ¹ , Damian Sal y Rosas ² , Julio Tafur ¹ <i>¹Pontificia Universidad Católica del Perú, Peru; ²Université de Toulouse, France</i>	
Reactive Power-Oriented Optimization Approach to Extend the ZVS Range of the DC-DC DABs at Light Load Operation [#743]	123
Payam Morsali, Ayan Mallik <i>Arizona State University, United States</i>	
A Multi-Port Integrated Topology Architecture for User-Side Fuel Cell Microgrid Systems [#833]	131
Ruixuan Wang, Shangzhi Pan, Qiyan Hu, Zisen Lin, Jinwu Gong, Xiaoming Zha <i>Wuhan University, China</i>	
Symmetric LCL Filter and Zero-Sequence Control for Accurate Filter Current Emulation in Four Quadrant Pump-Back Test [#1518]	138
Haoyu Chen ¹ , Hongyu Lin ¹ , Chunjiang Jia ² , Chong Ng ² , Hao Feng ¹ , Li Ran ³ <i>¹Chongqing University, China; ²Offshore House, United Kingdom; ³University of Warwick, United Kingdom</i>	
Data-Driven Estimation of Grid Voltage Phase Angle through di/dt Analysis for Hysteresis-Controlled Single Phase Inverter [#1698]	144
Hector Akuta, Yuan Li <i>Florida State University, United States</i>	
Modular Design of Solid-State Transformer with High Flexibility [#1756]	149
Zhuxuan Ma, Hui Cao, Yue Zhao <i>University of Arkansas, United States</i>	
Multi-Agent Reinforcement Learning Control Strategy for a Neutral-Point Clamped Power Converter, Maintaining Reliable Wind Energy Conversion System [#463]	156
Yazdan H. Tabrizi, M. Nasir Uddin <i>Lakehead University, Canada</i>	

Oral Session 24: Multiport Converters for Renewable Energy

Chair(s): Weihang Yan, Liliana de Lillo

Modeling and Implementation of a Wave Energy Converter Emulator for Testing Multi-Port Power Converters in a Marine DC Microgrid [#1122] 164

Amiya Haque, Zeljko Pantic, Iqbal Husain
North Carolina State University, United States

Enhanced PV-ESS Integration via Triple Active Bridge Interface in Modular Multilevel Converter-Based STATCOM [#1616] 170

Hamdan Alosaimi, Hadhlul Aladhyani, Osamah Aljumah, Sulaiman Alshammari,
Vasishtha Burugula, Subhashish Bhattacharya
North Carolina State University, United States

Wye-Asymmetric Extended-Delta based Three Phase Dual Active Bridge with Expanded Range of Soft Switching under Triple Phase Shift Control [#1460] 177

Mohamed Mansour, Joseph Olorunfemi Ojo
Tennessee Tech University, United States

A Novel Optimized Switch Count and High Voltage Gain Transformerless Inverter for Solar PV Application [#1779] 185

Phani Kumar Chamarthi¹, Shailendra Singh¹, Nicholas Gregory Baltas¹, Jun Cao¹, David Pera¹,
Pedro Rodriguez^{1,2,3}
¹Luxembourg Institute of Science & Technology, Luxembourg; ²Technical University of Catalonia, Spain; ³University of Luxembourg, Luxembourg

Triple-Phase-Shift Modulated Dual Active Bridge based Single-Stage Medium Voltage AC to Low Voltage DC Converter [#1378] 191

Harisyam PV, Surjakanta Mazumder, Saichand Kasichayanula, Shashidhar Mathapati, Kaushik Basu
¹Indian Institute of Science, India; ²Delta Electronics, Inc., India

Poster Session 2: Converters for Renewable Energy Systems

Chair(s): Minghui Lu

Design and Analysis of a High-Gain, Transformerless DC-DC Converter [#307] 197

Ahmed Allehyani
University of Jeddah, Saudi Arabia

Ultra Robust 1MHz Multi-Sampling Deadbeat Control for Megawatt-Class Grid-Tied Multi-Level Inverter with LC Type Output Filter Configuration using C-HIL [#738] 204

Kaya Kawashima¹, Shinnosuke Kubo¹, Hidayat Kreszens¹, Kohsuke Seki², Kenta Yamabe²,
Tomoki Yokoyama¹
¹Tokyo Denki University, Japan; ²TMEIC, Japan

Research on Bidirectional Quasi-Z-Source Nine-Switch Multiport Converter and Control Strategy for Direct-Drive Wave Power Generation System [#237] 210

Huang Lei¹, Wang Shixiang¹, Ma Ruiyang², Pan Baoyi¹, Mou Zihao¹, Tan Peiwen¹
¹Southeast University, China; ²State Grid Taizhou Power Supply Company State Grid, China

Novel Three-Phase PLL with per Phase Grid Angle Tracking Capability for Shunt-Connected Solar Microinverter [#1085]	217
Roshan Varadharajan ¹ , Avinash Dornala ² , Kangbeen Lee ² , Woongkul Lee ²	
¹ Michigan State University, United States; ² Purdue University, United States	
Hybrid Power Control of Full-Power Converter Variable-Speed Pumped Storage System for Oscillation Suppression [#265]	224
Kaihsun Chuang ¹ , Lijie Ding ² , Pengyu Pan ² , Yihang Luan ¹ , Xiaoming Zha ¹ , Jianjun Sun ¹	
¹ Wuhan University, China; ² State Grid Sichuan Electric Power Company, China	
Modular LLC Resonant Converters with New Active Voltage Doublers based Output Voltage Balancers for MVDC Distributed PV Systems [#1855]	231
Kajanan Kanathipan ¹ , Mehdi Abbasi ¹ , Muhammad Ali Masood Cheema ² , John Lam ¹	
¹ York University, Canada; ² Northern Transformer, Canada	
Investigating the Effect of Transport Delay on the Grid Current THD of Single-Phase Converters using Proportional-Resonant Controllers [#730]	234
Sobhan Mohamadian ¹ , Amir Ghasemian ² , Concettina Buccella ¹ , Carlo Cecati ¹	
¹ University of L'Aquila, Italy; ² Polytechnic University of Bari, Italy	
Modular Multilevel Converter (MMC) based Direct Tapping Method for High Voltage DC Transmission Networks [#1533]	240
Sulaiman Alshammari ¹ , Mohammed Alharbi ² , Vasishta Burugula ¹ , Hamdan Alosaimi ¹ , Hadhlul Aladhyani ¹ , Subhashish Bhattacharya ¹	
¹ North Carolina State University, United States; ² King Saud University, Saudi Arabia	
Enhanced Startup and Synchronization Transients for Virtual-Oscillator Grid-Tie Inverters using Predictive Feedback-Based Method [#533]	247
Shumeng Wang ¹ , Uthandi Selvarasu ¹ , Mahshid Amirabadi ¹ , Yuan Li ² , Brad Lehman ¹	
¹ Northeastern University, United States; ² Florida State University, United States	
Common Mode Voltage Reduction of a Modified Three-Phase Inverter [#662]	255
Kotb B. Tawfiq, Hatem Zeineldin, Ahmed Al-Durra, Ehab F. El-Sadaany	
Khalifa University, United Arab Emirates	
Fault Ride-Through for Cascaded Inverters using Mixed Grid-Forming and Grid-Following Control [#1196]	261
R. Mallik, D. Chatterjee, B. Johnson	
The University of Texas at Austin, United States	
Double Line Frequency Voltage Ripple Reduction Control Strategy for Dual-Active-Bridge in DC/AC System [#1383]	269
Hui Cao, Houqing Wang, Peyman Darvish, Liyang Du, Zhenqi Wang,	
Yushi Yang, Zhuxuan Ma, Yue Zhao	
University of Arkansas, United States	
DC-Link Voltages Digital Sampling for Cascaded H-Bridge Rectifiers with Single Voltage Sensor under Hierarchical Model Predictive Control [#757]	276
Yushi Yang, Hui Cao, Yue Zhao	
University of Arkansas, United States	

Poster Session 3: Energy Storage

Chair(s): Kaushik Basu

Modeling and Control Analysis of Parallel Triple Active Bridge Converters Integrating PV and ESS for a DC Microgrid [#1546]	281
Osamah Aljumah, Shubham Dhiman, Vasishta Burugula, Shrivatsal Sharma, Subhashish Bhattacharya North Carolina State University, United States	
Control of Multiport Series Resonant Converters for Green Hydrogen Production Systems [#704]	286
Lukas Antonio Budiwicaksana, Dong-Choon Lee Yeungnam University, Korea	
Real-Time ZVS Range Improvement for a Single-Stage Series-Resonant AC-DC Converter [#1623]	293
Huanghaohe Zou, Mafu Zhang, Saleh Farzamkia, Ruiyang Yu, Alex Q. Huang The University of Texas at Austin, United States	
Electro-Thermal Co-Design for ANPC-DAB Converter with Triple-Phase-Shift Modulation Strategy [#1464]	300
Zhenqi Wang, Hui Cao, Yue Zhao University of Arkansas, United States	
Fast Charging of Liquid Metal Batteries [#267]	306
Xianbo Zhou, Haomiao Li, Kangli Wang, Kai Jiang Huazhong University of Science & Technology, China	
Multiple Indicators Fusion-Based Health Prognostic for Battery Tray using Long Short-Term Memory Algorithm [#1677]	312
Taehyeon Gong ¹ , Jaehyeong Lee ¹ , Sungjun Lee ¹ , Seunghyun Lee ¹ , Yura Kim ¹ , Ganghyeon Kook ¹ , Woonki Na ² , Jonghoon Kim ¹ ¹ Chungnam National University, Korea; ² California State University, United States	
Converter-Governor Cooperative Control Strategy of Full-Power Variable Speed Pumped Storage Units for Frequency Response Characteristics Improvement [#281]	317
Yihang Luan, Minxuan Peng, Kaihsun Chuang, Yuanzhi Zhang, Jianjun Sun, Xiaoming Zha Wuhan University, China	
Optimizing Grid Regulation with Gravity Storage Systems: A Comparative Analysis with Different Motor Inertias [#1068]	323
Shubham Sundeep ¹ , Latha Sethuraman ¹ , Dayo Akindipe ¹ , Lee Jay Fingersh ¹ , Zach Wenrick ² , Aaron Munoz ² ¹ National Renewable Energy Laboratory, United States; ² Renewell Energy, United States	
A Novel Y-Connection Single Stage Three Phase Active-Half-Bridge AC-DC Series-Resonant Converter [#1679]	331
Huanghaohe Zou, Mafu Zhang, Saleh Farzamkia, Alex Q. Huang The University of Texas at Austin, United States	

Oral Session 35: Energy Storage I

Chair(s): Luca Vancini, Behrooz Mirafzal

A Novel Solar Energy Conversion using Supercapacitor Swapping Technology [#1073] 338

Kavishka Dissanayake¹, Dulsha Kularatna-Abeywardana¹, Nitish Patel¹, Nihal Kularatna²

¹University of Auckland, New Zealand; ²University of Waikato, New Zealand

A Comparison of Battery Charge Controller Technologies for Wave Energy Converters [#1744] 346

Alec Schnabel, Ben McGilton

National Renewable Energy Laboratory, United States

Current Source Inverter Drive of an Ironless Motor for Flywheel Batteries [#318] 354

Giada Sala¹, Claudio Bianchini¹, Mattia Vogni¹, Elena Macrelli², Alberto Bellini²

¹University of Modena & Reggio Emilia, Italy; ²Università di Bologna, Italy

Computationally Efficient Formulation of Flywheel Energy Storage System Components for Real-Time Power Systems Simulation [#422] 359

Damian Vilchis-Rodriguez, Ognjen Marjanovic, Robin Preece, Mike Barnes

The University of Manchester, United Kingdom

Optimal Management of a Modular Second-Life Battery with Optimal Reference Tracking for Three-Phase Grid Energy Storage [#1801] 366

Dibyendu Khan, Wei Qiao, Liyan Qu

University of Nebraska-Lincoln, United States

Oral Session 46: Hydrogen Applications

Chair(s): Rahul Mallik, Dinesh Kumar

Improving PEM Hydrogen Electrolyser Efficiency using AC Excitation [#225] 374

Thea Larsen¹, Seho Kim¹, John Kennedy², Jingjing Liu¹

¹University of Auckland, New Zealand; ²Geological & Nuclear Science, New Zealand

Comparative Analysis of Distribution Systems in Stand-Alone Wind-to-Hydrogen Plants [#73] 378

Thibaut Runser¹, Rik W. De Doncker²

¹Siemens Energy, Germany; ²RWTH Aachen University, Germany

Maximizing Green Hydrogen Production Efficiency for Hybrid Energy Storage and Solar Photovoltaic Systems: A Design Methodology [#807] 386

Cristian Blanco¹, Sergio Diaz¹, Irene Peláez², Cassiano Rech³, Pablo García¹

¹LEMUR Research Group, Universidad de Oviedo, Spain; ²Enfasys Enineering, Spain; ³Federal University of Santa Maria, Brazil

A Multilevel Current Source Converter with 19kA Output Capacity for Large-Scale Hydrogen Electrolyzer [#987] 392

Tianji Zhou¹, Biao Zhao¹, Lou Yantao², Sun Xiaoping², An He², Liu Yang³, Yue Wu³, Xueting Tang¹

¹Tsinghua University, China; ²Xi'an Xidian Power System Co., Ltd., China;

³Electric Power Research Institute, China Southern Power Grid, China

Test Platform for Silicon Carbide-Based Medium Voltage Electrolysis Converter [#178] 399

Martin Vang Kjaer¹, Morten Rahr Nielsen¹, Prashant Surana², Ramkrishan Maheshwari²,

Ankur Srivastava², Florin Iov¹, Thomas Ebel², Stig Munk-Nielsen¹

¹Aalborg University, Denmark; ²University of Southern Denmark, Denmark

Oral Session 47: Converters in Renewable Energy Systems I

Chair(s): Bowen Yang, Gab-Su Seo

A Hybrid Perturbation Technique for Wideband Online Impedance Spectroscopy Measurements of PV Panels using a DC-DC Converter [#42] 407

Awingot Akparibo^{1,2}, Paul Barendse¹

¹University of Cape Town, South Africa; ²Ashesi University, Ghana

A Modular Series Bridge Multilevel Converter for Grid Forming Application with Enhanced Current Rating [#1633] 414

Ajay Singh Negi, Anil Kumar Tiwari, Siba Kumar Patro

Indian Institute of Technology Roorkee, India

A Unified PV-Based Control Strategy for Voltage Regulation [#548] 420

Anjan Debnath, Alexander Stevenson, Sukanta Roy, Temitayo O. Olowu, Mohd Tariq, Arif Sarwat

Florida International University, United States

Simple and Highly Efficient Distributed Power Flow Controller based on Partial Power Conversion [#782] 425

Yian Hu, Reki Soeta, Kenji Natori, Yukihiko Sato

Chiba University, Japan

A Novel Two-Phase Isolated Buck Converter with Increased Inductor Frequency and Low Diode-Bridge Stress [#1092] 430

Jamil Muhammad Khan, Ashraf Ali Khan

Memorial University of Newfoundland, Canada

Oral Session 58: Converters in Renewable Energy Systems II

Chair(s): Vikram Roy Chowdhury, Minghui Lu

Design of a 100W 95.7%-Efficient (2.5V-4V)-to-360V Bidirectional Ultra High Gain DC/DC Converter for Cell-Integrated Power Electronics [#740] 436

Writtik Dutta¹, Naveed Ishraq¹, Ayan Mallik¹, Trevor Warren²

¹Arizona State University, United States; ²HigherWire Inc., United States

Design of a Multi-Mode Input-Parallel-Output-Series Power Optimizer for Wide-Voltage Range Photovoltaic Applications [#273] 444

Stefano Cerutti¹, Mario Giuseppe Pavone², Francesco Gennaro², Natale Aiello²,

Francesco Musolino¹, Paolo Stefano Crovetto¹

¹Politecnico di Torino, Italy; ²STMicroelectronics, Italy

Non-Isolated High-Gain DC-DC Converter for Hybrid-Inverter Application [#856] 452

Reza Rezaei, Mohammad Nilan, Issa Batarseh

University of Central Florida, United States

Characteristics-Based Design of a DC-DC Series Resonant Converter with Voltage Doubler Rectifier for Photovoltaic Applications [#1162] 457

Kalla Rama Krishna, Utsab Kundu, Vinod John

Indian Institute of Science, India

Flexible High Voltage Gain Converter based on Switched LC Cells with Common Ground for DC Microgrid [#430]	464
Sajid Kamal ¹ , Motiur Reza ² , Avneet Kumar ¹ , Yichen Zhang ³ , Wei-Jen Lee ³ , Kory Evanson ⁴	
¹ Indian Institute of Technology Patna, India; ² Khalifa University, United Arab Emirates; ³ University of Texas at Arlington, United States; ⁴ General Electrodynamics Corporation, United States	

Oral Session 69: Photovoltaic Systems

Chair(s): Cristina Terlizzi, Behrooz Mirafzal

A High-Gain Medium-Voltage Transformerless Current Source Inverter for Photovoltaic Systems [#684]	470
Mohammadjavad Hassani, Qiang Wei	
Lakehead University, Canada	
Steady-State Analysis of the Constant Power Region in Distributed Maximum Power Point Tracking Architecture with Photovoltaic Applications [#254]	475
Guanying Chu, Qinglei Bu, Meilin Yang	
Xi'an Jiaotong-Liverpool University, China	
Optimal DC-DC MIC Selection for a Series Stack of PV Modules Connected to the Grid through a Variable DC Voltage Inverter [#865]	482
Morteza Esteki, Mohammad Daryaei, S. Ali Khajehoddin	
University of Alberta, Canada	
Beta-Particle-Filter Method for Sensorless Solar Tracking Systems under Partial Shading Conditions [#498]	488
Ming Huang ¹ , Jieming Ma ¹ , Ka Lok Man ¹ , Steven Guan ¹ , Xue Zhang ²	
¹ Xi'an Jiaotong-Liverpool University, China; ² University of Liverpool, United Kingdom	
Energy Self-Sufficiency Assessment of a Novel Low-Light Enhanced Photovoltaic Model in the Residential Sector [#297]	494
Alexis Aguilar Celis, Hongjian Sun, Christopher Groves, Pratik Harsh	
Durham University, United Kingdom	

Oral Session 81: Wind Energy Grid Integration

Chair(s): Weihang Yan, Liliana de Lillo

A Platform-Less Voltage Sourced HVDC Collection System for Offshore Windfarms using Series-Connected Distributed Diode Rectifiers [#234]	501
Sakshi Singh, Dheeman Chatterjee, Tanmoy Bhattacharya	
Indian Institute of Technology, Kharagpur, India	
Active Structural Control of Floating Offshore Wind Turbine based on PID Controller and Resonant Filter [#1425]	508
Rene D. O. Pereira ¹ , Clauson S. do N. Rios ² , Juan P. R. Moreira ³ , Felipe T. do Nascimento ³ , Márcio V. R. Limaverde ³ , Thyago C. da S. Lopes ¹ , Marcus V. S. Costa ¹ , Victor de P. B. Aguiar ¹ , Ricardo S. T. Pontes ³	
¹ Federal Rural University of the Semi-arid Region, Brazil; ² Federal Institute of Education, Science and Technology of Ceara, Brazil; ³ Federal University of Ceara, Brazil	

Automated Testing of Step-Up Transformers in Solar and Wind Power Generation Systems [#160] 516

Byambasuren Battulga¹, Muhamad Faizan Shaikh¹, Sang Bin Lee¹, Mohamed Osama²

¹Korea University, Korea; ²General Electric, Germany

Modeling and Power-Hardware-in-the-Loop Validation of Synchronous Wind:

An Inverterless Grid-Forming Wind Power Plant [#1749] 522

Weihang Yan¹, Vahan Gevorgian¹, Przemyslaw Koralewicz¹, Robb Wallen¹, S

.M. Shafiul Alam², Tanveer Hussain², Juan Gallego-Calderon²

¹National Renewable Energy Laboratory, United States; ²Idaho National Laboratory, United States

Critical Evaluation of Dual-Speed Grid-Strengthening Synchronous Wind Generators [#929] 530

Ryno Gerber, Maarten J. Kamper

Stellenbosch University, South Africa

Oral Session 93: Energy Storage II

Chair(s): Cristina Terlizzi, Jinia Roy

Dynamic Stability Analysis and Grid Frequency Response of Adjustable Speed

Pumped Storage Hydropower [#372] 538

Muhammad A. Tayyab¹, Eduard Muljadi², Zerui Dong³

¹Western Area Power Administration, United States; ²Auburn University, United States;

³OPAL-RT Corporation, United States

BESS Sizing for PV Power Smoothing [#1718] 546

Uthandi Selvarasu¹, Mahshid Amirabadi¹, Yuan Li², Caleb Crow³, Brad Lehman¹

¹Northeastern University, United States; ²Florida State University, United States;

³City of Tallahassee Electric & Gas Utility, United States

A Bow-Shaped Underwater Piezoelectric Energy Harvester for

Broadband Energy Harvesting [#1096] 553

Yuqi Chen, Han Peng

Huazhong University of Science & Technology, China

Degradation Analysis of Lithium-Ion Capacitors based on Electrochemical

Impedance Spectroscopy [#789] 559

Tarek Ibrahim¹, Muhammad Usman Tahir¹, Vaclav Knap², Daniel Ioan Stroe¹

¹Aalborg University, Denmark; ²Czech Technical University in Prague, Czech Republic

A Helical Magnet Torsion Spring with a 130° Stroke Length [#1424] 565

Dawei Che¹, Bertrand Dechant², Colton Bruce², Seyed Payam Emami¹,

Sean Sevier², Gozde Sivka¹, Jonathan Z. Bird¹

¹Portland State University, United States; ²Fluxmagic. Inc., United States

**Poster Session 4: Sustainable Energy, Energy Storage,
and Power-to-X Technologies**

Chair(s): Luca Vancini

Model-Free Predictive Control of Wave- Hydrogen HESS [#392] 571

Peiwen Tan, Lei Huang, Shixiang Wang, Zihao Mou, Baoyi Pan, Bingxin Xu

Southeast University, China

A Networked Microgrid Framework and Testbed for Communication, Controls, and Optimization Testing [#1423]	577
Maximiliano Ferrari ¹ , Michael Starke ¹ , John Smith ¹ , Ben Ollis ¹ , Aditya Sundararajan ¹ , Yuly Garcia ²	
¹ Oak Ridge National Laboratory, United States; ² University of Puerto Rico Mayaguez, United States	
Heat Distribution Control in a Three-Phase AC Input Induction Heating System with Three Work Coils Arranged in a Row [#634]	585
Shunta Inami, Shohei Komeda	
Tokyo University of Marine Science & Technology, Japan	
Coordinated Active-Reactive Power Management of Renewable P2H Systems with Multiple Industrial Electrolyzers [#692]	591
Yangjun Zeng ¹ , Yiwei Qiu ¹ , Jie Zhu ¹ , Shi Chen ¹ , Buxiang Zhou ¹ , Jiarong Li ² , Bosen Yang ² , Jin Lin ²	
¹ Sichuan University, China; ² Tsinghua University, China	
Analysis of AC-DC Converters for Grid-Tied High Temperature Steam Electrolysis Systems [#644]	598
Temitayo O. Olowu, Amey Shigrekar, Micah J. Casteel, Ning Kang,	
Jeremy L. Hartvigsen, Tyler L. Westover	
Idaho National Laboratory, United States	
New High Gain Boost Converter for Fuel Cell Electric Vehicle [#1117]	606
Vinod Kumar Yadav, Amarendra Edpuganti, Prabodh Bajpai	
Indian Institute of Technology Kanpur, India	
Impact of Hydrogen on the Dispatch Scheduling of a CAES-Driven Energy Hub [#851]	614
Nikhil Anand ¹ , Monika Sandelic ¹ , Tobias Lindstrøm Jensen ¹ ,	
Thomas Aalund Fredholm ¹ , Henrik Lykke Sørensen ²	
¹ Norlys Energy Trading A/S, Denmark; ² Eurowind Energy A/S, Denmark	
Energy Management of Hybrid Fuel Cell MCHP for Building Incorporating Hydrogen Storage Dynamics [#1615]	622
Taoufiq Kaoutari, Rafik El Khatib, Hasna Louahlia, Pierre Schatzel, Hamid Gualous	
University of Caen Normandy, France	
Unlocking Capability for Green Hydrogen Production through Optimization of Hydropower Plant's Excess Power [#192]	630
Pupung Adiwibowo ¹ , Hendy Eka Hardana ²	
¹ Hult International Business School, United States; ² School of Business & Management Institut Teknologi Bandung, Indonesia	
High-Pressure Solid Oxide Electrolysis Cell (SOEC) Dynamic Operation for Enhanced Power-to-X (P2X) Applications [#264]	637
Yaqi Li, Xiaoti Cui, Soeren Hoejgaard Jensen, Frede Blaabjerg	
Aalborg University, Denmark	
Switching Sequence Investigation of the X-Type Five-Level Current Source Inverter for Reducing the Large DC Inductance [#734]	644
Zijian Wang, Kaiwen Yang, Qiang Wei	
Lakehead University, Canada	

Classification of Abnormal Battery Module based on Electric Circuit Model Parameter from Discharging Process for Re-Use and Re-Cycling System [#1675]	649
Dongho Han ¹ , Sangryuk Lee ¹ , Eunjin Ko ¹ , Minju Sim ¹ , Taebin Ha ¹ , Taeyoon Kim ¹ , Woonki Na ² , Jonghoon Kim ¹ ¹ Chungnam National University, Korea; ² California State University, United States	

Hydrogen Supply Infrastructure Planning Method considering Indirect Network Effects [#194]	654
Haoran Deng ¹ , Bo Yang ¹ , Dafeng Zhu ² , Gang Yao ¹ , Xiping Guan ¹ , Dipti Srinivasan ³ ¹ Shanghai Jiao Tong University, China; ² KTH Royal Institute of Technology, Sweden; ³ National University of Singapore, Singapore	

Topic B: Grid Modernization and Smart Grid

Oral Session 2: Grid-Forming Technologies I

Chair(s): Behrooz Mirafzal, Joseph Benzaquen

Capacity Optimized Grid-Forming Control: A Framework for AC Grid-Forming under Hardware and Source Constraints [#887]	662
M.A. Awal ¹ , Siye Cen ¹ , David Michaud ² , Iqbal Husain ² ¹ EPC Power Corporation, United States; ² North Carolina State University, United States	

Output Impedance Shaping of GFM Inverters using Robust H_∞ 2-DOF Controllers [#1006]	670
Bijit Kumar Dey ¹ , Deepak Ramasubramanian ² , Sairaj Dhople ¹ , Murti Salapaka ¹ ¹ University of Minnesota, Twin cities, United States; ² Electric Power Research Institute, United States	

Analysis and Transient Stability Enhancement of Capacity-Constrained Grid-Forming Control in Inverter Dominated Networks [#454]	678
Siye Cen ¹ , Rahul Chakraborty ² , Ma Awal ³ , Iqbal Husain ¹ ¹ North Carolina State University, United States; ² Dominion Energy Virginia, United States; ³ EPC Power Corporation, United States	

Investigation of Control Parameters' Impact on Damping Property of Grid-Forming Converters [#946]	686
Kavian Kamalinejad ¹ , Anant Narula ¹ , Massimo Bongiorno ¹ , Mebtu Beza ¹ , Jan R. Svensson ² ¹ Chalmers University of Technology, Sweden; ² Hitachi Energy, Sweden	

Power Angle Region Partitioning for Fault Recovery Analysis of Grid-Forming Inverters [#1113]	694
Rui Liu, Zhiheng Lin, Yunwei Ryan Li University of Alberta, Canada	

Oral Session 13: DC/Hybrid Solid-State Breakers

Chair(s): Zhi Jin Zhang, Reza Rezaei

SCR-Based Medium Voltage DC Solid-State Circuit Breaker [#1545]	699
Rajendra P. Kandula, Marcio L. Magri Magri Kimpara Oak Ridge National Laboratory, United States	

Electro-Thermal Design: Standardized Hybrid DC Breaker Architecture for Scalable Operation in MVDC Networks [#1046]	707
Shan Jayamaha, Carl Ngai Man Ho, Athula Rajapakse University of Manitoba, Canada	

A SiC MOSFET based Multi-Port Solid State Circuit Breaker for DC Protection [#1057]	714
Xiaoqing Song, Yannal Nawafleh, Mohammad Dehan Rahman <i>University of Arkansas, United States</i>	
Polarity Reversal Inhibitor Sizing Criteria for Meshed HVDC Grids Equipped with DC Circuit Breakers [#1403]	720
Francesca Pizzimenti ¹ , Stefano Lauria ¹ , Fabio Giulii Capponi ¹ , Luca Buono ² , Francesco Palone ² ¹ Sapienza – Università di Roma, Italy; ² Terna S.p.A., Italy	
An Improved Fault Current Bypass-Based DC Solid-State Circuit Breaker for DC Microgrid Applications [#1781]	728
Jiale Zhou ¹ , Qiang Mu ¹ , Xiuhu Sun ¹ , Tiancan Pang ¹ , Yao Wang ² , Tiefu Zhao ¹ ¹ University of North Carolina at Charlotte, United States; ² Hebei University of Technology, China	
 Oral Session 14: Grid-Forming Technologies II	
Chair(s): Joseph Benzaquen, Gab-Su Seo	
Two-Time Scale Model Reduction and Voltage Controller Design for Grid-Forming Converters [#1099]	735
Zicheng Zhang ¹ , Jingyang Fang ¹ , Chenghui Zhang ¹ , Cheng Fu ¹ , Huajia Wang ² , Yan Zhang ² ¹ Shandong University, China; ² State Grid Shandong Electric Power Research Institute <i>State Grid Shandong, China</i>	
A Virtual Synchronous Machine based Algorithm for Online Grid Impedance Estimation [#479]	740
Alessandro Roveri ¹ , Vincenzo Mallemaci ² , Fabio Mandrile ² , Radu Bojoi ² ¹ Prima Electro S.p.A., Italy; ² Politecnico di Torino, Italy	
Small-Signal Stability of Grid-Forming Inverters using Current-Limiting and Frequency Stabilization [#1562]	748
Bowen Yang, Nathan Baeckeland, Gab-Su Seo <i>National Renewable Energy Laboratory, United States</i>	
Model and Design of a Four-Wire Grid-Connected Grid-Forming Converter using Describing Functions [#880]	756
Eliabe D. Queiroz ¹ , André L. M. Leopoldino ² , Douglas de Assis Ferreira ¹ , Igor Alves Maronni ² , Victor Cordeiro de Arruda ² , José Antenor Pomilio ¹ , Joel Filipe Guerreiro ² ¹ Universidade Estadual de Campinas, Brazil; ² Eldorado Research Institute, Brazil	
Modified Andronov-Hopf Oscillator-Based Grid-Forming Converter with Emulated Virtual Cable for Enhanced Power Sharing Performance [#1412]	764
Vikram Roy Chowdhury, Gab-Su Seo, Barry Mather <i>National Renewable Energy Laboratory, United States</i>	
 Poster Session 1: Distributed Energy Resource (DER) Integration	
Chair(s): Ariya Sangwongwanich	
Reducing Dependency on Imported Electricity: Utilizing Renewable Energy and Minimizing Fossil Fuel Power Plant Operations in West Kalimantan [#161]	769
Ilham Akbar ¹ , Ariesa Budi Zakaria ¹ , Eduard Muljadi ² , Suwarno ³ , Nanang Hariyanto ³ ¹ PLN - ITB, Indonesia; ² Auburn University, United States; ³ Institut Teknologi Bandung (ITB), Indonesia	

Impact of Enhanced Wind Integration on Grid Capacity Expansion [#352]	774
Zabir Mahmud, Sarah Kurtz University of California Merced, United States	
Microgrid to Microgrid Synchronization with Grid-Forming Inverters: Challenges and Solution [#948]	779
Maximiliano Ferrari ¹ , Michael Starke ¹ , John Smith ¹ , Omar Martinez ² ¹ Oak Ridge National Laboratory, United States; ² University of Puerto Rico, United States	
Impact of Virtual Impedance based Ripple Mitigation on Microgrid Dynamics [#1345]	784
Shivam Chaturvedi, Mengqi Wang, Shahid Aziz Khan, Duc Dung Le, Wencong Su University of Michigan-Dearborn, United States	
Optimizing Zero Grid Injection in Hybrid Self-Consumption Installations: Advanced Control Strategies and Simulation Insights [#1659]	790
Jose M. Piedra ¹ , Hoang Hua Trinh ¹ , Pablo García ² , Geber Villa ¹ , Marcos Cuadrado ¹ ¹ ENFASYS Engineering S.L., Spain; ² University of Oviedo, Spain	
Model Predictive Decentralized Control Scheme for Network of Grid-Forming Inverters [#1741]	798
Sally Sajadian ¹ , Ola Carlson ² ¹ Lafayette College, United States; ² University of Chalmers, Sweden	
Controller Hardware-in-the-Loop Evaluation of a Microgrid Controller for a Microgrid System with Multiple Grid-Forming Inverters [#505]	804
Fuhong Xie ¹ , Jing Wang ¹ , Subhankar Ganguly ¹ , Shashank Singh ² , Wenzong Wang ³ , Jacqueline Baum ³ , Rahul R. Jha ⁴ ¹ National Renewable Energy Laboratory, United States; ² Siemens, India; ³ Electric Power Research Institute, United States; ⁴ Commonwealth Edison, United States	
Fault Location for Grid-Forming VSC System based on Transient Analysis [#969]	812
Yang Wu ¹ , Li Cheng ² , Xiongfei Wang ² ¹ Aalborg University, Denmark; ² KTH Royal Institute of Technology, Sweden	
Optimizing Hospital Isolated Microgrids in Gaza: Integrating DSS for Sustainable Energy and Resilience [#1009]	817
Bharath Kumar Sugumar ¹ , Nafisul Musfiq ¹ , Yajuan Guan ² , Alexander L. Julian ³ , Giovanna Oriti ⁴ , Norma Anglani ¹ ¹ University of Pavia, Italy; ² Aalborg University, Denmark; ³ Independent Researcher & Consultant, United States; ⁴ Naval Postgraduate School, United States	
Distance Relay Performance in IBR Dominated Networks and Improvements with Estimation-Based Protection [#1565]	825
Syed Sohail Feroz Syed Afroz, Emad Abukhousa, Abdulaziz Qwbaiban, Fahad Alsaeed, A.P. Sakis Meliopoulos Georgia Institute of Technology, United States	
Robust MIMO Controller for Distributed Generation System-Based Grid-Tied Voltage Sourced Converter [#1758]	833
Francis Mwasilu ¹ , Olorunfemi Ojo ² ¹ University of Dar es Salaam, Tanzania; ² Tennessee Tech University, United States	

Influence of Fault Clearing Angle on Temporary Over-Voltage at the Terminal of Grid Following Photovoltaic Inverter [#958]	841
H R Sai Kiran Pandit, Sarasij Das Indian Institute of Science, India	
Instant Transformer Energization for Inverter based Resources based on Pre-Fluxing and Virtual Resistance Control [#1554]	849
Jinli Zhu, Ahmad Fares Abdelhadi, Yuan Li, Fang Z. Peng Florida State University, United States	
Framework for Depth-of-Discharge Optimization and Operation of Battery Energy Storage for Maximum Return in Electricity Markets [#460]	855
Ala A. Hussein Prince Mohammad Bin Fahd University, Saudi Arabia	
Comparative Reliability Analysis of a Microgrid versus Zonal Nanogrids [#1235]	859
Gabrielle Smith ¹ , Douglas L. Van Bossuyt ¹ , Giovanna Oriti ¹ , Mark Vygoder ² , Richard Alves ¹ ¹ Naval Postgraduate School, United States; ² University of Wisconsin-Milwaukee, United States	
Impact of Supraharmonics on the Reliability of Distribution Transformers [#1684]	867
Reza Ilka, JiangBiao He University of Kentucky, United States	
Optimal Planning and Design of Low-Scale Solar DC MGs in Centralized and Distributed Environment – A Comparative Analysis [#1496]	873
Saqib Iqbal ¹ , Mashood Nasir ² , Hassan Abbas Khan ³ , Kamyar Mehran ¹ ¹ Queen Mary University of London, United Kingdom; ² CISSOID, Belgium; ³ Lahore University of Management Science, Pakistan	
Discussion on Instability of Current-Controlled Inverter with df/dT-Type Virtual Inertia Control [#1823]	880
Takumi Ueda ¹ , Kenichiro Sano ¹ , Daisuke Terazono ² , Kaho Nada ² ¹ Institute of Science Tokyo, Japan; ² Mitsubishi Electric Corp., Japan	
Retasking Phase Legs in Multiport DC-AC Converters for Fault Tolerant Operation [#1879]	883
Daniel Bowman, Gregory Kish University of Alberta, Canada	

Poster Session 1: Grid-Forming Technologies

Chair(s): Pranjal Gajare

A Grid-Forming Converter with Reduced Number of Sensors and Pre-Synchronization Strategy [#466]	886
Wenrui Li, Jingyang Fang Shandong University, China	
Singular-Perturbation-Based Control Design of Single-Phase Grid-Forming Inverters [#762]	893
Weiqian Cai, Rahul Mallik, Brian Johnson The University of Texas at Austin, United States	

Hardware-in-the-Loop Testing of the Impact of Grid-Following Inverters Control and Momentary Cessation on System Protection [#1650]	901
Stephen Ambe Chengu, Nikolaos Gatsis, Miltiadis Alamaniotis, Sara Ahmed <i>University of Texas at San Antonio, United States</i>	
An Effective Current Limiting Strategy to Enhance Transient Stability of Virtual Synchronous Generator [#1232]	909
Yifan Zhao ¹ , Zhiqian Zhang ¹ , Ziyang Xu ² , Zhenbin Zhang ¹ , Jose Rodriguez ³ ¹ Shandong University, China; ² Shanghai Jiaotong University, China; ³ Universidad San Sebastian Santiago, Chile	
Dual-Port Grid-Forming Control in MMC-Based ES-STATCOM for Enhanced Voltage Stability [#1755]	914
Hadhlul Aladhyani, Hamdan Alosaimi, Sulaiman Alshammari, Subhashish Bhattacharya <i>North Carolina State University, United States</i>	
A Fault Ride-Through Performance Analysis of Prominent Virtual Synchronous Generator Strategies [#365]	920
Chalitha Liyanage, Lasantha Meegahapola, Inam Nutkani <i>RMIT University, Australia</i>	
Current-Based Virtual Impedance for LVRT Capability in VSG for Predominantly Resistive Distribution Networks [#839]	927
Salil M. Dubey, Zakir H. Rather, Suryanarayana Doolla <i>Indian Institute of Technology Bombay, India</i>	
Phase-Locked Loop vs Synchronous Machine Emulation: A Comparative Study of Phase-Angle Determination Dynamics [#1132]	932
Prithwiraj Roy Chowdhury, Ehab Shoubaki, Madhav Manjrekar <i>University of North Carolina at Charlotte, United States</i>	
Black-Starting Microgrids using Inverter-Based Distributed Energy Resources [#1656]	939
Jay Sawant ¹ , Arundhuti Halder ¹ , Rishabh Jain ¹ , Ben Luck ² ¹ National Renewable Energy Laboratory, United States; ² Holy Cross Energy, United States	
The Implementation of Physical Parameters and Frequency Modulation in the Grid-Forming Converter with Energy Storage System [#278]	947
Minxuan Peng ¹ , Neng Peng ¹ , Yi Wang ² , Shuangyin Dai ² , Kaihsun Chuang ¹ , Xiaoming Zha ¹ , Jianjun Sun ¹ ¹ Wuhan University, China; ² State Grid Henan Electric Power Company, China	
Seamless Transition Strategies of MMC-Based Grid Forming/Following Inverter Systems for Critical Loads [#714]	953
Anupam Nigam, Dong-Choon Lee <i>Yeungnam University, Korea</i>	
Observer-Based Direct Power and Voltage Magnitude Control of Grid-Forming Converters [#837]	960
Tuure Nurminen ¹ , Rayane Mourouvin ¹ , Marko Hinkkanen ¹ , Jarno Kukkola ² ¹ Aalto University, Finland; ² ABB Ltd., Finland	
Transient Angle and Voltage Stability Joint Analysis of Grid-Forming Converters [#1244]	967
Wenjia Si, Jingyang Fang <i>Shandong University, China</i>	

Small-Signal Modeling and Parameter Design for DC-Link Voltage Synchronous Grid-Forming Converter with Decoupled Virtual Admittance [#1725]	972
Pan Feng ¹ , Zhen Tian ¹ , Meng Huang ¹ , Xiaoming Zha ¹ , Xin Ma ²	
¹ Wuhan University, China; ² State Grid Ningxia Electric Power Co., Ltd., China	

Comparative Analysis of Grid-Forming Inverters: Influence of Control Parameters and Grid Conditions on Transient Stability [#1752]	978
Hansi Wijayalath ¹ , Nabil Mohammed ² , Behrooz Bahrani ¹	
¹ Monash University, Australia; ² King Abdullah University of Science & Technology, Saudi Arabia	

Oral Session 25: Grid-Forming Technologies III

Chair(s): Gab-Su Seo, Wenzong Wang

Frequency Support from Grid Forming Inverters: A Power-Domain Impedance Perspective [#998] ...	986
Anuradha Mudalige ¹ , Heng Wu ² , Marius Langwasser ¹ , Marco Liserre ^{1,3}	
¹ Kiel University, Germany; ² Aalborg University, Denmark; ³ Fraunhofer ISIT, Germany	

Interactions of Machines and Grid-Forming PV in Mixed-Source Microgrids [#570]	994
Amir Afshari ¹ , Amirhossein Iraniparast ¹ , Dominic Groß ¹ , Wenzong Wang ² , Jacqueline Baum ²	
¹ University of Wisconsin-Madison, United States; ² Electric Power Research Institute, United States	

Transient Stability Improvement of Virtual Synchronous Generators under Current Limitation: The Benefits of Virtual Power Feedback [#110]	1002
Alessia Camboni, Vincenzo Mallemaci, Fabio Mandrile, Radu Bojoi	
Politecnico di Torino, Italy	

Large-Scale Inverter Integration in Bulk Power Grids using Heterogeneous Grid-Forming Control Strategies [#515]	1010
Xue Lyu, Quan Nguyen, Shuchismita Biswas, Xiaoyuan Fan, Wei Du	
Pacific Northwest National Laboratory, United States	

Parameter Design of Dual-Loop Control for Grid-Forming Inverter considering Power Oscillation Damping [#799]	1018
Jingying Guan, Hua Lin, Shaojie Li	
Huazhong University of Science & Technology, China	

Oral Session 26: Smart Buildings and Behind-the-Meter Technologies

Chair(s): Reza Rezaii, Ala Hussein

Enhancing Grid Stability and Reliability with Grid-Supportive Loads: Implementation, Analysis, and Hardware Testing in a Residential Refrigerator [#137]	1026
Yeongrack Son, Nischal Guruwacharya, Vikram Roy Chowdhury, Michael Blonsky, Barry Mather	
National Renewable Energy Laboratory, United States	

New Loads and Service Factors for Distribution Transformers Following the Transition to High-Efficiency Heat Pumps, Solar PV, and EV Charging [#1115]	1031
Steven B. Poore ¹ , Rosemary E. Alden ¹ , Tim Rooney ² , Dan M. Ionel ¹	
¹ University of Kentucky, United States; ² A. O. Smith Corporation, United States	

Multi-Carrier Energy Home Energy Management System using Genetic Algorithms and Random Forest Predictions [#78]	1037
Joel Alpizar-Castillo, Aihui Fu, Laura Ramirez-Elizondo, Milos Svetkovic, Pavol Bauer Delft University of Technology, Netherlands	

Optimal Operation of Multi-Energy Microgrids: A Hybrid Methodology using Stochastic Programming and Generalized Nash Bargaining [#342]	1045
Hualong Liu, Wenyuan Tang North Carolina State University, United States	

Architecture Analysis and Stability Evaluation of High Voltage DC-Powered Server Racks [#647]	1053
Qing Lin ¹ , Rolando Burgos ¹ , Dong Dong ¹ , Xiong Li ² , Haoyang Zheng ¹ , Mohammad Nair Aalam ¹ ¹ Virginia Polytechnic Institute and State University, United States; ² Google LLC, United States	

Poster Session 2: DC, AC, and Hybrid Microgrids

Chair(s): Mehrnaz Madadi

Decentralized Parameter Estimation of DC Microgrids through Voltage Disturbances [#1471]	1059
Chunlei Fu, Chenming Liu, Jingyang Fang Shandong University, China	

Estimation-Based Decentralized Secondary Control of DC Microgrids [#1472]	1064
Chunlei Fu, Chenming Liu, Jingyang Fang Shandong University, China	

Damped Signal to Improve Transient Response among DG in Microgrid Systems [#1149]	1069
Mohammed Alsubaie, Vasishta Burugula, Osamah Aljumah, Subhashish Bhattacharya North Carolina State University, United States	

A Single-Stage Reduced-Switch AC-DC Interlinking Converter with Integrated Dual DC Ports for Hybrid Microgrids [#625]	1077
Asad Hameed, Gerry Moschopoulos University of Western Ontario, Canada	

Development of a Practical Secondary Control for Hardware Microgrids [#1442]	1083
Soham Chakraborty, Jing Wang, Subhankar Ganguly, Benjamin Kroposki National Renewable Energy Laboratory, United States	

Energy Router-Based Hybrid AC/DC Microgrid Coordinated Control and SOC Balancing Strategies [#1735]	1091
Shushan Qiu, Kaushik Rajashekara, Tutan Debnath, Yuanzhuo Qi University of Houston, United States	

A Methodology for Assessment of Energy Secure Distribution Systems: An Architectural Comparisons of Zonal Nanogrid Building Blocks of Critical Facilities [#1600]	1098
Mark Vygoder ¹ , Jacob Gudex ¹ , Robert Cuzner ¹ , Giovanna Oriti ² ¹ University of Wisconsin-Milwaukee, United States; ² Naval Postgraduate School, United States	

Hybrid Energy Management with Real-Time Control of a High-Power EV Charging Site [#1340]	1105
Emin Ucer, Vaibhav Pawaskar, Derek Jackson, Alastair Thurlbeck, Ed Watt, Mithat John Kisacikoglu National Renewable Energy Laboratory, United States	

Quantitative Trade-Off in Distributed Secondary Control for Autonomous AC Microgrids [#1226]	1112
Zhong Liu ¹ , Xiaonan Lu ¹ , Walter Leon-Salas ¹ , Jin Tan ²	
¹ Purdue University, United States; ² National Renewable Energy Laboratory, United States	
Reliability Enhancement of DC Space Microgrids using Ring Distribution Topology [#1355]	1118
Leila Chebbo, Ali Bazzi	
University of Connecticut, United States	
Event-Triggered Communication Mechanism for DRL Secondary Frequency Compensation in AC Islanded Microgrid [#495]	1124
Sijia Li, Chen Liu, Frede Blaabjerg, Amjad Anvari-Moghaddam	
Aalborg University, Denmark	
Three Phase High-Frequency-Link-Y-Configuration AC-DC DAB Converter with Monolithic Bidirectional GaN Switch [#1575]	1130
Mafu Zhang, Huanghao Zou, Saleh Farzamkia, Chen Chen, Alex Q. Huang	
The University of Texas at Austin, United States	
Contrasting Power Consumption and Trading in Residential Microgrids considering Dynamic Pricing [#1406]	1137
Md. Mizanur Rahman, Ankon Babla Sushil, Daniela Wolter Ferreira Touma	
University of South Alabama, United States	
Active Controls of a Multi-Frequency Multi-Bus Microgrid Network using Hamiltonian-Based Techniques [#532]	1144
Connor A. Lehman ¹ , Wayne W. Weaver ² , David G. Wilson ¹ , Rush D. Robinett III ²	
¹ Sandia National Labs, United States; ² Michigan Technical University, United States	
Enhancing Behind-the-Meter Visibility: Integrating Bolt-On Sensors for Improved Disaggregation Algorithm Accuracy and Cost-Efficiency [#1541]	1151
Mehrnaz Madadi, Subhashish Bhattacharya	
North Carolina State University, United States	
Energy Sharing among Hydrogen-Based Regional Energy Systems with Multi-Energy Storage [#1352]	1157
Dafeng Zhu, Qianwen Xu	
KTH Royal Institute of Technology, Sweden	

Poster Session 3: Grid Stability and Power Quality

Chair(s): Sanket Parashar

Multi-Functional Intelligent MMC-Based HVDC Converter [#1476]	1163
Jiaxiong Yu, Richard Zhang	
Virginia Polytechnic Institute and State University, United States	
New Passive Damped-LCL-Filter based Three-Phase Four-Leg Shunt Active Power Filter [#1498]	1169
Houqing Wang ¹ , Yue Zhao ¹ , Hui Cao ¹ , Darvish Peyman ¹ , Dongfang Han ² , Zhuxuan Ma ¹ , Jinlai Zhang ³ , Zhenqi Wang ¹	
¹ University of Arkansas, United States; ² Xinjiang University, China; ³ Changsha University of Science and Technology, China	

Low-Frequency Stability Analysis of Grid-Tied Inverters under Multisampling Digital Control [#29] ...	1174
Tingkang Wang, Qianyi Huai, Wenxi Yao, Wuhua Li, Huan Yang Zhejiang University, China	
A Dual-PLL Structure Scheme for Stability Enhancement under Weak Grid [#292]	1180
Sicong Jin, Xin Zhang, Hao Wu ¹ Zhejiang University, China; ² Nanjing University of Aeronautics & Astronautics, China	
Numerical Methods Applied to Online Impedance Estimation in Grid-Tied PV Systems: A Performance Analysis [#1499]	1185
Andréia da Silva Gomes ¹ , Jefferson Rafael Pereira de Assis ² , Alfeu Joãozinho Sguarezi Filho ³ , Fabiano Fragoso Costa ¹ , Maurício Beltrão de Rossiter Corrêa ⁴ , Darlan Alexandria Fernandes ⁵ ¹ Federal University of Bahia, Brazil; ² Federal University of Campina Grande, Brazil; ³ Federal University of ABC, Brazil; ⁴ Federal University of Alagoas; ⁵ Federal University of Paraíba, Brazil	
On the Impact of High-Order Harmonic Generation in Electrical Distribution Systems [#1001]	1190
Aaqib Peerzada, Bhaskar Mitra, Soumya Kundu, James P. Ogle Pacific Northwest National Laboratory, United States	
A Passive Grid Impedance Estimation Method in Exploiting Variable Operating Conditions [#1300]	1198
Giulia Di Nezio ¹ , Giovanni Marini ¹ , Salvatore D'Arco ² , Elisabetta Tedeschi ³ , Alessandro Lidozzi ³ ¹ Università degli Studi Roma Tre, Italy; ² SINTEF Energy Research, Norway; ³ Norwegian University of Science & Technology, Norway	
An Analysis about Capital and Maintenance Costs Related to Electrical Flexibility [#218]	1204
Eduardo Perez Liberato ¹ , Matheus Bawden ¹ , Caio Mateus Cardozo Rego ¹ , Yan Tavares de Oliveira ¹ , Jose Oniram de Aquino Limaverde Filho ¹ , Thiago Felicio de Souza ² , Ronan Gustavo Carvalho Furtado ² , Eugênio Libório Feitosa Fortaleza ¹ ¹ University of Brasília, Brazil; ² Eletrobras Furnas, Brazil	
Delay Compensation Design and Wideband Oscillation of MMC-HVDC Cyber-Physical Systems [#7]	1210
Jingming Cao ¹ , Chaoyu Dong ² , Yunfei Mu ¹ , Junnan Qin ¹ , Qian Xiao ¹ , Hongjie Jia ¹ ¹ Tianjin University, China; ² Nanyang Technological University, Singapore	
Control Time Delay Compensation Method of Grid-Following Inverter by Complex Vector Theory [#52]	1217
Taisei Inoue, Minori Funakoshi, Toshiji Kato, Kaoru Inoue Doshisha University, Japan	
A Current Source Hybrid Series Active Power Filter with Reduced Rated DC Source Current Rating [#1028]	1223
Prashanth Atputhakumar, Carl Ngai Man Ho, Troy Eskilson University of Manitoba, Canada	
Voltage Support Control Method based on Grid Code under Unbalanced Voltage Conditions [#1274]	1229
Jaehoon Choi, Yongsug Suh Jeonbuk National University, Korea	

Three-Phase Circuit Analysis through Quaternions and Biquaternions [#630]	1237
Jingyang Fang Shandong University, China	
Optimization-Based Model Reduction Scheme for Renewable Energy Power Plants using Standardized Testing Scenarios [#1187]	1245
Ram Shankar Yallamilli, Xiaonan Lu, Wei Du ¹ Purdue University, United States; ² Pacific Northwest National Laboratory, United States	
Preventing Reverse Power Flow to Utility Grid from Bidirectional Battery Charger for EVs with Power Quality Compensator under Feed-In Tariff Program [#166]	1252
Reo Emoto ¹ , Shun Okamoto ² , Fuka Ikeda ² , Masayuki Okamoto ² , Hiroaki Yamada ¹ , Toshihiko Tanaka ¹ ¹ Yamaguchi University, Japan; ² National Institute of Technology, Ube College, Japan	
Solar PV and EV Controls for Reactive Power Support on Large Distribution Systems Modeled with Experimental and Synthetic Loads [#990]	1259
Rosemary E. Alden ¹ , Malcolm McCulloch ² , Dan M. Ionel ¹ ¹ University of Kentucky, United States; ² University of Oxford, United Kingdom	
Optimal Planning of Synchronous Condensers considering the Impact of Inverter-Based Resources [#211]	1265
Ehsan Fouladi ¹ , Ali Mehrizi-Sani ¹ , Behrooz Bahrani ² ¹ Virginia Polytechnic Institute and State University, United States; ² Monash University, Australia	
Influence of Auto-Recloser Dead Time on Power Swings after Consecutive LVRT of GFOL PV [#1880]	1271
Meenu Jayamohan, H.R. Sai Kiran Pandit, Sarasij Das Indian Institute of Science, India	
 Oral Session 36: Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) Technologies Chair(s): Marius Langwasser, Nidhi Haryani	
Three-Phase 50 kW Compact Contactless Connector for Automated EV Charging System using Multi-Function Integrated Magnetic Coupler [#565]	1274
Koji Shigeuchi ¹ , Yasumitsu Osada ¹ , Ishigaki Masanori ¹ , Yoshinobu Sugiyama ² , Katsuya Kobayashi ² , Akira Yoshizumi ² , Masaki Okamura ² ¹ Toyota Central R&D Labs., Inc., Japan; ² Toyota Motor Corporation, Japan	
A 240° Clamped Discontinuous PWM Operated Bidirectional High Efficiency EV Charger with Partial Power Operation [#1580]	1282
Chandrima Chatterjee, Adnan Farooq Khan, Soumya Shubhra Nag Indian Institute of Technology Delhi, India	
Making EVs and the Grid Work Together: A San Diego based Study [#1013]	1290
Rafael Aranzabal Obieta ¹ , Jose Torre-Bueno ² , Sridhar Seshagiri ¹ ¹ Universidad del Pais Vasco, Spain; ² Center for Community Energy, United States; ³ San Diego State University, United States	

Reinforcement Learning-Based Optimization for Electric Vehicle Dispatch in Renewable Energy Integrated Power Systems [#1493]	1297
Elif Aydin, Saqib Iqbal Queen Mary University of London, United Kingdom	

Coordinated Path Planning and Charging Scheduling in a Charging Station System using Greedy Best-First Search Algorithm [#1371]	1305
Junyan Shao, Baoze Wei, Qian He, Pagah Alaei, Josep M. Guerrero, Juan C. Vasquez Aalborg University, Denmark	

Oral Session 48: Grid-Connected Power Converter Control

Chair(s): Vikram Roy Chowdhury, Marius Langwasser

Robust All-Band-Pass Filter Configuration as Orthogonal Signal Generator in Three-Phase Prefilter-Based PLL [#1661]	1310
Adeola Balogun ¹ , Temiladeola Oladugba ² , Abdullahi Bamigbade ³ , Sodiq Agoro ⁴ , Olorunfemi Ojo ⁵ , Frank Okafor ¹ ¹ University of Lagos, Nigeria; ² Arnergy Solar Limited, Nigeria; ³ New York University, United States; ⁴ ABB Ltd., United States; ⁵ Tennessee Tech University, United States	

Coupling Quantization among Control Loops of Parallel Grid-Following and Grid-Forming Inverters [#982]	1318
Zhe Zhang ¹ , Yi Xiao ¹ , Hao Ruan ¹ , Yongheng Yang ¹ , Frede Blaabjerg ² ¹ Zhejiang University, China; ² Aalborg University, Denmark	

Real-Time Digital Simulation, Modelling and Control of a Grid Connected Distributed Energy Storage for Supervisory Control [#955]	1326
Akansha Garg, Peter R. Green, Mike Barnes The University of Manchester, United Kingdom	

Linear Quadratic Regulator-Based Controller for Control Mode Switching under Fault Operation of Grid-Connected PV with Supercapacitor System [#543]	1334
Paychuda Kritprajun ¹ , Leon M. Tolbert ¹ , Nattapat Praisuwanna ¹ , Jingxin Wang ¹ , Yunting Liu ² , Maximiliano Ferrari ³ ¹ The University of Tennessee, United States; ² The Pennsylvania State University, United States; ³ Oak Ridge National Laboratory, United States	

Dynamic Co-Simulation of Distributed Energy Resource Management Systems Utilizing Random Battery Energy Storage and Photovoltaic Penetrations [#1363]	1341
Shaun Duerr Marquette University, United States	

Oral Session 59: Grid Enhancing Technologies (GETs)

Chair(s): Ma Awal, Giovanni De Carne

E-STATCOM Damping for Secondary Voltage Control of Wind Power Plants considering Communication Delays [#1034]	1349
Shan He ¹ , Behnam Dattary Besheli ² , Federico Cecati ² , Liang Huang ¹ , Frede Blaabjerg ¹ , Marco Liserre ² ¹ Aalborg University, Denmark; ² Kiel University, Germany	

Voltage Balancing Design, Experiment and Application for High Voltage Converter with Series-Connected IGBTs [#500]	1355
Juanjuan Lu ¹ , Yunfei Xu ¹ , Weiguo Li ¹ , Xianzhe Bao ¹ , Qingping Li ¹ , Xutao Li ²	
¹ State Grid Smart Grid Research Institute Co., Ltd, China; ² Electric Power Research Institute of State Grid Ningxia Electric Power Co. Ltd, China	

A Third Harmonic Voltage Injection Technique to Improve the Power Transmission Capacity [#716]	1361
Anubrata Das ¹ , Fred Wang ¹ , Yaosuo Xue ²	
¹ The University of Tennessee, United States; ² Oak Ridge National Laboratory, United States	

Multiterminal High-Voltage DC Systems with Series- Parallel Valve Group-Based High-Voltage DC Substations [#872]	1369
Sreenivasa S. Jaldanki, Suman Debnath	
Oak Ridge National Laboratory, United States	

Control Study of Enhanced STATCOM for Supercapacitor Applying Virtual Synchronous Generator Control [#313]	1377
Kaho Nada, Toshiyuki Fujii, Kenichiro Sano	
¹ Mitsubishi Electric Corporation, Japan; ² Tokyo Institute of Technology, Japan	

Oral Session 70: Grid Stability and Power Quality

Chair(s): Wenzong Wang, Matthew Storm

Switching between MPPT and VSG Controls for Utility-Scale Photovoltaic Plants to Mitigate Power System Oscillations [#983]	1383
Rajan Ratnakumar ¹ , Ganesh K. Venayagamoorthy ^{1,2}	
¹ Clemson University, United States; ² University of Pretoria, South Africa	

Partitioning of Large-Scale Power Electronics-Based Power Systems for Small-Signal Stability Analysis [#1780]	1389
Nupur ¹ , Yaosuo Xue ² , Fred Wang ¹	
¹ The University of Tennessee, United States; ² Oak Ridge National Laboratory, United States	

Virtual Resistor Control for Inverter-Based Resource with Long Underground Cables [#1628]	1397
Bokang Zhou ¹ , Jinli Zhu ² , Yuchen He ² , Yuan Li ² , Fang Peng ²	
¹ ABB Ltd., United States; ² Florida State University, United States	

Effective Stability Contribution of Reactive Power from Grid-Following and Grid-Forming Converters [#810]	1404
Hao Ruan ¹ , Yi Xiao ¹ , Guang Hu ¹ , Yongheng Yang ¹ , Haoze Luo ¹ , Marta Molinas ²	
¹ Zhejiang University, China; ² Norwegian University of Science & Technology, Norway	

Control of Green Hydrogen Production on Isolated Hybrid Solar Plants considering the Effect of Communications [#1288]	1411
Daniel del Rivero ¹ , Ángel Navarro-Rodríguez ¹ , Carlos Gómez-Aleixandre ¹ , Cristian Blanco ¹ , Pablo Garcia ¹ , Pedro Rodriguez ²	
¹ Universidad de Oviedo, Spain; ² Luxembourg Institute of Science & Technology, Luxembourg	

Oral Session 82: Solid-State Transformers

Chair(s): Joseph Benzaquen, Rajendra Prasad Kandula

Improved DC Link Voltage Balancing in an MV-Compliant Solid-State Transformer [#707] 1418

Vasishtha Burugula¹, Mark Nations¹, Shrivatsal Sharma¹, Shubham Dhiman¹,
Osamah Aljumah¹, Subhashish Bhattacharya¹, Yos Prabowo²

¹North Carolina State University, United States; ²Ion Mobility, Indonesia

Design and Validation of a 2MW 10KV Medium-Voltage Solid State Transformer [#840] 1426

Jianxiong Yu¹, Cheng Luo¹, Jiajie Duan¹, Cheng Wang¹, Rui Lu¹,
Antonio Trujillo², Chushan Li³, Wuhua Li³

¹Eaton Corporation, China; ²Eaton Corporation, United States; ³Zhejiang University, China

Development of a Solid State Transformer for HEMP/GMD Common Mode Current Mitigation [#291] 1434

Timothy Donnelly, Lee Rashkin

Sandia National Laboratories, United States

A QAB-Based SST DC Charging System for Light Rail Transit Trains [#436] 1440

Mei-Fang Wang, Tzung-Lin Lee

National Sun Yat-sen University, Taiwan

Asymmetrical Bidirectional DC-DC Converter for Economical Solid-State Transformer [#927] 1447

Zuo Chen, Xiang Shen, Hanbing Xiao, Jianjun Ma, Miao Zhu

Shanghai Jiao Tong University, China

Oral Session 83: DC Microgrids

Chair(s): Vikram Roy Chowdhury, Zhi Jin Zhang

Beating Frequency Analysis for Feedforward-Controlled Converters in DC Microgrids [#120] 1453

Debora Pereira Damasceno¹, Paolo Sbabo², Mateus Pinheiro Dias¹, José Carlos Ugaz Pena¹,
Kaihang Zhang³, Paolo Mattavelli², Jose Antenor Pomilio¹

¹Universidade Estadual de Campinas, Brazil; ²Università degli Studi di Padova, Italy;

³CPFL Energia, Brazil

Prescribed Performance based Distributed Fixed-Time Economic Dispatch for Islanded DC Microgrids [#357] 1459

Mohamed Zaery, Syed Amrr, S.M. Suhail Hussain, Mohammad A. Abido

King Fahd University of Petroleum & Minerals, Saudi Arabia

Bipolar Current-Fed Triple Active Bridge for Resilient Power Supply in DC Microgrid [#861] 1465

Xiang Shen, Zuo Chen, Miao Zhu, Jianjun Ma

Shanghai Jiao Tong University, China

Output Voltage Control-Based Soft Pre-Charging for Downstream Capacitors in LVDC Microgrids [#697] 1471

Laura Bayerdoerffer¹, Julius Maximilian Placzek¹, Sebastian Brueske², Marius Langwasser¹

¹Kiel University, Germany; ²Maschinenfabrik Reinhausen GmbH, Germany

Data-Driven Observer based Detection for Series Arc Fault in DC Microgrids [#1446] 1477

Ge Yang, Luis Herrera, Xiu Yao

State University of New York at Buffalo, United States

Oral Session 94: Grid-Forming Technologies IV

Chair(s): Jay Sawant, Sanket Parashar

Experimental Benchmarking of Voltage Controllers for Grid-Forming Inverters [#967] 1484

Yi Xiao¹, Hao Ruan¹, Yongheng Yang¹, Hao Luo¹, Frede Blaabjerg²

¹Zhejiang University, China; ²Aalborg University, Denmark

Transient Performance of Grid-Forming VSCs with High-Switching-Frequency

Power Devices [#1069] 1491

Liang Zhao, Xiongfei Wang

KTH Royal Institute of Technology, Sweden

Performance Evaluation of a Single-Phase Grid-Forming Inverter through

Hardware Experiments [#1214] 1498

Jing Wang, Subhankar Ganguly, Soham Chakraborty, Benjamin Kroposki

National Renewable Energy Laboratory, United States

A Nonlinear MPC-Based Adaptive Inertia Strategy for Andronov-Hopf

Oscillator Controlled Grid-Forming Inverters [#1273] 1506

Shaokun Niu¹, Tong Liu¹, Wei Wang¹, Jiao Du¹, Guanguan Zhang¹,

Alian Chen¹, Gang Zhang², Yu Chen²

¹Shandong University, China; ²State Grid Shandong Electric Power Company, China

Transient Stability Analysis of Grid Forming MMC with Current Limitation

based on Junction Temperature [#943] 1512

Federico Cecati¹, Nidhi Bisht², Debi Prasad Nayak², Venkata Yoganand Konda², Marco Liserre^{1,2}

¹Kiel University, Germany; ²Fraunhofer ISIT, Germany

Poster Session 4: Grid Modernization and

Transportation Electrification

Chair(s): Sneha Narasimhan

Utilizing HVDC Links for Cross-Border Grids Interconnection: System Level Assessment [#826] ... 1520

Osama Saadeh¹, Baher Abu Sba², Bushra Alqabai¹, Zakariya Dalala³

¹German Jordanian University, Jordan; ²University of Arkansas, United States;

³Abdullah Al Salem University, Kuwait

A Generalized Configuring Architecture for Switching-Mode Multi-Level Multi-Line

DC Power Flow Controllers: Topology, Operation and Control [#1353] 1527

Hongyi Zhang¹, Miao Zhu¹, Pengfeng Lin¹, Lingyu Du¹, Zuo Chen¹, Linping Wu²

¹Shanghai Jiao Tong University, China; ²Nari Group Corporation, China

Improved High-Frequency, Medium-Voltage Isolation Planar Transformers [#509] 1533

Htat W. Min, Mike K. Ranjram

Arizona State University, United States

Optimal Design of Electromagnetic Structure of High-Frequency Transformer [#334] 1541

Yanjiao Jin, Binhao Chen, Guangyao Qiao, Yunfei Xu, Qiuyu Shi, Weiguo Li

State Grid Smart Grid Research Institute Co., Ltd, China

Power Loss Analysis and Optimal Design of High Efficiency MW-Level Medium Frequency Transformer [#517]	1548
Jialiang Hu, Yiqing Ma, Bin Cui, Xueteng Tang, Zhe Yang, Biao Zhao <i>Tsinghua University, China</i>	
Scalable Modular Power Converter Design: A PoE-Based Approach for Enhanced Adaptability and Synchronization [#931]	1556
Nicholas Leak, Yuxuan Wu, Fang Luo <i>Stony Brook University, United States</i>	
A 1200V/425A SiC MOSFET Power Module with Integrated Balancing Circuit for Series-Connection Applications [#919]	1563
Yumiao Yuan ¹ , Xingyu Pei ² , Weiqiang Zhou ¹ , An Lou ¹ , Haidong Yan ¹ , Junming Zhang ¹ , Shuai Shao ¹ ¹ <i>Zhejiang University, China;</i> ² <i>Zhuhai Power Supply Bureau of Guangdong Power Grid Co., Ltd., China</i>	
Bidirectional Performance-Considered 11 kW Integrated Wired/Wireless EV Charging System with Effective Operation Method [#393]	1571
Ju-A Lee ¹ , Dong Hyeon Sim ¹ , Hyeonu Jo ¹ , Chae-Lyn Kim ¹ , Dong-Wook Yoo ² , Byoung Kuk Lee ¹ ¹ <i>Sungkyunkwan University, Korea;</i> ² <i>Hanyang University, Korea</i>	
Optimized Design Strategy of CLLC Converter considering High Efficiency Operation in 22kW Bidirectional On-Board Charger [#373]	1576
Dong Hyeon Sim ¹ , Ju-A Lee ¹ , Hyeonu Jo ¹ , Chae-Lyn Kim ¹ , Dong-Wook Yoo ² , Byoung Kuk Lee ¹ ¹ <i>Sungkyunkwan University, Korea;</i> ² <i>Hanyang University, Korea</i>	
A Single-Stage Adaptable Multi-Mode On-Board Charger Facilitating G2V, V2G, and Traction Operations for EVs [#195]	1581
Priyatosh Jena, Virendra Prasad Maurya, Rajeev Kumar Singh, Vivek Nandan Lal <i>Indian Institute of Technology (BHU) Varanasi, India</i>	
Optimized Model Predictive Control in Single-Phase Seven-Level Flying Capacitor Multilevel Converter for Bi-Directional On-Board Charger [#1637]	1588
Parth Patel, Ambrish Chandra <i>École de Technologie Supérieure, Canada</i>	
Dynamic Modeling of Power Conversion Stages for an Exascale Supercomputer [#613]	1595
Rafal P. Wojda, Matthias Maiterth, Sedrick Bouknight, Wesley Brewer <i>Oak Ridge National Laboratory, United States</i>	

Topic C: Big Data, Machine Learning, Cyber Security and Design Automation

Oral Session 3: Design Automation, Digital Twins, and Condition Monitoring

Chair(s): Taesic Kim, Jinan Zhang

PowerSynth: Automated Power Converter Layout Synthesis with Customized Components [#618]	1602
Mehran Sanjabiasasi, H. Alan Mantooth, Yaru Peng <i>University of Arkansas, United States</i>	

WITHDRAWN

An ML-Enhanced Digital Twin Model of Photovoltaic Inverter for Estimating Component Degradation [#544]	1610
Sukanta Roy ¹ , Arif Sarwat ¹ , Milad Behnamfar ¹ , Anjan Debnath ¹ , Mohd Tariq ¹ , Patrick McCluskey ² ¹ Florida International University, United States; ² University of Maryland, United States	
Automation for Grid Interconnected Laboratory Emulation [#1529]	1618
Phani R. V. Marthi ¹ , Suman Debnath ¹ , Marshall McDonnell ¹ , Sebastian A. Soto ² , Harry Hughes ¹ , Steven Hahn ¹ , Jongchan Choi ¹ , Anees Al Najjar ¹ , Nageswara Rao ¹ , Ben Mintz ¹ ¹ Oak Ridge National Laboratory, United States; ² OPAL-RT, Canada	
Enhancing Solar Farm Operations: Machine Learning for Equipment Fault Detection and Classification [#511]	1626
Ali Hamza ¹ , Zunaib Ali ¹ , Sandra Dudley ¹ , Komal Saleem ² , Nicholas Christofides ³ ¹ London South Bank University, United Kingdom; ² University of East London, United Kingdom; ³ Frederick University, Cyprus	
Machine Learning for Prognostic and Health Management Systems Monitoring DC-Link Capacitors [#1654]	1634
Viktoriiia Sysoeva ¹ , Chi-Hao Cheng ² , Mark J. Scott ² ¹ Ernst & Young LLP, United States; ² Miami University, United States	
Oral Session 27: Cybersecurity in Power Electronics and Power Systems	
Chair(s): Jianwu Zeng, Yu Zeng	
False Data Injection Cyberattack Detection in Transmission System based on Deep Learning and Unscented Kalman Filter [#490]	1642
Fatemeh Sharifi, Ali Mehrizi-Sani Virginia Polytechnic Institute and State University, United States	
PWM-Based Hardware Authentication for Smart Inverters: Detecting Counterfeit Inverter through Transient Response Analysis [#528]	1648
Chanakya Hingu ¹ , Xingang Fu ¹ , Ramkrishna Mishan ¹ , Taesic Kim ² ¹ University of Nevada, Reno, United States; ² University of Missouri-Columbia, United States	
Resilient PID Controller for Communication Latency in Interconnected Power Systems [#1648]	1653
Deepak Kumar ¹ , G. Lloyds Raja ¹ , Omar Al Zaabi ² , Mohamed Alkhatib ³ , Utkal Ranjan Muduli ² ¹ NIT Patna, India; ² Khalifa University, United Arab Emirates; ³ United Arab Emirates University, United Arab Emirates	
Multi-Scale Robust Mitigation of Side-Channel Noise Intrusion in an Solid-State Transformer [#1797]	1659
Sudip K. Mazumder, Mateo D. Roig Greidanus, Debotrinya Sur, Shantanu Gupta University of Illinois Chicago, United States	
A Cyber-Attack Targeting HVDC-Connected Offshore Wind Farms considering Stability of Grid-Following Power Converters [#1667]	1667
Zhi Jin (Justin) Zhang ¹ , Zexian Zeng ¹ , Jiuping Pan ² , Maryam Saeedifard ¹ ¹ Georgia Institute of Technology, United States; ² Hitachi Energy Research, United States	

Poster Session 3: Data-Driven and Machine Learning Methods
Chair(s): Zahra Saadatizadeh

Performance Evaluation of Battery Abnormal Diagnostic based on Autoencoder according to the Battery Management System Input Dataset [#1678]	1675
Dongcheol Lee ¹ , Miyoung Lee ¹ , Youngmin Bae ¹ , Jongchan An ¹ , Garam Yang ¹ , Woonki Na ² , Jonghoon Kim ¹ ¹ Chungnam National University, Korea; ² California State University, United States	
Optimizing PV Array Performance: A² LSTM for Anomaly Detection and Predictive Maintenance based on Machine Learning [#530]	1681
Ali Hamza ¹ , Zunaib Ali ¹ , Sandra Dudley ¹ , Komal Saleem ² ¹ London South Bank University, United Kingdom; ² University of East London, United Kingdom	
Real-Time Energy Price Forecasting using BiLSTM-Autoencoder Deep Learning Model [#1601]	1689
Soumya Namani ¹ , Md Al Amin ² , Md Ochiuddin Miah ² , Abdullah Al Ahad Khan ³ , Md Faisal Kabir ¹ , Md Habib Ullah ¹ ¹ Penn State Harrisburg, United States; ² North Dakota State University, United States; ³ United International University, Bangladesh	
A Data-Driven Advisory Tool for Mixed-Generation Power Systems [#274]	1695
Otavio Bertozzi ¹ , Guang An Ooi ¹ , Mohd Asim Aftab ¹ , Murali S. Venkatraman ² , Grain P. Adam ² , Charalambos Konstantinou ¹ , Shehab Ahmed ¹ ¹ KAUST University, Saudi Arabia; ² NEOM ENOWA, Saudi Arabia	
Locality Preserving Projections based Model Predictive Control for Three-Phase Inverter [#107]	1702
Jianwu Zeng Minnesota State University, Mankato, United States	
Assessing Deep Learning Models in Predicting Heatsink Temperature: A Comparative Study on Extrapolation Capabilities [#884]	1707
Jiaze Kong, Xiaobing Shen, Wilmar Martinez KU Leuven - EnergyVille, Belgium	
Physical Layout Design Automation for High-Power Density DC-DC Converter [#1768]	1713
Zahra Saadatizadeh, H. Alan Mantooth University of Arkansas, United States	
Digital Twin of Power Modules based on Physics Informed Machine Learning [#1504]	1718
Borong Hu ¹ , Wei Mu ¹ , Hui Zhu ² , Ameer Janabi ¹ , Xufu Ren ¹ , Daohui Li ² , Jiayu Li ¹ , Yunlei Jiang ¹ , Teng Long ¹ ¹ University of Cambridge, United Kingdom; ² NIO Inc., China	
Neural Network Trained Cold-Plate Models for Modular Converter Exploration [#1475]	1723
Hamed Shabani ¹ , Robert M. Cuzner ¹ , Juan Ordonez ² , Cristofer Hood Marques ³ ¹ University of Wisconsin-Milwaukee, United States; ² Florida State University, United States; ³ Federal University of Rio Grande, Brazil	
Automated Companion Tool for Synthesis of Model-Based Control Design for Power Converters [#1125]	1731
Aidar Zhetessov, Giri Venkataramanan University of Wisconsin-Madison, United States	

Reliability-Based Design Framework for Assessment of Digital Twin Models Applied to Vessel Controllers [#1707]	1738
Hyungjun Jeon, Dong Trong Nguyen, Mehdi Zadeh Norwegian University of Science & Technology, Norway	
PE-GPT: A Physics-Informed Interactive Large Language Model for Power Converter Modulation Design [#165]	1744
Fanfan Lin ¹ , Junhua Liu ² , Xinze Li ³ , Shuai Zhao ⁴ , Bohui Zhao ¹ , Xinyuan Liao ⁵ , Hao Ma ¹ , Xin Zhang ¹ ¹ Zhejiang University, China; ² Forth AI, Singapore; ³ University of Arkansas, United States; ⁴ Aalborg University, Denmark; ⁵ Northwestern Polytechnical University, China	
Real-Time Anomaly Detection and Remedy Actions for Resilient Operation of DC-Coupled Fast EV Chargers [#719]	1748
Omar Abu-Rub ¹ , Ali Sharida ^{2,3} , Maryam Saeedifard ¹ , Mohammad B. Shadmand ⁴ , Sertac Bayhan ⁵ ¹ Georgia Institute of Technology, United States; ² Texas A&M University at Qatar, Qatar; ³ Texas A&M University, United States; ⁴ University of Illinois Chicago, United States; ⁵ Hamad Bin Khalifa University, Qatar	
Field Demonstration of Blockchain-Based Security for a Solar Farm [#1608]	1753
BoHyun Ahn ¹ , Kalyan Nakka ² , Nathaniel R. Handke ¹ , Trevor J. Reyna ¹ , Taesic Kim ³ ¹ Texas A&M University-Kingsville, United States; ² Texas A&M University-College Station, United States; ³ University of Missouri-Columbia, United States	
Adversarial Machine Learning Attack on Machine Learning-Based Controller for Solar Inverters [#1606]	1760
Joaquin Massa ¹ , Kyoung-Tak Kim ² , Taesic Kim ³ , BoHyun Ahn ¹ , Kumar Venayagamoorthy ⁴ , Jianwu Zeng ⁵ ¹ Texas A&M University-Kingsville, United States; ² Soongsil University, Korea; ³ University of Missouri-Columbia, United States; ⁴ Clemson University, United States; ⁵ Minnesota State University, Mankato, United States	
A Framework for Cyber-Secure Monitoring and Safe Operation of Solar PV Microgrids [#1245]	1765
Jaewon Kim ¹ , Marija Ilic ¹ , Le Xie ² ¹ Massachusetts Institute of Technology, United States; ² Texas A&M University, United States	
Design and Development of AC Impedance Measurement Test Circuit for Lithium-Ion Cells [#1295]	1773
Sarbani Mandal ¹ , Shaurya Pandey ¹ , Bikash Sah ² , Sai Krishna Mulpuri ¹ , Praveen Kumar ^{1,3} ¹ Indian Institute of Technology Guwahati, India; ² Bonn-Rhein-Sieg University of Applied Sciences, Germany; ³ Oak Ridge National Laboratory, United States	
Weighted Model-Based State-of-Charge Estimation Algorithm for Differential Terminal Voltage Application of LFP Battery [#1676]	1779
Minhyeok Kim ¹ , Eunjin Kang ¹ , Seongkyu Lee ¹ , Minwoo Song ¹ , Bomyeong Ko ¹ , Jaee Lee ¹ , Woonki Na ² , Jonghoon Kim ¹ ¹ Chungnam National University, Korea; ² California State University, United States	
Induction Motor Fault Diagnosis using Shifting Window Data Augmentation of Current Signals [#638]	1784
Robert Wright ¹ , Poria Fajri ¹ , Xingang Fu ¹ , Arash Asrari ² ¹ University of Nevada Reno, United States; ² Purdue University Northwest, United States	

Poster Session 3: Analytical and Control Tools

Chair(s): Yang Wu

Proposal of Battery Back-Up Unit (BBU) Configuration for Data Centers [#1660] 1791

Mahmoud A. Gaafar, Samer Said, Mostafa Mosa, Mohamed Orabi, Tarek Sayed
Aswan University, Egypt

Investigation of the Heat Generation of Liquid Metal Battery during Internal Short Circuit [#277] 1797

Yi Zhang, Min Zhou, Kai Jiang
Huazhong University of Science & Technology, China

Rolling Horizon-Based Building-to-Building Grid Energy Exchange Optimization:

A Game Theory Method [#916] 1801

Mhret Berhe Gebremariam, Pablo García, Ángel Navarro-Rodríguez, Óscar Pasarín, Cristian Blanco
Universidad de Oviedo, Spain

MATLAB GUI based Simulation and Optimization Tool for

Generic N-Port MAB Converters [#1173] 1808

Saikat Dey, Ayan Mallik
Arizona State University, United States

Reinforcement Learning-Based Development of Time-Optimal Current Trajectories for Permanent

Magnet Synchronous Motor Drives under Voltage and Current Constraints [#1248] 1816

Jeonghan Lee, Jae Suk Lee
Jeonbuk National University, Korea

From Black Box to Clarity: AI-Powered Smart Grid Optimization with

Kolmogorov-Arnold Networks [#1884] 1820

Xiaoting Wang, Yuzhuo Li, Yunwei Li, Gregory Kish
University of Alberta, Canada

Oral Session 37: Machine Learning and AI for IBR-Interfaced Grids

Chair(s): Yang Wu, Jinan Zhang

Safe Deep Reinforcement Learning based Volt-VAR Control for Three-Phase

Unbalanced Distribution System with PV Integration [#1324] 1823

Fei Liu, Qianwen Xu
KTH Royal Institute of Technology, Sweden

Optimizing Cylindrical Heatsink Design Topology with Feedforward

Neural Networks and NSGA II [#882] 1829

Jiaze Kong, Xiaobing Shen, Wilmar Martinez
KU Leuven - EnergyVille, Belgium

Explainable AI for Fault Detection and Classification in Microgrids [#1788] 1835

Oluwadamilola Ajayi¹, Mohammadreza Mirjafari², Peter B. Idowu², Md Habib Ullah²
¹Schweitzer Engineering Laboratories, United States; ²Penn State Harrisburg, United States

Analysis of Transfer Learning for Output Impedance Estimation of Power Electronics Converters [#1175]	1841
Andrea Zilio, Nicola Balasso, Alberto Bregantin, Davide Biadene, Tommaso Caldognetto, Paolo Mattavelli <i>Università degli Studi di Padova, Italy</i>	

Machine Learning based Power Loss Modeling and Fault Diagnostics for Power Transformer and AC Drive System [#1136]	1848
Zhijun Liu ¹ , Kadir Liano ¹ , Bijan SayyarRodsari ¹ , Yujia Cui ¹ , Zhuo Liu ² , Hao Yang ² , Haihui Lu ² , Zhongyuan Cheng ³ , Jiangang Hu ¹ ¹ Rockwell Automation, United States; ² Rockwell Automation, China; ³ Rockwell Automation, Canada	

Oral Session 84: Multiphysics and Physics-Based Modeling and Design

Chair(s): Pengxiang Huang, Mateo Greidanus

A Novel Approach to Dynamic State Estimation through DMD and Adjacency Matrices in Power Converter Dominated Power Grids [#1772]	1854
Gregory N. Baltas ¹ , Shailendra Singh ¹ , Jun Cao ¹ , Phani Chamarthi ¹ , Pedro Rodriguez ^{1,2} ¹ Luxembourg Institute of Science & Technology, Luxembourg; ² Universitat Politècnica de Catalunya, Spain	

Machine Learning-Aided Design of Switched-Mode Power Converters [#1022]	1859
Skye Reese, Bailey Sauter, Abhinav Kumar, Shoudong Hu, Vignesh Iyer, Dragan Maksimović <i>University of Colorado Boulder, United States</i>	

Enhancing Arc Fault Detection Performance through Data Augmentation with Artificial Intelligence Technology: An Approach to Time Series Dataset Enlargement [#514]	1866
Shangze Chen, Kamal Chandra Paul, Tiefu Zhao <i>University of North Carolina at Charlotte, United States</i>	

A Secure Fast Charging Control based on a Machine Learning-Aided Electrothermal Model for Lithium-Ion Batteries [#45]	1873
Yajie Jiang ¹ , Junxiang Yang ¹ , Jiayang Wu ² , Kerui Li ² , Yun Yang ¹ , Siew-Chong Tan ² ¹ Nanyang Technological University, Singapore; ² The University of Hong Kong, Hong Kong	

On Noise Resiliency of Neuromorphic Inferential Communication in Microgrids [#883]	1881
Yubo Song ¹ , Subham Sahoo ¹ , Xiaoguang Diao ² ¹ Aalborg University, Denmark; ² Hubei University of Technology, China	

Topic D: Transportation Electrifications Applications

Oral Session 4: Inductive Wireless Power Transfer for Transportation

Chair(s): Thomas Luo, Deepak Ronanki

A Hybrid Rectifier Mode Control for Communication-Free Wireless Power Transfer [#3]	1887
Gangwei Zhu ¹ , Jianning Dong ² , Pavol Bauer ³ <i>Delft University of Technology, Netherlands</i>	

A 3D-Spiral Sensing Coil for Foreign Object Detection in EV Wireless Charging Applications [#904] 1893
 Ali Ramezani, Sepehr Semsar, Matthew Perry
 eLeapPower, Canada

Analytical Efficiency Maximization with Constant-kQ Optimal Coupler Design for Inductive Wireless Power Transfer Systems [#1622] 1898
 Ronaq Nazir, Sreyam Sinha
 Indian Institute of Technology Delhi, India

Design of High-Power Polyphase PCB Coil Systems for Wireless Power Transfer [#933] 1903
 Donovan D. Lewis¹, Lucas Gastineau¹, Omer Onar², Malcolm McCulloch³, John F. Eastham⁴, Dan M. Ionel¹
¹University of Kentucky, United States; ²Oak Ridge National Laboratory, United States;
³University of Oxford, United Kingdom; ⁴University of Bath, United Kingdom

On Balancing of Dynamic Wireless Power Transfer System in the Presence of Misalignment and Load Variation [#1552] 1909
 Mohammad Rastegar, Mohammad Hassan Ghaderi, Milad Bahrami Fard
 The University of Texas at Dallas, United States

Oral Session 15: Battery Management Systems for Transportation

Chair(s): Feng Guo, Fnu Nishanth

Effects of Fast Charging of EV Batteries at Low Temperatures based on Temporary Lithium Plating and Temperature Gradients [#650] 1917
 Chandan Chetri, Sheldon Williamson
 Ontario Tech University, Canada

Advanced Battery Aging Prediction through Impedance Spectroscopy Including Thermal Behavior and Degradation Analysis [#611] 1922
 Latha Anekal, Sheldon Williamson
 Ontario Tech University, Canada

Ultra-Fast Temperature Estimation of Lithium-Ion Batteries Through Impedance Measurements [#534] 1928
 Minh Tran¹, Daniel Stroe², Tomi Roinila¹
¹Tampere University, Finland; ²Aalborg University, Denmark

Optimizing Experiments for Accurate Battery Circuit Parameters Estimation: Reduction and Adjustment of Frequency Set Used in Electrochemical Impedance Spectroscopy [#1052] 1935
 Vladimir Sovljanski¹, Mario Paolone¹, Sylvain Tant², Damien Pierre Sainflou²
¹École Polytechnique Fédérale de Lausanne, Switzerland; ²Stellantis, France

EMD-Enhanced Multi-Step Regression: A Practical Approach for Lithium-Ion Battery Remaining Useful Life Prediction [#1577] 1943
 Ahnaf Akif Rahman¹, Philip Korta², Caniggia Viana¹, Ahmad Ali¹, Philip Lewoc¹, Lakshmi Varaha Iyer², Narayan C. Kar¹
¹University of Windsor, Canada; ²Magna International Inc., United States

Poster Session 1: Transportation Electrification I

Chair(s): Ashik Amin

High Power Density Integrated Power Electronics Unit for Small Mobility Applications [#12] 1950

Shahid Aziz Khan¹, Feng Zhou², Mengqi Wang¹, DucDung Le¹, Shivam Chaturvedi¹

¹University of Michigan, United States; ²Toyota Research Institute of North America, United States

A Novel Multiple Parameters Identification Method for the Wireless Power Transfer System [#96] 1954

Xiaosheng Wang, Sheng Ren, Liping Mo, C.Q. Jiang, Jiayu Zhou, Chen Chen

City University of Hong Kong, Hong Kong

Thermal Distribution Optimization Method for Inductive Power Transfer

System Utilizing Nanocrystalline Flake Ribbon Core [#326] 1959

Chen Chen, Ben Zhang, Sheng Ren, Liping Mo, Weisheng Guo, Xiaosheng Wang, C.Q. Jiang

City University of Hong Kong, Hong Kong

Design of Wireless Charging Pad for EV Power Seats considering Surrounding Structures [#424] 1964

Chang-su Shin¹, Seungmin Kim¹, Xie Junchen¹, So Jeong Kang¹, Geun Wan Koo², Dong-Hee Kim¹

¹Chonnam National University, Korea; ²Korea Automotive Technology Institute, Korea

A Novel Misalignment Tolerant DSSq Receiver Pad for Wireless EV Charging Applications [#612] 1970

Rajanikant, Vivek Agarwal

Indian Institute of Technology Bombay, India

Output Current Estimation and Control in Primary Side LCC Secondary Side Series Compensated

Wireless Power Transfer System without Secondary Side Sensors [#1326] 1976

Subhajyoti Mukherjee, Omer Onar

Oak Ridge National Laboratory, United States

Optimization of WPT-Based Snubber Circuit via Coupled-Mode Theory to

Eliminate Switching Oscillations [#1547] 1982

Bowang Zhang¹, Wei Han¹, Youhao Hu¹, Weikang Hu², Binhong Cao¹, Xuxing Duan¹

¹The Hong Kong University of Science and Technology Guangzhou, China;

²The Hong Kong University of Science and Technology, China

Multifunctional 22kW Bidirectional Integrated Charger with 2.01kW/L High-Power Density [#329] .. 1987

Jaeyeon Lee, Kyunghoon Nam, Jihoon Park, Dohyun Kim, Donghyuk Yang, Heonhee Kim

Hyundai Mobis Co.,Ltd, Korea

A Modified S-S Wireless Charging Circuit with Single-Stage Voltage Regulation Capability [#708] ... 1994

Wenzheng Xu¹, Mingyue Zheng¹, Jingjing Qi², Long Jing¹, Xuezhi Wu¹

¹Beijing Jiaotong University, China; ²Tsinghua University, China

Excitation SiC Converter for Electrically Excited Traction Synchronous Motor using

Rotary Transformer and Field Rotor Current Estimator [#1666] 2000

Fausto Stella, Sandro Rubino, Enrico Vico, Radu Bojoi, Eric Armando

Politecnico di Torino, Italy

Design, Implementation, and Comparison of Multi-MHz Multi-kW H-Bridge Inverters

based on 650V SiC and GaN Devices for High-Frequency WPT [#142] 2007

Yao Wang¹, Kaiyuan Wang¹, Yun Yang¹, Shu Yuen Ron Hui²

¹Nanyang Technological University, Singapore; ²The University of Hong Kong, Hong Kong

Oral Session 28: EV Charging Infrastructures

Chair(s): Athar Hanif, Thomas Luo

A Comparison of AC and DC Distribution Architectures for Electric Vehicle High Power Charging Facilities [#300] 2013

Derek Jackson, Emin Ucer, Mithat John Kisacikoglu, Alastair Thurlbeck
National Renewable Energy Laboratory, United States

A Low Footprint Multiport Charging Station based on Transformerless Series Hybrid Converter [#1658] 2020

Jayant Kumar¹, Ibhan Chand Rath², Nageswara Rao Karaka², Siba Kumar Patro¹
¹Indian Institute of Technology Roorkee, India; ²Indian Institute of Technology Bombay, India

Hybrid Modulation for a SHB-FB Converter Employed in an Integrated On-Board Charger and Auxiliary Power Module [#1701] 2027

Ziwei Liang¹, Rajib Bijukchhe¹, Liyan Zhu², Hua Bai¹, Evgheni Cebanov³, Myron Samila³,
Mojtaba Forouzesh³, Headley Phillips³
¹The University of Tennessee, United States; ²Virginia Polytechnic Institute and State University, United States; ³Magna Powertrain Inc., Canada

Pulsating Power Processing through Multi-Active Bridge for Electric Vehicle Charging Applications [#1170] 2035

Md Didarul Alam, Mohammad Mahinur Rahman, M. A. Awal, Iqbal Husain, Srdjan Lukic
North Carolina State University, United States

Magnetic Gear WPT: Prototype and EV Charging [#1110] 2042

Caleb Dunlap, Charles Van Neste, Ping Chen
Tennessee Technological University, United States

Poster Session 2: Transportation Electrification II

Chair(s): Feng Guo

Development of a Medium-Voltage Transformerless Multilevel Inductive Power Transfer System [#363] 2047

Hyeonji Hwang¹, Sumi Park², Myung-Yong Kim¹, Jaehong Lee¹, Seung-Hwan Lee¹
¹University of Seoul, Korea; ²Korea Railroad Research Institute, Korea

Coil Optimization of a Planar Omnidirectional WPT System [#585] 2054

Xipei Yu, Junjie Feng, Liyan Zhu, Qiang Li
Virginia Polytechnic Institute and State University, United States

Frequency-Domain Method to Determine Validity of the Fundamental Harmonic Approximation [#763] 2061

Chenmin Deng¹, Yihao Wu¹, Tim Merkin², Alex J. Hanson¹
¹The University of Texas at Austin, United States; ²Texas Instruments, United States

A Novel Scheme with Maximum Efficiency and Fast Response for Dynamic Wireless Battery Charging Systems [#1287] 2067

Jiayang Wu¹, Huawei Yuan¹, Sinan Li², Siew-Chong Tan¹, Shu-Yuen Ron Hui¹
¹The University of Hong Kong, Hong Kong; ²University of Sydney, Australia

A Bridgeless Single Stage Power Factor Corrected Inductive Wireless Power Transfer Converter [#1422]	2072
Saman Rezazade, Mohammed Agamy State University of New York at Albany, United States	
Design and Experimental Test of a High Frequency Rotary Transformer [#669]	2079
Francesco Tripaldi, Manuele Bertoluzzo, Nicola Bianchi Università degli Studi di Padova, Italy	
A Closed-Loop-Controlled Wireless Motor System with Maximum Efficiency Point Tracking [#337]	2087
Youhao Hu ¹ , Wei Han ¹ , Bowang Zhang ¹ , Weikang Hu ² ¹ Hong Kong University of Science & Technology Guangzhou, China; ² Hong Kong University of Science & Technology, Hong Kong	
Precise Coil Inductance Prediction with Transfer Learning Improved Deep Neural Networks in WPT Systems [#347]	2092
Yue Wu ¹ , Delin Zhao ² , Yongbin Jiang ² , Yaohua Li ² , Xipei Yu ³ , Sicheng Wang ² , Min Wu ¹ , Xiaohua Wang ¹ , Yi Tang ² ¹ Xi'an Jiaotong University, China; ² Nanyang Technological University, Singapore; ³ Virginia Polytechnic Institute and State University, United States	
Optimization of Integrated Inductors for Wireless Power Transfer Applications [#978]	2099
Peyman Darvish, Hui Cao, Yue Zhao, Muhamad Fasih Uddin, Houqing Wang University of Arkansas, United States	
Range Extension of Robust Wireless Power Transfer using a Metamaterial-Based Relay Resonator Array [#1059]	2107
Jiali Zhou ¹ , Chi-Kwan Lee ² ¹ The University of Hong Kong, Hong Kong; ² University of Technology Sydney, Australia	
A Soft-Switching On-Board Charger for Electric Vehicle Application [#1739]	2113
Anran Wei, Brad Lehman, Mahshid Amirabadi Northeastern University, United States	
Opportunities for Improved Cooling of AC Machine Rotors using Centrifugal Heat Pipes [#1544]	2120
S.A. McElhinney ¹ , T.M. Jahns ² ¹ VerdeGo Aero, United States; ² University of Wisconsin-Madison, United States	
A Multi-Objective Design Optimization Method for Auxiliary Resonant Commutated Pole Inverter [#870]	2126
Nan Lin ¹ , Yuheng Wu ¹ , Long Wu ¹ , Zach Wehri ¹ , Yushi Yang ² , Yue Zhao ² , Brij Singh ¹ ¹ John Deere, United States; ² University of Arkansas, United States	
Traction Inverter Integrated On-Board DC Fast Charging through Partial Power Processing [#1396]	2134
Ashraf Siddiquee ¹ , Alper Uzum ¹ , Syed Imam Hasan ¹ , Yilmaz Sozer ¹ , Mithat John Kisacikoglu ² ¹ The University of Akron, United States; ² National Renewable Energy Laboratory, United States	
A SiC-Based 243 kW 60 kW/L Electric Vehicle Traction Inverter [#401]	2140
Chih-Chiang Wu ¹ , Uma Sankar Rout ^{1,2} , Hsin-Ping Chou ¹ , Jwu-Sheng Hu ¹ ¹ Industrial Technology Research Institute, Taiwan; ² National Yang Ming Chiao Tung University, Taiwan	

An Advanced PWM Strategy with Capacitor Voltage Balancing for Hybrid Five-Level Inner-Paralleled ANPC Traction Inverters in Heavy-Duty Vehicle Applications [#49]	2146
Feng Guo ¹ , Fei Diao ² , Zhuxuan Ma ³ , Yue Zhao ³	
¹ University of Wisconsin-Milwaukee, United States; ² John Deere Intelligent Solutions Group, United States; ³ University of Arkansas, United States	
Challenges and Solutions for Uneven Voltage Distribution in SiC-Driven AC Motors [#1328]	2151
Milad Sadoughi ¹ , Fariba Fateh ¹ , Jiangbiao He ² , Behrooz Mirafzal ¹	
¹ Kansas State University, United States; ² University of Kentucky, United States	
Comparative Analysis of Power Semiconductor Devices for use as a Solid-State Circuit Breaker in a Cryogenically Cooled Electrical Aircraft Propulsion Network [#444]	2157
Reza Khoshnati ¹ , Nick Wright ¹ , Peter Malkin ¹ , Mark Husband ² , Daniel Malkin ²	
¹ Newcastle University, United Kingdom; ² GKN Aerospace, United Kingdom	
Poster Session 3: Transportation Electrification III	
Chair(s): Deepak Ronanki	
Triple-Layer Coil Design for Cubic Wireless Charging Spaces: Enhancing Output Power and Power Flow Control [#131]	2163
Kaiyuan Wang ¹ , Rui Liang ² , Xiangrong Zhang ¹ , Yun Yang ¹ , Siew-Chong Tan ³	
¹ Nanyang Technological University, Singapore; ² Hong Kong Polytechnic University, Hong Kong; ³ The University of Hong Kong, Hong Kong	
Unveiling the Essential Output Deviation Factors of Non-Ideal Inductive Power Transfer Systems with Self-Oscillating Control [#146]	2169
Zhen Sun ¹ , Kaiyuan Wang ¹ , Yao Wang ¹ , Yun Yang ¹ , Siew-Chong Tan ² , Shu Yuen Ron Hui ²	
¹ Nanyang Technological University, Singapore; ² The University of Hong Kong, Hong Kong	
Cross-Coupling Compensation using Gradient Ascent Method for Single-Transmitter Dual-Receiver Wireless Power Transfer [#221]	2176
Ryo Matsumoto, Toshiyuki Fujita, Hiroshi Fujimoto	
University of Tokyo, Japan	
A CLC-S Compensated Dynamic Wireless Power Transfer System for Output Power Fluctuation Mitigation [#1183]	2181
Wenbo Wang, Junjun Deng, Lantian Li, Yuhong Li, Renjie Wang, Zhenpo Wang	
Beijing Institute of Technology, China	
Comparison of Resonant Inverter Topologies for Multi-MHz Wireless Power Transfer Systems [#1581]	2187
Sounak Maji, Dheeraj Etta, Khurram K. Afridi	
Cornell University, United States	
Battery Equalization Architecture using Capacitively-Coupled ZETA-Derived Topology [#268]	2193
Zhengqi Wei ¹ , Henry Shu-Hung Chung ¹ , Ruihong Zhang ²	
¹ City University of Hong Kong, Hong Kong; ² BYD Auto Industry Co., Ltd, China	
Towards Practical Impedance-Based Temperature Estimation of Li-Ion Batteries: Impedance Measurements and Feature Extraction [#76]	2200
Jussi Sihvo, Daniel Ioan Stroe	
Aalborg University, Denmark	

Identification of Lithium-Ion Battery Degradation under Fast Charging Protocols [#261]	2206
Yaqi Li, Hongbo Zhao, Wendi Guo, Frede Blaabjerg, Daniel Ioan Stroe <i>Aalborg University, Denmark</i>	
Cold-Weather Profiling of Lithium-Ion Cell using Hybrid Pulse Power Characterization [#1197]	2212
Majid Najafpour Ahangar ¹ , Minh Tran ² , Mohammad Hassan Shojaeefard ¹ , Tomi Roinila ² ¹ <i>Iran University of Science & Technology, Iran;</i> ² <i>Tampere University, Finland</i>	
Study of the Temperature and Aging Impact on an Enhanced Coulomb Counting Method for Estimating SOC of Lead-Acid Batteries [#1386]	2219
Shokoufeh Valadkhani, Muhammad Abdelraziq, Zhansen Akhmetov, Samuel Klein, Zeljko Pantic <i>North Carolina State University, United States</i>	
Precise Remaining Useful Life Estimation of Lithium-Ion Batteries via Pulse Test without Historical Data [#100]	2227
Maoshu Xu ¹ , Qionglin Shi ¹ , Junyi Xia ¹ , Kangli Wang ¹ , Kai Jiang ¹ , Lei Fan ² , Bo Li ² ¹ <i>Huazhong University of Science & Technology, China;</i> ² <i>Institute of Electric Power Science, Guizhou Power Grid Co., Ltd., China</i>	
Hybrid Controller Automatic Fast Charging with Capacity Retention for Lithium Ion Batteries [#312]	2232
Kyle Waterman, Raymond Sepe Jr. <i>Electro Standards Laboratories, United States</i>	
Adaptive Stacking Ensemble Model with Genetic Algorithm-Driven Hyperparameter Optimization for State of Health Prediction of Lithium-Ion Batteries [#1683]	2240
Mohamed J.M.A. Rasul ¹ , Faiz Majeed ¹ , Dania Batool ¹ , Femi Okemakinde ¹ , Abeebe A. Adejare ¹ , Woonki Na ² , Jonghoon Kim ¹ ¹ <i>Chungnam National University, Korea;</i> ² <i>California State University, United States</i>	
Charging Strategies Influence on DC-DC Converter and Li-Ion Battery Performance [#46]	2248
Muhammad Usman Tahir ¹ , Sajib Chakraborty ^{2,3} , Erdem Akboy ^{1,4} , Ariya Sangwongwanich ¹ , Daniel Ioan Stroe ¹ , Omar Hegazy ^{2,3} , Frede Blaabjerg ¹ ¹ <i>Aalborg University, Denmark;</i> ² <i>Vrije Universiteit Brussel, Belgium;</i> ³ <i>Flanders Make, Belgium;</i> ⁴ <i>Yildiz Technical University, Turkey</i>	
Variable-Frequency PWM Switching of Charge Equalization Circuits for Balancing Current Control in Adjacent Cell-to-Cell Architectures [#703]	2254
Jyotirmaya Sahoo, P. Ramesh, Amit Patra, Siddhartha Mukhopadhyay <i>Indian Institute of Technology Kharagpur, India</i>	
Time-Based Equalization Strategy of Parallel Charge Balancing Architecture for Lithium-Ion Battery Application [#1361]	2262
Jyotirmaya Sahoo, P. Ramesh, Amit Patra, Siddhartha Mukhopadhyay <i>Indian Institute of Technology Kharagpur, India</i>	
An All-GaN 800V Three-Level PFC Converter [#1605]	2269
Emad Nazerian ¹ , Mojtaba Heydari ¹ , Ruiyang Yu ¹ , Alex Q. Huang ¹ , Qingyun Huang ² ¹ <i>The University of Texas at Austin, United States;</i> ² <i>University of Missouri, United States</i>	

A New Common-Mode Free 1- ϕ /3- ϕ Combo Non-Isolated Battery Charger with a Wide Output Voltage Range [#1369] 2277
Preetha Philip, Durga Prasad Pilli, Gyanendra Tiwari, Deepak Ronanki
Indian Institute of Technology Madras, India

Fractional Power based Multi-Utility Fast Charger with V2Aux and V2V Capability [#869] 2283
Warda Matin Khan, Rajeev Kumar Singh, Ranjit Mahanty, Vivek Nandan Lal
Indian Institute of Technology (BHU), Varanasi, India

Experimental Validation of Rotor Position Synchronization Control in Central-Converter Multi-Motor Architectures for Aerospace Applications [#1419] 2289
Cláudio Lima, Christopher Lute, James Cale
Colorado State University, United States

Poster Session 3: Transportation Electrification IV

Chair(s): Marium Rasheed

Voltage-Level based SMPC with CMV Minimization for a Four-Level Inverter [#765] 2296
Hoang Le, Apparao Dekka
Lakehead University, Canada

Temporal Sensitivity Analysis of Internal Temperature Informed Charging Algorithms and Rapid Thermal Management System for E-Mobility [#1846] 2302
Akash Samanta¹, Chandan Chetri¹, Dominic Karnehm², Antje Neve², Sheldon Williamson¹
¹Ontario Tech University, Canada; ²Bundeswehr University Munich, Germany

A Normalized Coupler Model of Capacitive Power Transfer Systems under Positional Offset of Plates [#1824] 2305
Yangbin Zeng, Chi K. Tse, Li Ding, Xiaolu Lucia Li
City University of Hong Kong, Hong Kong

A Fast Computation Method to Calculate Performances of an Electric Propulsion System for Drive Cycles [#1663] 2308
Md Sariful Islam, Ali Safayet, Mohammad Islam
HL Mechatronics, United States

Mitigation of Soldering Joint Aging Failures in Power Converters with Immersion Cooling [#1851] ... 2315
Reza Ilka¹, JiangBiao He¹, Roger England², Z. George Zhang², Ning Ren²
¹University of Kentucky, United States; ²Valvoline Global Operations, United States

Advanced SSPC based on SiC-MOSFET for Aircraft Applications [#1881] 2318
Fatma A. Khera, Jun Xie, Pat Wheeler
University of Nottingham, United Kingdom

Virtual Admittance based Switch Fault Detection for Hybrid UAVs [#535] 2320
Taehyung Kim, Sahithya Parvathareddy
University of Michigan-Dearborn, United States

Electrolytic Capacitorless Wireless DC Motor Drive System with Delta-Sigma Modulation [#1828] ... 2325
Xin Felix Chen¹, Chi K. Tse¹, Qianhong Chen²
¹City University of Hong Kong, Hong Kong; ²Nanjing University of Aeronautics & Astronautics, China

Oral Session 38: Hydrogen Fuel Cell

Traction and Infrastructure

Chair(s): Deepak Ronanki, Feng Guo

Operation and Control of Fuel Cell Powered Tower Wagon [#1204] 2328

Rajbala Purnima Priya, Siddhartha Vishwanatha, Vinod Kumar Yadav,
Amarendra Edpuganti, Prabodh Bajpai
Indian Institute of Technology Kanpur, India

Advanced Ripple Reduction in Interleaved Boost Converter for Fuel Cell Application [#467] 2334

Seungmin Kim, Seungjin Jo, Seungsoo Kim, Chang-Su Shin, Cheol-Hee Jo, Dong-Hee Kim
Chonnam National University, Korea

Underactuated Control of Multi-Port Systems with Fuel Cells using Nonlinear Control [#1207] 2341

Felipe Morales¹, Antonio Sánchez-Squella, Rafael Cisneros², Romeo Ortega², Patricio Valdivia-Lefort³
¹Universidad Técnica Federico Santa María, Chile; ²Instituto Tecnológico Autónomo de México, México; ³Universidad de Santiago, Chile

A Novel Design Methodology of Multi-Purpose Control System in a Multi-Input-Single-Output Converter Considering Coupling Effect [#1560] 2349

Xueshen Zhang, Yeonho Jeong
University of Rhode Island, United States

A Battery Pack Coupling Coefficient for Scaling a Cell Electrical Model for an All Electric Aircraft Application [#674] 2357

Giuseppe Bossi, Alfonso Damiano
University of Cagliari, Italy

Oral Session 49: Hybrid and Electric Vehicle Power Electronics

Chair(s): Khorshed Alam, Liwei Zhou

A High-Power Compact Segmented Traction Drive Inverter [#1495] 2365

Gui-Jia Su, Jon Wilkins, Clayton Hickey, Cliff White, Burak Ozpineci, Emre Gurbinar
Oak Ridge National Laboratory, United States

Control of MVDC Bus in Electric Ships using Multiphase Hybrid Generator [#547] 2372

Mahzad Gholamian¹, Omid Beik¹, Wajiha Ateeq², Owais Manzoor²
¹Colorado School of Mines, United States; ²North Dakota State University, United States

Investigation of 10-kW Cryogenic Bidirectional DC-DC Converter for Electric Aircraft [#1312] 2378

Jiawen Xi¹, Xianwu Zeng¹, Peilin Liu¹, Gowtham Galla², Ravi-Kiran Surapaneni²,
Ludovic Ybanez³, Xiaozhe Pei¹
¹University of Bath, United Kingdom; ²Airbus UpNext, Germany; ³Airbus UpNext, France

A Novel Technical Approach for Battery Self-Heating in Electric Vehicles based on Inherent Resonance [#688] 2385

Feifan Ji¹, Zihao Chen², Yanjun Li¹, Cun Wu², Tong Wang¹, Yan Liu¹
¹Hangzhou City University, China; ²Zhejiang Leapmotor Technology Co., Ltd., China

A 200 kW (62 kW/L) Traction Inverter for Next Generation Electric Vehicles [#819] 2393

Srdjan Srdic¹, Chi Zhang², Srdjan Lukic³

¹EGSTON Power Electronics GmbH, Austria; ²Delta Electronics, Inc., United States;

³North Carolina State University, United States

Oral Session 60: Capacitive Wireless Power Transfer for Transportation

Chair(s): Shuai Shao, Sina Vahid

Comparison of Air Core versus Ferrite Core Inductors for Capacitive Wireless EV Charging Systems [#1188] 2398

Subhabrata Basak, Utsab Kundu, L. Umanand

Indian Institute of Science, India

A Phase Angle Measurement-Based Approach for Characterization of Capacitive Couplers for Wireless EV Charging [#1271] 2406

Subhabrata Basak, Utsab Kundu, L. Umanand

Indian Institute of Science, India

An Optimized Two-Module Capacitive Wireless Power Transfer System for EV Charging [#1630] 2413

Ayush Dixit, Sreyam Sinha

Indian Institute of Technology Delhi, India

Design of Vertical Aligned Capacitive Couplers for Wireless Charging Applications [#465] 2418

Gyanendra Tiwari, Deepak Ronanki

Indian Institute of Technology Madras, India

Self-Resonant Capacitive Power Transfer System Leveraging Printed-Circuit-Board Coupler with Integrated Compensation Inductance [#147] 2425

Yao Wang¹, Kaiyuan Wang¹, Kerui Li², Yun Yang¹, Shu Yuen Ron Hui²

¹Nanyang Technological University, Singapore; ²The University of Hong Kong, Hong Kong

Oral Session 61: On-Board Battery Chargers

Chair(s): Thomas Luo, Athar Hanif

A New Integrated Onboard Battery Charger for LEVs Featuring FPGA-Enhanced Precision Delay Time Control for Four-Step Switching AC-AC Converter [#1491] 2430

Peng-Hao Huang, Vishwam Raval, Agustin Perez, Abner Mendoza, Neeharika Baireddy, Prasad Enjeti

Texas A&M University, United States

A Three-Phase 22kW Soft Switching based Two-Stage Onboard Charger [#996] 2437

Gibum Yu, Tianlong Yuan, Xingyu Chen, Qiang Li

Virginia Polytechnic Institute and State University, United States

Planar Transformer with High Leakage Inductance Integration for Resonant Converters [#1409] 2443

Liyang Zhu, Qiang Li

Virginia Polytechnic Institute and State University, United States

Basic Study on Onboard Wireless Power Transfer System Integrating Auxiliary Battery Charger [#1184]	2449
Ryosuke Ota, Miyake Haruto Tokyo Metropolitan University, Japan	

22kW High-Efficiency High-Power-Density Bidirectional DC/DC Converter with Surface Mount SiC MOSFETs for OBCs [#226]	2454
Hailin Wang ¹ , Yuequan Hu ² , Zongzeng Hu ¹ ¹ Wolfspeed, China; ² Wolfspeed, United States	

Oral Session 71: Applications of Electric Traction and Propulsion

Chair(s): AK Arafat, Sina Vahid

Design of Grid-Forming Control for AC-AC Modular Multilevel Converter in Railway Traction System [#1230]	2459
Yang Zhang, Kamil Swiderski, Qianwen Xu KTH Royal Institute of Technology, Sweden	

Optimization-Based Comparative System Evaluation of Single and Dual Traction Inverters with Focus on Partial Load Efficiency and Chip Area [#518]	2467
Christoph Sachs ^{1,2} , Fabian Stamer ³ , Jan Allgeier ³ , Duleepa Thrimawithana ⁴ , Martin Neuburger ¹ ¹ Esslingen University of Applied Sciences, Germany; ² University of Stuttgart, Germany; ³ Robert Bosch GmbH, Germany; ⁴ University of Auckland, New Zealand	

Design of a 75kW Three-Level DC/DC GaN Converter for Automotive Fuel-Cell Application [#381]	2475
Simone Giuffrida, Stefano Savio, Fabio Mandrile, Fausto Stella, Eric Armando, Radu Bojoi Politecnico di Torino, Italy	

A Three Phase Unfolding based Solid-State Traction Transformer for Railway Application [#821]	2483
Adnan Farooq Khan, Soumya Shubhra Nag, Bhim Singh Indian Institute of Technology Delhi, India	

800V, 500kW High Power Density SiC Traction Inverter for Electric Vehicles [#1155]	2491
Rashmi Prasad ¹ , Suresh Gopalakrishnan ¹ , Ronald O. Grover, Jr. ¹ , Chunhao Joseph Lee ¹ , Mohamed Kamel ¹ , Muhammad Alvi ^{1,2} ¹ General Motors, United States; ² Tesla, Inc., United States	

Oral Session 85: Electric Aircraft Propulsion Technologies

Chair(s): Tao Yang, Shuai Shao

Model Predictive Control of 5L-ANPC Inverter Fed Coreless AFPM Motor with Mitigated CMV in Electric Aircraft Propulsion [#1143]	2498
Farzad Y. Notash, Matin Vatani, JiangBiao He, Dan M. Ionel University of Kentucky, United States	

Electro-Thermal Design Characterization of a High Power SiC based ANPC Inverter for EV / Aerospace Applications [#1466]	2506
Ankit Vivek Deshpande, Erick I. Pool-Mazun, Enrique Garza-Arias, Shaozhe Wang, Rolando Sandoval, Nathan Malone, Prasad Enjeti, Jonathan Felts <i>Texas A&M University, United States</i>	
Application of Optimized Pulse Pattern Modulation to 1 MVA Three-Level Aerospace Inverters [#1123]	2513
Gilvan Silva ¹ , Battur Batkhishig ¹ , Di Wang ¹ , Giorgio Pietrini ¹ , Piranavan Suntharalingam ² , Ali Emadi ¹ ¹ McMaster University, Canada; ² Eaton Corporation, United States	
Online Power Cycling Lifetime Extension for SiC ANPC Multilevel Converters [#1662]	2517
Victor M. Logan, JiangBiao He <i>University of Kentucky, United States</i>	
Fault-Tolerant Topologies with Halbach Array and PM-Free Multi-Stage Multi-Module Electric Machines for Electric Aircraft Propulsion [#936]	2524
Donovin D. Lewis, David R. Stewart, Matin Vatani, Oluwaseun A. Badewa, Ali Mohammadi, Dan M. Ionel <i>University of Kentucky, United States</i>	
Oral Session 95: Other Topics in Transportation Electrification	
Chair(s): AK Arafat, Fnu Nishanth	
Reconfigurable Dual Active Bridge Converter with Full Load Range Soft-Switching Capability for Wide Voltage Range EV Charging Applications [#36]	2529
Uddhav Surve, Deepak Ronanki, Srirama Srinivas <i>Indian Institute of Technology Madras, India</i>	
Comparative Analysis of Integrated Onboard Battery Chargers for Zero Charging Torque using PMSM with and without Neutral Point Access [#1473]	2535
Kamal M. Vaghasiya ¹ , Amrutha K Haridas ¹ , Wesam Taha ² , Yicheng Wang ² , Aniket Anand ² , Sreejith Chakkalakkal ¹ , Ali Emadi ¹ , Phil Kollmeyer ¹ ¹ McMaster University, Canada; ² Vitesco Technologies Canada, Inc., Canada	
Non-Invasive Approach of Emergency Rescue Assistance through Vehicle-to-Vehicle AC Charging [#939]	2542
Nagesh Kamma ¹ , Srinivas Srirama ² , Deepak Ronanki ² , Uddhav Surve ² , S. Eswara Rao ² ¹ Bharat Heavy Electricals Limited, India; ² Indian Institute of Technology Madras, India	
Issues and Solutions for a GaN based Modified Non-Isolated Integrated On-Board Charger Configuration using Traction Motor [#148]	2548
Kazuki Toda ¹ , Shohei Funatsu ¹ , Hiroaki Matsumori ¹ , Takashi Kosaka ¹ , Nobuyuki Matsui ¹ , Keisuke Nakamura ² , Keisuke Ushida ² , Yutaka Hotta ² , Subrata Saha ² ¹ Nagoya Institute of Technology, Japan; ² Aisin Corporation, Japan	
Model Predictive Control for Wide Output Voltage Range Integrated Onboard Charger with Inherent Smooth Mode Transition Capability [#938]	2553
Harish Karneddi, Deepak Ronanki <i>Indian Institute of Technology Madras, India</i>	

Topic E: Power Converter Topologies

Oral Session 5: Switched Capacitor Converters

Chair(s): Reza Rezaii, Dong Cao

- Extended Analysis and Evaluations on a Floating Four-Phase Interleaved Bidirectional DC-DC Converter Utilizing Asymmetric Duty Limit Control [#963] 2560**
Shiqiang Liu¹, Guiyi Dong¹, Tomokazu Mishima¹, Ching-Ming Lai²
¹Kobe University, Japan; ²National Chung Hsing University, Taiwan
- The 48V to 3.3V Matrix Autotransformer Switched Capacitor DC-DC Partial Power Converter for Datacenter Application [#1373] 2568**
Zhongshu Sun, Maohang Qiu, Haoran Meng, Xiaoyan Liu, Dong Cao
University of Dayton, United States
- Topology Comparison and Dead-Time Optimization for Efficiency Enhancement of Always-Dual-Path Hybrid DC-DC Converter with Soft Charging [#1691] 2576**
Katsuhiro Hata¹, Shinsaku Tanaka², Toru Ashikaga², Yasuhiro Rikiishi²
¹Shibaura Institute of Technology, Japan; ²Sanken Electric Co., Ltd., Japan
- Symmetric Series-Capacitor Buck in 48V-to-12V Regulated Conversion for High-Performance Server Boards [#1512] 2583**
Xinmiao Xu, Qiang Li
Virginia Polytechnic Institute and State University, United States
- MASC-PoL: A 48V-1V Matrix Autotransformer Switched-Capacitor Point-of-Load DC-DC Converter for Data Center Application [#1461] 2589**
Haoran Meng, Zhongshu Sun, Maohang Qiu, Xiaoyan Liu, Vafa Marzang, Dong Cao
University of Dayton, United States

Oral Session 6: DC-DC Converters

Chair(s): Jongwon Shin, Mohammed Agamy

- A Compact 48-V-to-Sub-1-V Switching Bus Converter with 4.7-mm Height for Processor Vertical Power Delivery [#970] 2596**
Yicheng Zhu¹, Jiarui Zou¹, Nathan M. Ellis¹, Sudhir Kudva², Mostafa Mosa²,
C. Thomas Gray², Robert C.N. Pilawa-Podgurski¹
¹University of California Berkeley, United States; ²NVIDIA Corporation, United States
- Capacitorless DC-DC Buck Converter [#681] 2604**
Haitham Kanakri, Euzeli Cipriano Dos Santos, Jr., Maher Rizkalla
Purdue University, United States
- Design and Testing of an 8: 1 Non-Isolated Bus Converter for 48V Data Centers [#686] 2610**
Xufu Ren¹, Jinfeng Zhang¹, Borong Hu¹, Pengcheng Xu², Teng Long¹
¹University of Cambridge, United Kingdom; ²EPIC Technology, China
- Stability Analysis of Nonisolated DC/DC Converter in BWPTs Considering Inductance and Switching [#84] 2615**
Eita Sato¹, Keiichiro Kondo¹, Osamu Yamazaki², Kazuaki Yuuki²
¹Waseda University, Japan; ²Toshiba Infrastructure Systems & Solutions Corporation, Japan

Active Switched-Inductor High-Gain Step-Up DC-DC Converter with Reduced Voltage Stress [#349]	2622
Truong-Duy Duong ¹ , Jianghai Xiao ² , Caisheng Wang ³ , Yi-An Liao ¹	
¹ Wayne State University, United States; ² The ISF Academy, Hong Kong;	
³ Cranbrook Kingswood, United States	

Oral Session 16: DAB based DC-DC Converters

Chair(s): Pablo F. Miaja, Dao Zhou

A Low-Complexity Load-Decoupled Talkative Power Conversion Strategy for the Dual-Active-Bridge Converter [#253]	2628
Arkadeb Sengupta, Thiago Pereira, Marco Liserre	
Kiel University, Germany	

Improved Modulation Scheme for a Dual Active Bridge to Ensure Complete ZVS Operation Utilizing Circular Currents [#186]	2634
Fabian Sommer, Tobias Merz, Ruediger Schwendemann, Marc Hiller	
Karlsruhe Institute of Technology, Germany	

A Linearised Approach for Voltage Controller Design of Inherent Decoupled Triple Active Bridge Converters [#437]	2642
Nicola Campagna ¹ , Giuseppe Bossi ² , Rosario Miceli ¹ , Alfonso Damiano ²	
¹ University of Palermo, Italy; ² University of Cagliari, Italy	

Full-Load Range ZVS Achievement by using Both Burst Mode and PWM with Variable Frequency Modulation for DAB Converters [#1800]	2648
Cheng Huang, Tomoyuki Mannen, Takanori Isobe	
University of Tsukuba, Japan	

Multi-Switch-Leg DAB DC-DC Converter with Split Transformer Configuration for MVDC Grid [#968]	2656
Suman Mandal, Ankam Karthik, Anshuman Shukla, Suryanarayana Doolla	
Indian Institute of Technology Bombay, India	

Poster Session 1: DC-DC Power Converters

Chair(s): Jeremy Nuzzo

A DCM Compatible Fast Transient Pi-Type Dual-Path Hybrid Buck Converter [#167]	2662
Chieh-Ju Tsai, Ting-You Lin, Ching-Jan Chen	
National Taiwan University, Taiwan	

Quasi-Parallel Resonant Switched Capacitor DC-DC Converter with Continuous Voltage Regulation Capability [#185]	2668
Jingjing Qi ¹ , Xuezhi Wu ² , Wenzheng Xu ² , Kai Sun ¹	
¹ Tsinghua University, China; ² Beijing Jiaotong University, China	

A β-Type Ultrahigh-Gain Boost Converter [#566]	2675
Hong Li ¹ , Peng Sun ¹ , Mingbo Wei ¹ , Xu Shangguan ¹ , Jiangwei Hu ¹ , Yangbin Zeng ²	
¹ Beijing Jiaotong University, China; ² City University of Hong Kong, Hong Kong	

Averaged Model based Analysis of Output Resistance of The Resonant Switched-Capacitor Converters [#648]	2681
Liang Jia, Yanchao Li Google LLC, United States	
Numerical Output Resistance Modeling for Hybrid Switched-Capacitor Converters with LTP Mapping Technique [#694]	2686
Liang Jia, Yanchao Li Google LLC, United States	
Novel Burst-Mode Control Strategy for Enhanced Light-Load Efficiency of DAB Converters [#1203]	2691
Byeong-Ryeol Na, Jung-Soo Park, Chanh-Tin Truong, Sung-Jin Choi University of Ulsan, Korea	
Use of Metamaterial-Based Variable Inductor for Stability Enhancement of DC-DC Converter [#1822]	2698
Yuanxi Chen, Henry Shu-Hung Chung, Hongjian Lin City University of Hong Kong, Hong Kong	
A 48V-2.2V Matrix Autotransformer Switched-Capacitor DC-DC Converter for Data Center Application [#1029]	2701
Haoran Meng, Zhongshu Sun, Maohang Qiu, Xiaoyan Liu, Vafa Marzang, Dong Cao University of Dayton, United States	
A SPICE based Multi-Domain Optimization of a Quasi-Resonant Passive Snubber Circuit for GaN-Based DC/DC Converter Applications [#305]	2709
Jeremy Nuzzo, Michael Bosch, Tobias Fink, Dominik Koch, Ingmar Kallfass University of Stuttgart, Germany	
Small Signal Modeling of DC-DC SEPIC Converter with Multilevel Flying Capacitor Switching Cell [#995]	2714
Rhavél Batista Morais ¹ , Montiê Alves Vitorino ¹ , Jens Friebe ² ¹ Federal University of Campina Grande, Brazil; ² University of Kassel, Germany	
A Control Method for Full Voltage Conversion Ratio for a Zero-Inductor-Voltage Converter [#621]	2722
Sina Salehi Dobakhshari, Aamna Nasir Hameed, Binghui He, Mojtaba Forouzesh, Yan Fei Liu Queen's University, Canada	
Comparison of Two-Phase Buck Converters with Two- and Three-Winding Coupled Inductors for Low-Voltage High-Current Charging Applications [#954]	2730
Muhammad Abdelraziq, Zeljko Pantic North Carolina State University, United States	
A Quasi-Symmetrical Active-Clamp Forward Converter without Output Inductor to Achieve Full Working Range Soft-Switching [#57]	2737
Liting Li, Guo Xu, Mei Su Central South University, China	

Operation Range Extension Method of DAB Converter considering ZVS Condition using Core-Insertable Transformer with Variable Inductance [#391]	2742
Cheol-Woong Choi, Jae-Sub Ko, Keun-Yong Yoon, Dae-Kyong Kim <i>Sunchon National University, Korea</i>	
Multi-Objective Phase Shift Control Optimization for Dual Active Bridge Converters [#1652]	2747
Antonella Haro Davila, Syed Imam Hasan, Alper Uzum, Ali Elrayyah, Yilmaz Sozer <i>The University of Akron, United States</i>	
An Ultrawide Input Range LLC Resonant Converter with Multi-Mode Switchable Rectifier [#162] .	2752
Wenjie Zhao ¹ , Qunfang Wu ¹ , Qin Wang ¹ , Lan Xiao ¹ , Xiaodong Yang ¹ , Xinrong Cai ² ¹ Nanjing University of Aeronautics & Astronautics, China; ² Nanjing University of Science & Technology, China	
A Novel 4kW Output Low-Voltage DC Converter with Integrated Planar Transformer [#181]	2756
Gyeong-Hyun Kwon, Seong-Wook Jeong, Dong-In Lee, Han-Shin Youn <i>Incheon National University, Korea</i>	
ZVS Operation and Current Ripple Minimization in a Capacitively Blocked Dual Active Half-Bridge Converter [#1060]	2762
Nithyadas P V, Utsab Kundu, Vinod John <i>Indian Institute of Science, India</i>	
Ripple Analysis and Experimental Verification of a Non-Isolated Interleaved DC-DC Converter with Auxiliary H-Bridge Converters for Drastic Minimization of Output Inductor [#1825]	2769
Yusuke Sato ¹ , Hidemine Obara ¹ , Jin Xu ² , Noboru Xu ² ¹ Yokohama National University, Japan; ² Myway Plus Corporation, Japan	
A Static Gain Linearization for a Differential Buck-Boost Inverter Output Voltage THD Reduction [#1843]	2772
Ion dos Santos, Hermano Lazzarin Campos, Telles Brunelli Lazzarin <i>Federal University of Santa Catarina, Brazil</i>	
Poster Session 1: AC-DC and DC-AC Power Converters	
Chair(s): Shenghui Cui	
Submodule Voltage Balancing Methods in Modular Multilevel Converters: A Review [#1791]	2775
Shiyuan Fan ¹ , Leon M. Tolbert ¹ , Xin Xiang ² , Wuhua Li ² ¹ The University of Tennessee, United States; ² Zhejiang University, China	
Design of Load-Independent Class-Φ_3 Resonant Inverter [#1753]	2783
Yutaro Komiyama ¹ , Wenqi Zhu ² , Akihiro Konishi ¹ , Kien Nguyen ¹ , Hiroo Sekiya ¹ ¹ Chiba University, Japan; ² Tokyo University of Science, Japan	
Modulated Model Predictive Control for a Four-Leg Indirect Matrix Converter [#1750]	2789
Mohammad Ali Hosseinzadeh ¹ , Maryam Sarebanzadeh ¹ , Ralph Kennel ¹ , Ebrahim Babaei ² , Marco Rivera ³ , Patrick Wheeler ³ ¹ Technical University of Munich, Germany; ² University of Tabriz, Iran; ³ University of Nottingham, United Kingdom	

An Adaptive Total Sliding Mode Control for Cascaded H-Bridge Multilevel Converters to Suppress Ground Fault in Active Distribution Networks [#1722]	2796
Bin-Long Zhang ¹ , Mohammadreza Lak ¹ , Mou-Fa Guo ² , Sahel Solemanifard ³	
¹ Yuan Ze University, Taiwan; ² Fuzhou University, China; ³ National Sun Yat-Sen University, Taiwan	
Three-Phase AC-DC Isolated Rectifier with Single-Transformer Excited by the Common Mode Voltage and ZVS Capability [#1668]	2803
Vitor Freire Bezerra ¹ , Montiê Alves Vitorino ¹ , Jean Torelli Cardoso ¹ , Paulo Peixoto Praça ²	
¹ Federal University of Campina Grande, Brazil; ² Universidade Federal do Ceará, Brazil	
Development of an Ultra Compact Active Clamp Flyback AC/DC Converter with a Wide Input Voltage Range [#1644]	2810
Reza Mounesi, Navid Hadifar, Enrico Santi, Adel Nasiri	
University of South Carolina, United States	
Efficiency Considerations of a 3 kW, all SiC Current-Source Converter [#1631]	2816
Benedikt Riegler ¹ , Yonghwa Lee ² , Alberto Castellazzi ² , Michael Hartmann ¹	
¹ Graz University of Technology, Austria; ² Kyoto University of Advanced Science, Japan	
A Si and SiC based Enhanced Level Hybrid Converter with Improved Efficiency and Reduced Footprint [#1627]	2824
Jayant Kumar, Anil Kumar Tiwari, Siba Kumar Patro	
Indian Institute of Technology Roorkee, India	
A Novel Digital Control Strategy for GaN-Based Interleaving CRM Totem-Pole PFC [#223]	2831
Wenhao Yu, Xuefeng Fan, Tao Wei, Yingchun Xu	
Navitas Semiconductor, China	
Three-Phase PUC5 Multilevel Inverter Fed by a Single DC-Source [#1509]	2837
Saul M. S. Junior ¹ , Edgard L. L. Fabricio ^{1,2} , Samuel C. S. Júnior ³ , Darlan A. Fernandes ¹	
¹ Federal University of Paraíba, Brazil; ² Federal Institute of Paraíba;	
³ Federal University of Campina Grande, Brazil	
A Review of Challenges in Switching Cycle Control for Modular Multilevel Converters [#1507]	2844
Jayesh Kumar Motwani, Boran Fan, Dushan Boroyevich, Dong Dong, Rolando Burgos	
Virginia Polytechnic Institute and State University, United States	
Capacitor Voltage Balancing Pulsewidth Modulation Method for a Single DC Source Driven Cascaded Three-Level Inverter Drive [#660]	2851
Swapnil Tripathi, Uddhav Surve, Srirama Srinivas	
Indian Institute of Technology Madras, India	
New Space Vector Modulation to Maintain Unbalanced Flying Capacitor Voltage for Output Current Ripple Reduction [#628]	2857
Shinjiro Shimura, Keisuke Kusaka	
Nagaoka University of Technology, Japan	
A DPWM-Based Hybrid Variable Switching Frequency Control for Parallel Interleaved Three-Level T-Type Inverter [#608]	2864
Jie Deng ¹ , Jianliang Chen ² , Zhicheng Guo ¹	
¹ Arizona State University, United States; ² Hebei University of Technology, China	

Enhanced Reconstruction Model-Based Voltage Predictive Control with Superior Capabilities [#472]	2872
Yousefreza Jelodar ¹ , Omid Salari ¹ , Mohamed Z. Youssef ² , Alireza Bakhshai ¹	
¹ Queen's University, Canada; ² Ontario Tech University, Canada	

Improved Finite-Control-Set Model Predictive Control of a Modular Multilevel Converter with Reduced Computational Burden [#443]	2880
Hussein Kadhum, Alan J. Watson, Marco Rivera, Pericle Zanchetta, Patrick Wheeler	
University of Nottingham, United Kingdom	

Study and Implementation of a Three-Phase Three-Level T-Type Inverter with Fault Ride through Capabilities [#404]	2888
Meng-Shien Tsai, Tsorng-Juu Liang, Xue-Yi Chen, Kim Kien Nghiep Huynh, Kai-Hui Chen, Wen-Chung Chen	
National Cheng Kung University, Taiwan	

Oral Session 29: Multi-Phase AC-DC Converters

Chair(s): Mahima Gupta, Sridhar Pulikanti

Y-Configuration Solid State Transformer Module [#1440]	2894
Mafu Zhang, Huanghao Zou, Saleh Farzamkia, Chen Chen, Alex Q. Huang	
The University of Texas at Austin, United States	

A Practical Carrier-Based Discontinuous PWM Method of Vienna Rectifier considering Neutral-Point Voltage Fluctuation [#1030]	2900
Juyeon Lee, Suhyeon Kim, June-Seok Lee	
Dankook University, Korea	

Single-Stage Isolated Bidirectional Extended-Functionality X-Rectifier for EV Chargers with Three/Single-Phase AC Input Capability [#809]	2906
Daifei Zhang, Sven Weihe, Jonas Huber, Johann W. Kolar	
ETH Zurich, Switzerland	

Performance Analysis of the Dynamic Voltage Balancing using Series-Connected 15kV SiC IGBT and 10kV SiC MOSFET for Medium Voltage 3L-NPC Power Converter [#1327]	2914
Sanket Parashar, Shubham Rawat, Bhattacharya Subhashish	
North Carolina State University, United States	

Design and Development of a Compact GaN based 3-Level Flying Capacitor Inverter [#1598]	2922
Xiang Li, Xiaoqing Song	
University of Arkansas, United States	

Poster Session 2: Resonant Power Converters

Chair(s): Ralph Kennel

A New Control Strategy for a Voltage and Current Fed Multiport DC-DC Converter [#1134]	2927
Rupert Power, Udaya Madawala, Akshya Swain	
University of Auckland, New Zealand	

Architecture of Self-Power-Supplied Auxiliary Power Supply for High-Voltage SiC MOSFET [#1283]	2933
Yuan Zhou ¹ , Li Zhang ¹ , Yilun Chen ² , Tianxiang Yin ¹ , Lei Lin ¹	
¹ Huazhong University of Science & Technology, China; ² Southwest Jiaotong University, China	
A 5 MHz Capacitor-Isolated Resonant SEPIC DC-DC Converter with a Wide Input Voltage Range [#1497]	2938
Ning Yan ¹ , Dong Dong ¹ , Rolando Burgos ¹ , Yehuda Levy ² , Shimon Khananashvili ² , Ilan Yoscovich ²	
¹ Virginia Polytechnic Institute and State University, United States; ² SolarEdge Technologies, Inc., Israel	
Attention Mechanism Empowered Dual Active Bridge Converter Performance Modeling with Enhanced Interpretability and Lighter Data [#170]	2946
Weihao Lei ¹ , Fanfan Lin ¹ , Xinze Li ² , Hao Ma ¹ , Rui Li ³ , Lin Xu ³	
¹ Zhejiang University, China; ² University of Arkansas, United States;	
³ Wuhan Second Ship Design & Research Institute, China	
Design and Prototyping of Dual Planar Coils for High-Frequency GaN-Based Wireless Power Transfer Converters [#1433]	2950
Araz Saleki, Mahima Gupta	
University of Wisconsin-Madison, United States	
Optimal Design of Wide Input Voltage Range LLC Converter in Avionics Application [#1227]	2957
Woonjung Hong, Tianyu Zhao, Dong Dong, Rolando Burgos	
Virginia Polytechnic Institute and State University, United States	
A Compact Multilevel Converter with Trapezoidal Modulation for MVdc-LVdc [#1130]	2962
Rajat Shahane ¹ , Mohd Shadab Ansari ² , Suman Mandal ¹ , Anshuman Shukla ¹	
¹ Indian Institute of Technology Bombay, India; ² Hitachi Energy, Sweden	
Fault-Tolerant Control Strategy for Half Bridge ANPC based DAB Converter with Enhancing Reliability [#1527]	2969
Piyali Pal ¹ , Ranjan Kumar Behera ¹ , Khalifa Al Hosani ² , Utkal Ranjan Muduli ²	
¹ Indian Institute of Technology Patna, India; ² Khalifa University, United Arab Emirates	
Modelling of a Multi-Period Damped Resonant DC-DC Converter with Capacitive Isolation [#275]	2975
Stefano Cerutti ¹ , Mario Giuseppe Pavone ² , Francesco Musolino ¹ , Paolo Stefano Croveti ¹	
¹ Politecnico di Torino, Italy; ² STMicroelectronics, Italy	
Extension of the Series Resonant Converter Topology for Gate Driver Supply with a CM Choke [#914]	2982
Christian Beckemeier, Axel Mertens	
Leibniz University Hannover, Germany	
Input Impedance Modeling and Reshaping Control Strategy for Hybrid Modular DC Transformers in DC Distribution Networks [#1548]	2987
Wei Wang, Shijie Cheng, Shaokun Niu, Tong Liu, Alian Chen	
Shandong University, China	
Design Considerations for a Three-Phase DAB with Instantaneous Flux and Current Control under Wide Voltage Variation [#327]	2993
Apoorv Agarwal, Subhashish Bhattacharya	
North Carolina State University, United States	

**A Photovoltaic Interleaved Boost Integrated CL Resonant Converter for
Magnetron Application [#1883] 3001**
Aref Molaei, Kajanan Kanathipan, John Lam
York University, Canada

**Fast Load Dump Effect in Inductive Wireless Power Transfer System:
Analysis and Mitigation [#695] 3004**
Yanchao Li, Haoquan Zhang, Liang Jia, Srikanth Lakshmikanthan
Google LLC, United States

**Multi-Agent Deep Reinforcement Learning Aided Active Disturbance Rejection
Control of DC Solid-State Transformer in Electric Aircraft [#651] 3009**
Yu Zeng¹, Qingxiang Liu¹, Josep Pou¹, Yanlei Yu¹, Candra Adi Wiguna¹,
Christopher H. T. Lee¹, James Wang¹, Huanqing Sun², Armen Baronian³
¹Nanyang Technological University, Singapore; ²Eaton Corporation, China;
³Eaton Corporation, Canada

**A Low-Profile Gate Power Supply for a SiC Phase Leg with
Reduced Isolation Capacitance [#1101] 3015**
Bo Li, Xingchen Zhao, Zichen Zhang, Emmanuel Arriola, Yuchi Qingrui,
Guo-Quan Lu, Rolando Burgos, Khai Ngo
Virginia Polytechnic Institute and State University, United States

Poster Session 3: Soft Switching in Power Converters **Chair(s): Caisheng Wang**

**Design Optimization and Planar Magnetics Integration of Three-Phase Interleaved LLC
Resonant Converter [#785] 3022**
Tong Li, Jin Wen, Jiajia Guan, Jiaxin Liu, Cai Chen, Yong Kang
Huazhong University of Science & Technology, China

**18 kV Partial Discharge Free Medium Voltage Insulated Gate Driver Power Supply for
SiC-Based Power Conversion System [#1024] 3026**
Abhinav Soni¹, Dong Dong¹, Rolando Burgos¹, Troy Beechner², Zachary Smith²
¹Virginia Polytechnic Institute and State University, United States; ²RCT Systems, United States

**Optimization of Transformer Design Parameters of a 20 kW SiC-Based Dual-Active
Bridge Converter for Enhanced Efficiency [#459] 3034**
Gayoung Park, Hwigoon Kim, Shenghui Cui
Seoul National University, Korea

**High-Performance Dual-Output Impedance Control Network-Based
Single Stage AC-DC Converter [#1437] 3040**
Firehiwot Gurara, Dheeraj Etta, Khurram K. Afridi
Cornell University, United States

**A Soft-Switched Bidirectional Single-Phase Single-Stage AC-DC Isolated Converter with
Active Power Factor Correction and Reduced Power Device Count [#925] 3046**
Junwei Liu, Muhammad Talib Faiz, Chi Shing Wong, Ka Hong Loo, Chi Yung Chung
Hong Kong Polytechnic University, Hong Kong

Single-Stage Isolated On-Board Charger with Reduced MOSFET Count by Sharing Switch Leg [#248]	3052
Dong-In Lee, Seong-Wook Jeong, Gyeong-Hyun Kwon, Han-Shin Youn Incheon National University, Korea	
Novel Isolated Direct AC/DC Converter with Low Leakage-Inductance Transformer and Hard-Switching Technology Capable of Suppressing Surge Peak-Voltage [#380]	3057
Shuji Katoh ¹ , Naoki Takagi ¹ , Keita Suzuki ¹ , Tetsuo Endoh ¹ , Yoshitaka Iwaji ² , Yoshikazu Takahashi ¹ ¹ Tohoku University, Japan; ² Ibaraki University, Japan	
Single-Phase Unidirectional Multilevel Rectifiers based on Cascaded Cells [#17]	3064
Amanda Pereira Monteiro ¹ , Cursino Brandão Jacobina ² , Filipe Antonio da Costa Bahia ³ , Reuben Palmer Rezende de Sousa ⁴ , Jean Torelli Cardoso ² , Alan Robson Andrade Pinto ³ ¹ Federal University of Ceara, Brazil; ² Federal University of Campina Grande, Brazil; ³ Federal University of Bahia, Brazil; ⁴ Federal University of Pernambuco, Brazil	
A Rectifier with Inherent Unity Power Factor [#1322]	3072
Sayed Reza Afzali Arani ¹ , Alireza Ramezan Ghanbari ¹ , Heinz Seyringer ¹ , Dietmar Klien ² , Lukas Saccavini ² , Norbert Linder ² ¹ V-Research GmbH, Austria; ² Tridonic GmbH & Co KG, Austria	
Enhanced Efficiency for 11kW On-Board Charger with Variable Switching Frequency [#1182]	3079
Seong-Yong Hong, Seok-Min Hong, Chan-Bae Park, Hyung-Woo Lee, Jae-Bum Lee Korea National University of Transportation, Korea	
Mathematical Analysis and Space Vector Modulation of the Three-Phase Buck-Boost Rectifier with Reactive Power Capability [#999]	3083
Yan Pontes Figueiredo ^{1,2} , Montiê Alves Vitorino ¹ , Jens Friebe ² ¹ Federal University of Campina Grande, Brazil; ² University of Kassel, Germany	
Single-Phase Single-Stage Isolated Buck-Boost Inverters [#70]	3091
Usman Ali Khan ¹ , Ashraf Ali Khan ² , Won-Yong Jang ¹ , Hyeonwoo Jung ¹ , Jung-Wook Park ¹ ¹ Yonsei University, Korea; ² Memorial University of Newfoundland, Canada	
Load-Independent Class-E Inverter with ASK Modulation [#830]	3097
Wenqi Zhu ¹ , Ayano Komanaka ² , Yutaro Komiyama ² , Xiuqin Wei ³ , Kien Nguyen ² , Hiroo Sekiya ² ¹ Tokyo University of Science, Japan; ² Chiba University, Japan; ³ Chiba Institute of Technology, Japan	

Oral Session 39: LLC Resonant Converters

Chair(s): Suyong Chae, Reza Rezaii

A Medium Voltage Bidirectional Modular LLC Converter with an Extendable Stacked-Switches Leg [#1531]	3102
Maria Beshara ¹ , Muhammad Ali Masood Cheema ² , John Lam ¹ ¹ York University, Canada; ² Northern Transformer Corporation, Canada	
Design and Implementation of Dual Active Bridge DC-DC Resonant Converter with Dual Phase-Shift Controls for Wide Voltage Range Applications [#399]	3107
Te-Wei Peng, Tsorng-Juu Liang, Shih-Ming Chen, Kim Kien Nghiep Huynh, Xue-Yi Chen, Kevin Chen National Cheng Kung University, Taiwan	

A Multiport Configuration of Dual Active Bridge CLLC Resonant Converter for Solar Powered Electric Vehicle Fast Charging [#341]	3115
Md Safayatullah ¹ , Reza Rezaii ² , Mohammad Nilian ² , Issa Batarseh ²	
¹ Ford Motor Company, United States; ² University of Central Florida, United States	

Optimal Module Count for ISOP LLC Resonant Converters based on an HF Transformer Genetic Algorithm Optimization in Motorsport Applications [#1638]	3122
Andrea Volpini ¹ , Giulia Tresca ¹ , Salvatore Campailla ² , Andrea Dappiano ² , Pericle Zanchetta ¹	
¹ University of Pavia, Italy; ² Marelli Motorsport, Italy	

Cascaded Voltage and Power Control for Full-Bridge-Fed CLLC Resonant Converter to Expand Output Voltage Range [#109]	3130
Hung-Chi Chen ¹ , Ya-Chun Chang ¹ , Jia-Liang Lin ¹ , Chih-Chiang Wu ²	
¹ National Yang Ming Chiao Tung University, Taiwan; ² Industrial Technology Research Institute, Taiwan	

Oral Session 40: High Frequency DC-DC Converters

Chair(s): Yeonho Jeong, Mattia Rossi

Dual PWM Three-Level Resonant DC/DC with Voltage Balancing for Stacked Capacitors [#590] ..	3137
Yu Zuo, Xiaobing Shen, Bangli Du, Camilo Suarez, Wilmar Martinez	
KU Leuven - EnergyVille, Belgium	

A DC-Bias Elimination Strategy for Maintaining ZVS in Transient Operations of IGCT-Series-DCT [#323]	3143
Yiqing Ma, Jialiang Hu, Bin Cui, Xueteng Tang, Liang Dong, Long Zhang, Biao Zhao	
Tsinghua University, China	

Efficient Integrated Magnetics with Winding Cancellation Technique to Reduce Common-Mode EMI Noise for a Single Phase CLLC Converter [#731]	3151
Feng Jin, Tianlong Yuan, Ahmed Nabih, Zheqing Li, Qiang Li	
Virginia Polytechnic Institute and State University, United States	

Efficiency Improvement of DAB Converter for Double Line Frequency Oscillating Power Operations in SST by Achieving Zero-Voltage Switching in Low Power Operations [#1789]	3159
Yota Suzuki, Cheng Huang, Tomoyuki Mannen, Takanori Isobe	
University of Tsukuba, Japan	

Design Optimization of a 3.3 v Bus Converter for Vertical Power Delivery in Next-Generation Processors [#1484]	3167
Yan Liang ¹ , Pranav Raj Prakash ¹ , Ahmed Nabih ² , Qiang Li ¹	
¹ Virginia Polytechnic Institute and State University, United States; ² NVIDIA Corporation, United States	

Oral Session 50: AC-DC Converters

Chair(s): John Lam, Yeonho Jeong

Quasi-Fixed Frequency Triangular Modulation for MatriX-Type AC-DC Dual Active Bridge Converter with Enhanced Battery Charging [#196]	3175
Priyatosh Jena, Rajeev Kumar Singh, Vivek Nandan Lal	
Indian Institute of Technology (BHU) Varanasi, India	

Operation Characteristics of an Active Buffer DAB AC-DC Converter with a Wide Output Voltage Range [#224]	3182
Shohei Komeda ¹ , Sindisiwe Malanda ¹ , Kain Arai ¹ , Hiroyasu Kifune ¹ , Shunsuke Takuma ² , Yoshiya Ohnuma ² ¹ Tokyo University of Marine Science & Technology, Japan; ² Nagaoka Power Electronics Co., Ltd., Japan	
A New Half-Bridge/Dual-Stacked-Switches Structured Electrolytic Capacitor-Less AC/DC Bi-Directional On-Board Charger for High-Voltage EV Battery [#1438]	3188
Siamak Derakhshan, John Lam York University, Canada	
Comparison between an Isolated AC-DC Matrix Converter and a Conventional On-Board Charger Topology for Electric Vehicle Application [#964]	3195
Paulius Pazera, Lee Empringham, Liliana De Lillo, Stewart Marchant University of Nottingham, United Kingdom	
Robust Fixed-Frequency Sliding Mode Control based on Sequential Control Logic for a Four-Level FCML Totem-Pole PFC Converter [#746]	3203
Naveed Ishraq, Ayan Mallik Arizona State University, United States	
 Oral Session 51: Single Phase DC-AC Converters	
Chair(s): Dongbin Hou, Rashmi Prasad	
High Power Dense 1-Ph 3-Port Converter for On-Board EV Charging Application [#988]	3211
Suman Mandal, Subhasree Mondal, Anshuman Shukla, Suryanarayana Doolla Indian Institute of Technology Bombay, India	
Partially Variable Switching Frequency based Soft- Switched Triple-Phase Shift Modulation for DC-AC DAB [#758]	3217
Saikat Dey, Ayan Mallik Arizona State University, United States	
A Single-Stage Double-Side LCL Resonant Mode Microinverter for Grid-Tied PV Applications [#1743]	3225
Chenmin Deng ¹ , Yihao Wu ¹ , Tim Merkin ² , Alex J. Hanson ¹ ¹ The University of Texas at Austin, United States; ² Texas Instruments, United States	
Wireless DC-AC Inverter with Secondary Side SR Duty Cycle Modulation and Unfolding Stage [#117]	3232
Hsin-Che Hsieh ¹ , Bryan Gutierrez ¹ , Seunghoon Baek ² , Jih-Sheng Lai ¹ ¹ Virginia Polytechnic Institute and State University, United States; ² Qcells, United States	
T-Type Inverter in Both Continuous and Discontinuous Current Mode for Active Power Decoupling Capability [#879]	3239
Ryohei Higashide, Rintaro Kusui, Hiroki Watanabe, Yuki Nakata, Jun-ichi Itoh Nagaoka University of Technology, Japan	

Oral Session 62: Modular Power Converters

Chair(s): Todd Monson, Luca Tarisciotti

- 3.3kV SiC-Based 200-2100V Local Power Supply for Modular Solid State Transformer Applications [#1592]** 3245
Pranit Pawar¹, Wensong Yu¹, Cam Pham², Ali Shahabi², Jonathan Hoffman²
¹North Carolina State University, United States; ²Microchip Technology, United States
- A Bidirectional Single-Inductor Multiple-Output (SIMO) Buck-Boost Converter for Multi-Coil Wireless Power Transfer Applications [#258]** 3253
Chuyue Ji, Albert Ting Leung Lee, Jiayang Wu, Yunhe Hou, Ngai Wong
The University of Hong Kong, Hong Kong
- Advanced Control for Modularized Bridge Rectifier Solid-State Transformers in MVAC-LVDC Applications [#1757]** 3259
Giacomo Andrioli¹, Sandro Calligaro¹, Jonas Huber², Johann W. Kolar², Roberto Petrella¹
¹University of Udine, Italy; ²ETH Zurich, Switzerland
- A Modular Commutated Converter with DC-Fault Ride-Through Capability for Overhead-Line-Based VSC-HVDC Application [#496]** 3267
Ruihang Bai¹, Biao Zhao¹, Xueyin Zhang², Lin Wang¹, Zhanqing Yu¹, Rong Zeng¹
¹Tsinghua University, China; ²Tsinghua Sichuan Energy Internet Research Institute, China
- A Modular, Non-Resonant Multi-Output Inverter for use in Flexible Cooking Surfaces [#877]** 3275
Felix Rehm¹, Jan Philipp Klein¹, Héctor Sarnago², Rüdiger Schwendemann¹, Marc Hiller¹
¹Karlsruhe Institute of Technology, Germany; ²University of Zaragoza, Spain

Oral Session 63: Topology of Multi-Level Converters

Chair(s): Philippe Gray, Slavko Mocevic

- A Three-Level Improved NPC (3L-INPC) Topology with Higher Voltage Gain [#896]** 3283
Marif Daula Siddique, Prasanth Sundararajan, Mrutyunjaya Sahani, Sanjib Kumar Panda
National University of Singapore, Singapore
- Nonlinear Capacitance-Based Accurate ZVS Analysis for Full-Bridge T-Type-Based Resonant Converters [#1501]** 3288
Shubhangi Gurudiwan, Aditya Zade, Hongjie Wang, Regan Zane
Utah State University, United States
- Investigation of Pole-to-Pole DC Voltage and Circulating Current on Design Requirements of Full-Bridge Modular Multilevel Converter [#944]** 3296
Sohrab Mohtat¹, Massimo Bongiorno¹, Mebtu Beza¹, Jan R. Svensson²
¹Chalmers University of Technology, Sweden; ²Hitachi Energy, Sweden
- A Single-Phase MMC-Based Solid-State Transformer Suitable for EV Charging [#1079]** 3304
Xi Lan, Peter Lehn
University of Toronto, Canada

Development of a 13.8 kV, 22 kV DC, 1.1 MVA, 7-Level Multi-Cell Converter based on 10 kV SiC MOSFETs [#1519]	3312
David Nam ¹ , Ning Yan ¹ , Arthur Mendes ¹ , Mingze Gao ¹ , Vladimir Mitrovic ¹ , Joshua Stewart ² , Xiang Lin ³ , Dong Dong ¹ , Rolando Burgos ¹ ¹ Virginia Polytechnic Institute and State University, United States; ² The Aerospace Corporation, United States; ³ Tesla, United States	

Oral Session 72: Control of DC-AC Converters

Chair(s): Shuo Wang, Wenkang Huang

High Frequency Three-Phase CRM Inverter with Integrated Magnetics for Auxiliary Power Supply in Railway Applications [#1239]	3320
Xingyu Chen ¹ , Gibong Son ² , Zhengrong Huang ³ , Feng Jin ¹ , Qiang Li ¹ ¹ Virginia Polytechnic Institute and State University, United States; ² Tesla, United States; ³ Analog Devices Inc., United States	

A Buck-Boost Current-Controlled Permanent Magnet Synchronous Motor Drive with Stiff Motor Terminal Voltage and Current Waveforms [#1429]	3326
Daisy Delgado-Zaragoza ¹ , Mahima Gupta ² ¹ Portland State University, United States; ² University of Wisconsin-Madison, United States	

A Novel Soft-Switching Scheme for Three-Phase DC/AC Universal Minimal Converters (UMC) [#1536]	3333
Ruomu Hao, Satish Belkhode, Joseph Benzaquen, Deepak Divan Georgia Institute of Technology, United States	

Implementation of Advanced Grid Support Functionalities by Smart Operation of Residential Loads with Low Cost Converter Interface [#1402]	3339
Vikram Roy Chowdhury, Yeongrack Son, Nischal Guruwacharya, Michael Blonsky, Barry Mather National Renewable Energy Laboratory, United States	

On the Analysis of the Losses of the Resonant Inductor in ARCP Inverters [#1000]	3344
Eddy Aeloiza ¹ , Weiqiang Chen ¹ , Bernhard Wunsch ² , Stanislav Skibin ² , Francisco Canales ² ¹ ABB Ltd., United States; ² ABB Ltd., Switzerland	

Oral Session 73: Resonant and Soft Switched Converters

Chair(s): Anshuman Shukla, Xin Zan

A High-Frequency Soft Switched Inverter with a Low-Loss and Low Device Stress Auxiliary ZVT Circuit for High-Voltage Applications [#1621]	3351
Arnab Acharya, Vivek Thomas Chacko, Raja Ayyanar Arizona State University, United States	

500-kHz Operated Three-Phase Grid-Tied Inverter using GaN-HEMTs Enabled by DCM-Based ZVS Control Utilizing Device Parasitic Capacitance [#1700]	3357
Takeru Yoshizato, Cheng Huang, Tomoyuki Mannen, Takanori Isobe University of Tsukuba, Japan	

Design and Development of a Family of Non-Isolated Three-Port DC-DC Converters for Hybrid Energy Systems Application [#159] 3364
 Pouya Zolfi, Sina Vahid, Ayman El-Refaie
Marquette University, United States

Analysis and Performance Improvement of Hybrid DAB Converter over Wide Operating Region with a Novel Optimized Modulation Scheme [#1008] 3372
 Nikhil Suresh Patil, Anshuman Shukla
Indian Institute of Technology Bombay, India

High-Performance Wide Operating Range Impedance Control Network-Based Single-Stage Onboard Electric Vehicle Charger using Reconfigurable Active Bridges [#1318] 3379
 Dheeraj Etta, Firehiwot Gurara, Khurram K. Afridi
Cornell University, United States

Oral Session 86: Control of Multi-Level Converters II **Chair(s): Qichen Yang, Zhou Dong**

FCS-MPC with Computational Efficiency and dv/dt Mitigation in Multilevel Converters [#1731] 3386
 Cristian Castillo¹, Cristian García¹, Daniel Sanchez¹, Baldomero Araya¹, Chenwei Ma²,
 S. Alireza Davari³, Bo Long⁴, Jose Rodriguez⁵
¹Universidad de Talca, Chile; ²Southwest Jiaotong University, China; ³Universidad Andres Bello, Chile;
⁴University of Electronic Science & Technology of China, China; ⁵Universidad San Sebastián, Chile

A Novel Control Strategy for a Four-Level ANPC-Based DAB Converter to Achieve Soft Switching in Full Power Range [#1586] 3393
 Jupeng Pang, Wei Zhou, Kui Wang, Zedong Zheng, Yongdong Li
Tsinghua University, China

An Analytical Closed-Loop Steady-State Model for Modular Multilevel Converters [#140] 3400
 Zhixiang Li, Yunqing Pei, Lu Chen, Laili Wang
Xi'an Jiaotong University, China

FPGA based Space Vector Modulation Strategy for the Three-Phase 7-Level Multiplexed Converter [#1180] 3405
 Nicolas Eugênio Lima Baschera, Marco di Benedetto, Alessandro Lidozzi, Luca Solero
Università degli Studi Roma Tre, Italy

Comprehensive AI-Based System for Control, Sensor Estimation, and Fault Detection of Cascaded Multilevel Inverters [#1584] 3413
 Renata R. Reis Kimpara, Marcio L. Magri Kimpara, Pedro Ribeiro, Joao O. Pereira Pinto, Burak Ozpineci
Oak Ridge National Laboratory, United States

Oral Session 96: AC-AC Power Converters **Chair(s): Giovanni De Carne, Shuo Wang**

Fixed-Off-Time Pulse Coding Modulation for Single-Phase Resonant Direct AC-AC Converter in High-Frequency Induction Heating Systems [#1017] 3420
 Guiyi Dong¹, Shiqiang Liu¹, Tomokazu Mishima¹, Ching-Ming Lai²
¹Kobe University, Japan; ²National Chung Hsing University, Taiwan

Large- and Small-Signal Modeling of Differential Mode PWM Active-Clamp Ćuk AC/AC Converter [#1225]	3427
Shantanu Gupta, Sudip K. Mazumder University of Illinois Chicago, United States	
Current Control of Bidirectional WPT System using a Matrix Converter [#230]	3435
Masaki Yamamoto, Takaharu Takeshita Nagoya Institute of Technology, Japan	
Three-Phase Transformerless Unified Power Quality Conditioner based on Six-Leg Converter [#1220]	3443
Lucas Fabrício M. de Lucena ¹ , Cursino B. Jacobina ¹ , Alan S. Felinto ¹ , Jean T. Cardoso ¹ , Victor F.M.B. Melo ² , Nady Rocha ² ¹ Federal University of Campina Grande, Brazil; ² Federal University of Paraíba, Brazil	
Model Predictive Current Control for a Three-Phase Modular Matrix Converter [#1799]	3451
Maryam Sarebanzadeh ¹ , Mohammad Ali Hosseinzadeh ¹ , Ralph Kennel ¹ , Ebrahim Babaei ² , Marco Rivera ³ , Patrick Wheeler ³ ¹ Technical University of Munich, Germany; ² University of Tabriz, Iran; ³ University of Nottingham, United Kingdom	
Oral Session 97: Flying Capacitor Multi-Level Converter	
Chair(s): Yongsug Suh, Marco di Benedetto	
A High Power Density MW-Level Medium Voltage Eight-Level Flying Capacitor Converter [#1747]	3457
Ruirui Chen ¹ , Min Lin ¹ , Zihan Gao ¹ , Yang Xu ¹ , Mohamed Al Sager ¹ , Fred Wang ^{1,2} , Hua Bai ¹ , Leon M. Tolbert ¹ ¹ The University of Tennessee, United States; ² Oak Ridge National Laboratory, United States	
A Start-Up Method for Flying Capacitor Topologies using the Output Filter with Few Additional Components [#468]	3465
Jannik Maier, Burkhard Ulrich, Philipp Czerwenka, Eckhard Hennig, Gernot Schullerus Reutlingen University, Germany	
A Variable Switching Frequency Control Technique for DC-AC Flying Capacitor Multilevel Converters to Improve Efficiency and Inductor Utilization [#1339]	3473
Francesca Giardine ¹ , Yixuan Wu ² , Robert C. N. Pilawa-Podgurski ¹ ¹ University of California Berkeley, United States; ² KTH Royal Institute of Technology, Sweden	
An 840 V-to-120 V Radiation-Tolerant Flying Capacitor Multilevel Converter for Space Robotics [#1790]	3479
Elisa Krause ¹ , Samantha Coday ² , Logan Horowitz ¹ , Robert C. N. Pilawa-Podgurski ¹ ¹ University of California Berkeley, United States; ² Massachusetts Institute of Technology, United States	
Fully Soft-Switching Flying-Capacitor-Based Quasi-Resonant Buck Converter with Reduced Voltage and Current Stress [#1687]	3486
Kumar Joy Nag, Gianluca Roberts, Aleksandar Prodic University of Toronto, Canada	

Poster Session 4: Multi-Level Power Converters

Chair(s): Ruirui Chen

- Comparison of Phase-Shifted and Phase-Disposition PWM Schemes in an Asymmetrical Cascaded H-Bridge Converter [#537] 3494**
Pascal Lingom¹, Emmanuel Agamloh¹, Annette von Jouanne¹, Alex Yokochi¹,
Joseph Song-Manguelle², Roland Unruh³
¹Baylor University, United States; ²University of Quebec at Trois-Rivieres, Canada;
³Paderborn University, Germany
- Harmonic Optimization in High Gain 13-L Switched-Capacitor Multilevel Inverter using Hybrid Ant Colony Optimization [#184] 3500**
Arya Singh, Vivek Nandan Lal, Ranjit Mahanty
Indian Institute of Technology (BHU) Varanasi, India
- Suppression of Overvoltage and Oscillation in Three-Level ANPC Converter using Duty-Decreased PWM and Saturable Ferrite Cores [#474] 3508**
Qianyi Huai, Chengxiang Zhu, Shan Li, Tingkang Wang, Wenxi Yao, Xiangning He
Zhejiang University, China
- Resonant Flying Capacitor Multi-Level Converter with Rerouted Capacitor for High Power Density and Efficiency [#384] 3514**
Dam Yun, Sunghyuk Choi, Jung-Ik Ha
Seoul National University, Korea
- A Hybrid Si/SiC Cross-Connected Submodule based MMC for Enhanced Performance [#1129] ... 3519**
Rajat Shahane, Anshuman Shukla
Indian Institute of Technology Bombay, India
- A New Three-Level Split-Inductor T-Type Inverter [#732] 3527**
Lucas Vinicius de Araújo Gomes, Montiê Alves Vitorino, Maurício Beltrão de Rossiter Corrêa
Federal University of Campina Grande, Brazil
- A Heuristic Method to Minimize Switching Actions for Y-Matrix Modulated SC-MMC [#775] 3534**
Ziyao Liao, Yunting Liu
The Pennsylvania State University, United States
- Evaluation of Grid-Tied SiC-Based Modular Multilevel Converter with Medium Frequency Operation [#1217] 3542**
Haodong Yang, Liyang Du, H. Alan Mantooth
University of Arkansas, United States
- A Fully Distributed Modulation Scheme for Modular Multilevel Converters [#1479] 3548**
Minghui Lu, Marcelo Elizondo, Timothy Salsbury, Veronica Adetola, Kevin Schneider
Pacific Northwest National Laboratory, United States
- Abnormal Voltage Compensation Caused by Vertical Crossing in Phase-Shifted PWM-Based Cascaded H-Bridge Inverters [#698] 3553**
Jeong-Yul Bang, Dongho Choi, Hyeon-Woo Oh, June-Seok Lee
Dankook University, Korea

Modular Multilevel Converters with Three-Active-Switch Symmetrical-Half-Bridge Submodules and Sensorless Voltage Balance [#635]	3559
Chenming Liu, Jiang Lai, Jingyang Fang <i>Shandong University, China</i>	
Enhanced Modular Multilevel Converter based PV System for Injecting Balanced Grid Current under Partial Shading Conditions [#562]	3563
Mustafa Fadel Al-Qaisi, Mohammed Elgendy, Mohamed Dahidah, Andrew Smith, Osama Abushafa <i>Newcastle University, United Kingdom</i>	
A Pulse Compensation Scheme for Maintaining Balanced Voltage of a Cascaded Multilevel Converter under Multiple Submodule Failures [#320]	3569
Yosuke Aoki, Yushi Miura <i>Nagaoka University of Technology, Japan</i>	
An Innovative Multiport Soft Open Point with Ground Fault Suppression for Future Continuous Power Supply-Oriented Distribution Networks [#202]	3577
Bin-Long Zhang ¹ , Mohammadreza Lak ¹ , Mou-Fa Guo ² , Sahel Solemanifard ³ ¹ <i>Yuan Ze University, Taiwan</i> ; ² <i>Fuzhou University, China</i> ; ³ <i>National Sun Yat-Sen University, Taiwan</i>	
Enhanced Reactive Power Transfer Capability and ZVS Range Analysis for a Single-Stage DAB based Electronic Transformer using Bidirectional Switches [#1486]	3585
Shubham Rawat, Ramandeep Narwal, Subhashish Bhattacharya, B. Jayant Baliga, Douglas C. Hopkins <i>North Carolina State University, United States</i>	
A Three-Phase Reduced Stage AC-AC Converter with Galvanic Isolation and Isolated DC Ports [#627]	3593
Asad Hameed, Gerry Moschopoulos <i>University of Western Ontario, Canada</i>	
Unaligned Boost Function and Buck Function for Parallel Capacitive-Link Universal Converter [#598]	3599
Junhao Luo ¹ , Khalegh Mozaffari ² , Brad Lehman ¹ , Mahshid Amirabadi ¹ ¹ <i>Northeastern University, United States</i> ; ² <i>Enphase Energy, United States</i>	
A High Performance Si/SiC Hybrid Switch-Based ANPC Converter with a Novel Configuration Optimization Algorithm [#471]	3606
Ping Liu, Mengmeng Jiao, Liu Long, Chunming Tu <i>Hunan University, China</i>	

Poster Session 4: High Density Power Converters

Chair(s): Issa Batarseh

A Soft-Switching Single-Phase Half-Bridge NPC Inverter based on a Magnetic Coupled Active Filter [#831]	3612
Qiyuan Hu, Shangzhi Pan, Ruixuan Wang, Zisen Lin, Jinwu Gong, Xiaoming Zha <i>Wuhan University, China</i>	
Novel Current Sensor based on Parasitic Inductance with Adaptive Compensation for Parasitic Resistance [#569]	3618
Xingchen Zhao, Tam Nguyen, Dong Dong, Rolando Burgos <i>Virginia Polytechnic Institute and State University, United States</i>	

A SiC-Based 200°C 1200V Half-Bridge Phase-Leg Integrated with High-Density Power Supply and Novel Current Sensor based on Parasitic Inductance [#571] 3625
Xingchen Zhao, Bo Li, Zichen Zhang, Emmanuel Arriola, Qingrui Yuchi, Guo-Quan Lu,
Rolando Burgos, Khai Ngo, Dong Dong
Virginia Polytechnic Institute and State University, United States

All-GaN MHz Hybrid-Switched-Capacitor Converter with Low Parasitic Inductance [#1877] 3630
Tian Xia, Huaqiao Liu, Yenan Chen
Zhejiang University, China

Topic F: Control, Modelling and Optimization of Power Converters

Oral Session 7: Power Converters for Next-Gen Electricity Grids
Chair(s): Liping Guo, Tianqi Hong

Development of Control Algorithm for Medium Voltage AC to Multi-Port Low Voltage DC Converters for Utility-Scale Grid Integration of Solar and Storage [#1579] 3633
Surjakanta Mazumder, Harisyam Pv, Kaushik Basu
Indian Institute of Science, India

Comprehensive Input Voltage Sharing Analysis for a Novel Partially Modular SST Topology [#1209] 3639
Chen Chen, Mafu Zhang, Alex Q. Huang
The University of Texas at Austin, United States

Model Predictive Control of a Wide Voltage Range Battery Charger for G2V and V2G Applications [#940] 3647
Harish Karneddi, Deepak Ronanki, Jose Rodriguez
¹Indian Institute of Technology Madras, India; ²Universidad San Sebastián, Chile

Distributed Control System with UPS Mode for CHB-Based Photovoltaic Solid State Transformer (PV-SST) Utilizing LCL Filter [#43] 3653
Saleh Farzamkia, Mafu Zhang, Huanghaohe Zou, Alex Q. Huang
The University of Texas at Austin, United States

Indirect Sliding Mode Control of a MIMO Modular Converter for DC Microgrids: A ROV Case Study [#1343] 3659
Giovanni Garraffa¹, Angelo Accetta², Massimiliano Luna², Marcello Pucci²,
Francesco Alonge³, Antonino Sferlazza³
¹University of Enna Kore, Italy; ²National Research Council of Italy, Italy; ³University of Palermo, Italy

Oral Session 17: Advanced Control Algorithm for Grid-Connected Applications

Chair(s): Yonghao Gui, Sante Pugliese

- Analytical Determination of Harmonic Controller Gains for High Performance Grid-Connected Resonant Current Regulators [#1672]** 3665
Donald Grahame Holmes, Brendan Peter McGrath
RMIT University, Australia
- Passivity-Based Grid Forming Control for DERs [#1261]** 3673
Yonghao Gui, Sunil Subedi, Yaosuo Xue
Oak Ridge National Laboratory, United States
- An Improved Control for Grid-Following Inverter with Active Damping and Capacitor Voltage Decoupling [#878]** 3678
Amiron Wolff dos Santos Serra^{1,2}, Luiz Antonio de Souza Ribeiro¹, Mehdi Savaghebi²
¹Federal University of Maranhão, Brazil; ²Technical University of Denmark, Denmark
- Equivalent Circuit Model and Stability Analysis of Multi-Paralleled Grid-Tied SiC Inverters with Low Voltage Ride-Through Capability [#952]** 3685
Xuli Quan¹, Xiaofeng Dong², Matthew Bosworth¹, Hui Li¹
¹Florida State University, United States; ²Tesla, United States
- A Seamless Transition between Grid-Forming and Grid-Following Controls of Inverter-Based Resources [#593]** 3692
Heqing Huang¹, Lizhi Ding², Yuzhang Lin¹, Xiaonan Lu², Yue Zheng³
¹New York University, United States; ²Purdue University, United States;
³Northeastern University, United States

Oral Session 18: Fault Analysis of Power Converters

Chair(s): Mateja Novak, Xiangyu Han

- Fault-Tolerant Control under Switch Short-Circuit and Open-Circuit Faults for Parallel Winding Current Source Inverter [#493]** 3700
Yanchao Xiong, Dong Jiang, Yixuan Shuai, Xiangwen Sun, Guangyu Wang, Zicheng Liu
Huazhong University of Science & Technology, China
- DC Fault and Switching Device Open-Circuit Fault Protection of the Isolated Modular Multilevel DC-DC Converter [#304]** 3708
Shiyuan Yin¹, Xiangyu Han², Maryam Saeedifard¹
¹Georgia Institute of Technology, United States; ²Tesla, Inc., United States
- A Novel use of 1-D Convolutional Transformer Neural Network Model in CHB Motor Drive Fault Diagnosis [#1696]** 3716
Samuela Rokocakau¹, Giulia Tresca¹, Behrouz Mohammadzadeh¹, Pericle Zanchetta¹, Giansalvo Cirrincione², Maurizio Cirrincione^{3,4}
¹University of Pavia, Italy; ²University of Picardie Jules Verne, France; ³University of the South Pacific, Fiji; ⁴University of Technology of Belfort Montbéliard, France

An Intelligent Framework for Accurate Identification of Open-Circuit Faults in Asymmetrical Six-Phase Induction Motors [#417]	3723
Khaled Laadjal ¹ , Acácio M. R. Amaral ^{1,2} , João Serra ¹ , Antonio J. Marques Cardoso ¹	
¹ CISE - Universidade da Beira Interior, Portugal; ² Polytechnic Institute of Coimbra, Portugal	

Fault Diagnosis using 1-D Convolutional Transformer Hybrid Neural Network for Cascaded H-Bridge Converters [#1708]	3729
Samuela Rokocakau ¹ , Giulia Tresca ¹ , Behrouz Mohammadzadeh ¹ , Pericle Zanchetta ¹ , Giansalvo Cirrincione ² , Maurizio Cirrincione ^{3,4}	
¹ University of Pavia, Italy; ² University of Picardie Jules Verne, France; ³ University of the South Pacific, Fiji; ⁴ University of Technology of Belfort Montbéliard, France	

Poster Session 1: Power Converter Modeling

Chair(s): Pengxiang Huang

An Automated Time-Domain Modeling Approach [#564]	3737
Mingbo Wei, Hong Li, Jiangwei Hu, Yanjun Li, Yidi Liang, Jinchang Pan	
Beijing Jiaotong University, China	

Analytical and Numerical Output Resistance (R_{out}) Modeling and Comparison for Direct and Indirect Resonant Switched Capacitor Converters [#622]	3743
Liang Jia, Yanchao Li, Haoquan Zhang, Srikanth Lakshmikanthan	
Google LLC, United States	

High-Performance Cascaded Model Predictive Control for Multilevel Inverters [#527]	3749
Hoang Le ¹ , Apparao Dekka ¹ , Deepak Ronanki ²	
¹ Lakehead University, Canada; ² Indian Institute of Technology Madras, India	

Design Optimization Method of High Power-Density Planar Inductor [#1215]	3755
Zahra Saadatizadeh, H. Alan Mantooth	
University of Arkansas, United States	

A Study on the Analysis and the Operation of a Single-Input/Double-Output Buck-SEPIC Converter [#1555]	3759
Mahdi Ghavaminejad ¹ , Mengqi Wang ¹ , Sara Sharifizadeh ² , Ebrahim Afjei ² , Morteza Kheradmandi ²	
¹ University of Michigan-Dearborn, United States; ² Shahid Beheshti University, Iran	

High-Fidelity FEA-Based Circuit Simulation for Multi-Active-Bridge Converter [#1257]	3765
Jaekeun Lee, Jonghun Yun, Hwigon Kim, Shenghui Cui	
Seoul National University, Korea	

Fundamental Harmonic Approximation based Small-Signal Modeling Method of Three-Port Three Series Resonant Converters [#1374]	3771
Zhijing Ye, Chi Li, Zedong Zheng	
Tsinghua University, China	

Multi-FPGA Co-Simulation of SST and DAB in HIL: A Case Study for EV Charging Station Application [#1861]	3778
Juan Paez Alvarez, Satish Kumar Ancha, Milad Hoseinizadeh, Wei Li	
OPAL-RT Technologies, Canada	

The Average Modeling of Active Neutral Point Clamped (ANPC) Converters [#1367]	3781
Ashkan Barzkar, Qing Lin, Rolando Burgos <i>Virginia Polytechnic Institute and State University, United States</i>	
Analysis of Random Center/Edge Alignment PWM and Its Application to Digital Current Control for Boost DC/DC Converters [#111]	3787
Hung-Chi Chen, Yi-Fan Tsai, Wen-Cheng Tsai <i>National Yang Ming Chiao Tung University, Taiwan</i>	
Analyzing and Controlling a Triple Active Bridge Converter using a Small Signal State-Space Model [#512]	3793
Francisco J. Arizaga ¹ , Juan M. Ramirez ¹ , Janeth Alcala ² , Armando G. Rojas-Hernandez ³ ¹ CINVESTAV Guadalajara, México; ² Universidad de Colima, México; ³ Universidad de Sonora, México	
Event-Based Constant On-Time Digital Current Mode Control Techniques in Series Capacitor Buck Converters for Enhanced Stability and Performance [#814]	3798
Prantik Majumder, Teja Golla, Santanu Kapat, Debaprasad Kastha <i>Indian Institute of Technology Kharagpur, India</i>	
Elemental Real-Time Modeling for High Voltage Low Power Pulse Generators [#875]	3804
Chinara Kuldip, N. Lakshminarasamma <i>Indian Institute of Technology Madras, India</i>	
Critical Inductance of Multiphase Constant On-Time Controlled Buck Regulators [#1542]	3811
Sundaramoorthy Sridhar ¹ , Adhistira M. Naradhipa ¹ , Shuai Jiang ² , Qiang Li ¹ ¹ Virginia Polytechnic Institute and State University, United States; ² Google LLC, United States	
Estimating Switching and Conduction Losses during Overmodulation of Three-Phase VSIs [#957]	3819
Ujjwal Kumar, Josiah Haruna, Caleb W. Secrest <i>BorgWarner Inc., United States</i>	
Fast Circuit Simulation of Linear Electronic Circuits using Modified Nodal Analysis [#63]	3825
Nicolas Voyer ¹ , Akinu Nakabayashi ² , Ryota Kondo ² ¹ Mitsubishi Electric Research Centre Europe, France; ² Mitsubishi Electric Corporation, Japan	
System Identification of a DC-DC Buck Converter based on Two-Channel Relay Method [#306] ..	3833
Ayman AlZawaideh, Hao Tu, Srdjan Lukic <i>North Carolina State University, United States</i>	
Modeling and Implementation of High Gain Bi-Directional Boost Full Bridge-Based Series Resonant Converter [#1298]	3838
R. Nitheesh, N. Lakshminarasamma, Arun Karuppaswamy B <i>Indian Institute of Technology Madras, India</i>	
A Ripple-Equivalent Circuit-Based Method for Analyzing Soft-Charging Operation in Hybrid Switched-Capacitor Converters [#1537]	3846
Nagesh Patle, Rose A. Abramson, Rahul K. Iyer, Robert C. N. Pilawa-Podgurski <i>University of California Berkeley, United States</i>	

Poster Session 1: Advanced Control of Power Converter

Chair(s): Rui Wang

- Disturbance Observer-Based Control with Sensor Noise Suppression for DAB Converters [#1832]** 3854
Oluleke Babayomi, Jongseok Kim, Ki-Bum Park
Korea Advanced Institute of Science & Technology, Korea
- Additional Feedback Loop for Improved Control Robustness [#1007]** 3857
Huawei Yuan¹, Wanrong Li², Yuhang Zhang², Sinan Li², Jianguo Zhu², Shu Yuen Ron Hui¹
¹The University of Hong Kong, Hong Kong; ²University of Sydney, Australia
- Control Method for the Cascaded H-Bridge Converter using Cascaded Switching Frequencies and Voltage Levels to Minimize the High-Frequency Ripple-Current [#433]** 3863
R.W.T. (Remco) Bonten, B.J.D (Bas) Vermulst
Eindhoven University of Technology, Netherlands
- Kalman Filter-Based Model Predictive Control of Grid-Connected 3L-ANPC Inverter with Optimized Space Vector [#319]** 3871
Euntaek Nam, Suyong Chae
Pohang University of Science & Technology, Korea
- On Bounding the Junction Temperature by Means of Optimal Modulation with Relaxed Properties [#242]** 3877
Isavella Koukoulou¹, Petros Karamanakos¹, Tobias Geyer²
¹Tampere University, Finland; ²ABB Ltd., Switzerland
- Enhanced Current-Mode Control of DCM/CCM Boundary Boost PFC Provides Low THD in DCM [#1876]** 3885
Claudio Adragna, Giovanni Gritti
STMicroelectronics, Italy
- A Modified Park Transformation Algorithm for Phase-Locked Loop Applications in Unbalanced Three-Phase Systems [#752]** 3888
Hsueh-Ju Wu, Yaow-Ming Chen
National Taiwan University, Taiwan
- Fast Algorithm for Eliminating Common Mode Voltage in Dual Three-Phase Inverter [#790]** 3895
Xiangyu Sun, Wenjun Zhu, Xiao Chen, Antonio Griffo, Geraint Jewell
The University of Sheffield, United Kingdom
- Sensorless Current Sharing Interleaved Control Strategy for High-Current DC/DC Converter [#1357]** 3902
Cristina Terlizzi¹, Mohammad Wasiq¹, Stefano Bifaretti¹, Alessandro Lampasi²
¹Università degli Studi di Roma Tor Vergata, Italy; ²ENEA & DTT S.C. a r.l., Italy
- A Low Cost Constant Output Current Control Method for PSR Active-Clamp Flyback Converter in DCM and CCM with ADTD Method [#588]** 3909
Daying Sun¹, Jingjing Guo², Yu Yao¹, Chong Wang¹, Wenhua Gu¹
¹Nanjing University of Science & Technology, China; ²Nanjing University of Posts & Telecommunications, China

Indirect Minimization of Common-Mode Voltage with Finite Control-Set Model Predictive Control in a Five-Level Inverter [#594]	3917
Dharmikkumar Prajapati ¹ , Apparao Dekka ¹ , Deepak Ronanki ² , Jose Rodriguez ³	
¹ Lakehead University, Canada; ² Indian Institute of Technology Madras, India;	
³ Universidad San Sebastián, Chile	
Performance Analysis of Constant Current LCC Resonant LED Driver [#804]	3923
Arvin Escultero, Carl Michael Odulio	
University of the Philippines Diliman, Philippines	
A Novel Control Scheme for Voltage Regulators with Coupled Inductors and Discrete Inductor [#397]	3930
Wei Dai ¹ , Xiaoguo Liang ¹ , Alan Wu ² , Kaladhar Radhakrishnan ³ , Michael Hansen ³ , Rishik Bazaz ³	
¹ Intel Asia Pacific R&D Ltd., China; ² Intel Canada, Canada; ³ Intel, United States	
Active Power Control Strategy with Load Impedance Estimation Method for IH Cooktop considering Utilization of Double-Bottom Pot [#379]	3936
Man Jae Kwon ¹ , Seung Hyun Kang ¹ , Yun Seong Hwang ¹ , Hyeon Soo Kim ¹ , Dong-Wook Yoo ² , Byoung Kuk Lee ²	
¹ Sungkyunkwan University, Korea; ² Hanyang University, Korea	
Finite-Control-Set Model Predictive Control with Reduced Computational Burden in Cascaded H-Bridge Permanent Magnet Synchronous Motor Drives for EV Applications [#671]	3941
Filippo Gemma ¹ , Jacopo Riccio ² , Giulia Tresca ¹ , Andrea Volpini ¹ , Pericle Zanchetta ¹	
¹ University of Pavia, Italy; ² University of Nottingham, United Kingdom	
Mutual Inductance Extraction and Power Allocation of a Planar Omnidirectional WPT System [#586]	3948
Xipei Yu, Junjie Feng, Liyan Zhu, Qiang Li	
Virginia Polytechnic Institute and State University, United States	
A Load Insensitive Model Predictive Control for Three-Phase Inverter with L-C Filter [#325]	3955
Jianwu Zeng ¹ , Taesic Kim ² , Vincent Winstead ¹	
¹ Minnesota State University, Mankato, United States; ² University of Missouri, United States	
Control Strategy of Circulating Currents Mitigation in Paralleled High-Power Adjustable Speed Drives with Independent DC Links [#124]	3960
Kevin Lee ¹ , Zhihao Song ² , Wenxi Yao ² , Bo Wei ²	
¹ Eaton Corporation, United States; ² Zhejiang University, China	
Sensor-Less Current Control based on Inverse Function for Three-Phase SiC Back-to-Back Inverter Systems [#727]	3967
Tohfa Haque, Wensong Yu, Md Tanvir Ahammed	
North Carolina State University, United States	
 Oral Session 30: Model Predictive Control in Power Electronics	
Chair(s): Zhang Zhenbin, Petros Karamanakos	
Gradient-Based Predictive Pulse Pattern Control with Improved Steady-State and Dynamic Behavior [#89]	3974
Ilari Hilden ¹ , Petros Karamanakos ¹ , Tobias Geyer ² , Shirin Rahmanpour ¹	
¹ Tampere University, Finland; ² ABB Ltd., Switzerland	

A Digital-Twin-Based Monitoring and Predictive Control Technique for Three-Level Back-to-Back Power Converters [#787] 3982
Haoyu Chen, Huimin Huang, Zhen Li, Yimin Zhang, Zhenbin Zhang
Shandong University, China

Real-Time Model Predictive Control of a DC-DC Buck Converter [#678] 3990
Kamlesh Sawant¹, Ryan Caverly¹, Jason Poon², Sairaj Dhople¹
¹University of Minnesota, Twin Cities, United States; ²California Polytechnic State University, San Luis Obispo, United States

Optimized DSP-FPGA Communication in CHB-STATCOM with Direct MPC [#797] 3997
Francesco Simonetti¹, Morteza Dezhbord², Sobhan Mohamadian², Alessandro D'Innocenzo², Carlo Cecati², Roberta Di Fonso¹
¹Aalborg University, Denmark; ²University of L'Aquila, Italy

Novel Finite Control Set Model Predictive Control based Overlap-Time Effect Suppression Technique in High-Power CSI Drive under Stand-Alone Mode [#783] 4003
Tahmin Mahmud, Hang Gao
Washington State University-Vancouver, United States

Oral Session 31: Control of Multilevel Converters I

Chair(s): Marco di Benedetto, Apparao Dekka

Inter-Bridge Power-Sharing Capabilities in a Single-Phase 5-Level Cascaded H-Bridge Inverter [#213] 4011
Pascal Lingom¹, Emmanuel Agamloh¹, Annette von Jouanne¹, Alex Yokochi¹, Joseph Song-Manguelle², Roland Unruh³
¹Baylor University, United States; ²University of Quebec at Trois Rivières, Canada; ³Paderborn University, Germany

Steady-State Analysis of Switching Cycle Control of Modular Multilevel Converter [#1384] 4018
Haoyang Zheng, Jayesh Kumar Motwani, Biqi Wang, Qing Lin, Rolando Burgos
Virginia Polytechnic Institute and State University, United States

Arm Energy Estimation based Improved Arm Current Sensor-Less Circulating Current Control in MMC [#871] 4024
Swamy Jakkula, Nallamatti Poornachandra Rao, Anshuman Shukla
Indian Institute of Technology Bombay, India

Design of a Digital Multi-Mode Control Architecture in a Three-Level Flying Capacitor Boost Converter for Improved Energy Efficiency and Fast Transient [#855] 4030
Ruturaj Garnayak, Calvin Paul, Santanu Kapat, Chandan Chakraborty
Indian Institute of Technology Kharagpur, India

Modeling and Control Development of a Cost-Effective Hybrid Modular Multilevel Converter [#1646] 4037
Jayesh Kumar Motwani, Dushan Boroyevich, Dong Dong
Virginia Polytechnic Institute and State University, United States

Poster Session 2: Control of Power Converter Applications

Chair(s): Liang Huang

Thiran-All-Pass-Filter-Based Repetitive Control for Wide-Variable-Frequency Inverter [#633] 4045

Zhuolin Yang¹, Qiang Qian¹, Rui Wu¹, Shian Guo², Li Zhang¹

¹Hohai University, China; ²Nanjing University of Aeronautics & Astronautics, China

Hybrid ZCD-Based Critical Conduction Mode Totem-Pole PFC [#754] 4049

Gibum Yu, Xingyu Chen, Rahul Rajendran, Qiang Li

Virginia Polytechnic Institute and State University, United States

A Modulation Scheme of CLLC Converters for Bidirectional Power Transfer with Reduced Switching Frequency Range [#685] 4055

Leheng Wang, Huan Chen, Kai Sun

Tsinghua University, China

Enhanced Model Predictive Control Strategy for the Three-Phase 5-Level Multiplexed Converter [#1181] 4061

Marco di Benedetto, Andrea Formentini, Alessandro Lidozzi, Luca Solero, Mario Marchesoni

¹Università degli Studi Roma Tre, Italy; ²Università di Genova, Italy

Small-Signal Stability Constrained Optimal Power Flow of Inverter-Dominated Power Systems with Flexible Operation Mode Selection [#1185] 4068

Lizhi Ding¹, Yuxi Men¹, Heqing Huang², Xiaonan Lu¹, Junjie Qin¹, Yuzhang Lin², Jin Tan³

¹Purdue University, United States; ²New York University, United States; ³National Renewable Energy Laboratory, United States

PRACL Converters for Motor Drive Applications [#1759] 4074

Farid Naghavi, Guanhua Tao, Hamid A. Toliyat

Texas A&M University, United States

Study of Overmodulation of Solid-State Transformer under Asymmetric Grid Short-Circuit Faults [#1765] 4082

Haoyang Zheng¹, Qing Lin¹, Rolando Burgos¹, Dong Dong¹, Xiong Li²

¹Virginia Polytechnic Institute and State University, United States; ²Google LLC, United States

A Trapezoidal Modulation for Three-Level Flying Capacitor Converters [#924] 4088

Jingrui Liu, Zhigang Yao, Julian Chung Zhong Wei, Yi Tang

Nanyang Technological University, Singapore

A Fast Three-Phase Boundary Controller with XY Transform [#1014] 4093

Troy Eskilson, Carl Ngai Man Ho

University of Manitoba, Canada

Modified Nearest Level PWM under Circulating Current Control in MMC Enabling Unity Modulation Index Operation [#1216] 4100

Swamy Jakkula, Nallamatti Poornachandra Rao, Anshuman Shukla

Indian Institute of Technology Bombay, India

ZCD Circuit Improvement and Novel Signal Processing Method for GaN-Based CRM PWM Converters [#1237] 4106

Xingyu Chen, Gibum Yu, Qiang Li

Virginia Polytechnic Institute and State University, United States

High Efficiency Control of AC-DC Matrix based Buck Converters: DCM Modulation [#1334]	4112
Dmytro Rodkin, Andrea Formentini, Massimiliano Passalacqua, Luis Vaccaro, Mario Marchesoni <i>Università di Genova, Italy</i>	
An Effective Predictive Control of PMSG Wind Turbine Systems: A Solution Simultaneously Immune to Model and Feedback Uncertainties [#772]	4119
Sining Li ¹ , Zhen Li ¹ , Junda Li ¹ , Zhenbin Zhang ¹ , Liuchen Tai ² ¹ Shandong University, China; ² Weifang University, China	
A Digital Dual 4-Step Switching for an Isolated 3-Phase AC-DC Matrix Converters in Industrial Computing Applications [#1841]	4126
Peng-Hao Huang, Vishwam Raval, Enrique Garza-Arias, Prasad Enjeti <i>Texas A&M University, United States</i>	
Dual Mode BCM Control for Single-Phase Grid-Connected Inverter [#390]	4129
Chen Liu, Sijia Li, Pooya Davari, Frede Blaabjerg <i>Aalborg University, Denmark</i>	
Modulated Model Predictive Control for Active Front-End Rectifier [#462]	4137
Mobina Pouresmaeil, Jorma Kyyrä, Edris Pouresmaeil <i>Aalto University, Finland</i>	
Design of Active Filters for High-Current Power Supply [#1211]	4143
Mohammad Wasiq ¹ , Cristina Terlizzi ¹ , Stefano Bifaretti ¹ , Alessandro Lampasi ² ¹ Università degli Studi di Roma Tor Vergata, Italy; ² ENEA, DTT S. C. a r. l., Italy	
A Fast Model-Based Control for a Double Input Three-Switch Bidirectional DC-DC Converter [#1208]	4151
Alessandro Benevieri, Massimiliano Passalacqua, Andrea Formentini, Luis Vaccaro, Mario Marchesoni <i>Università di Genova, Italy</i>	
A Methodology to Solve the Instability Issue in Decoupled Controller for Current Fed Triple Active Bridge Converter [#1198]	4158
Rajat Kumar Shukla, Debasattam Pal, Dipankar Saha, B. G. Fernandes <i>Indian Institute of Technology Bombay, India</i>	
 Poster Session 2: Reliability, Diagnostics and Fault Analysis of Power Converters Chair(s): Sreenivasa Jaldanki	
Switch Open Fault Detection Method for Asymmetric 6-Phase Motor Drives based on Stationary Reference Frame dq-axis Currents [#539]	4164
Soyoung Jun ¹ , Myeongjae Kim ¹ , Seonhwan Hwang ¹ , Kichang Lee ² , Hui Li ³ ¹ Kyungnam University, Korea; ² Korea Electrotechnology Research Institute, Korea; ³ Florida State University, United States	
A DSP Internal Signal-Based Fault Diagnosis Method for Three-Level TNPC Inverter in PMSM Driver System [#1289]	4170
Wei Zhou ¹ , Jupeng Pang ¹ , Dong Ding ² , Ling Peng ² , Kui Wang ¹ , Yongdong Li ¹ ¹ Tsinghua University, China; ² Wuhan Institute of Marine Electric Propulsion, China	

Analyzing the Impact of High-Frequency Transient Coupled Noise on Coreless Current Sensing in Power Electronics [#1075]	4176
Hossein Niakan, Alireza Omid, Zachary Matheson, Babak Parkhideh <i>University of North Carolina at Charlotte, United States</i>	
Learning High-Dimensional Waveform Features to Identify Partial Discharge Source [#1061]	4182
Vedant Tewari, Suaib Al Sufi, Chanyeop Park <i>University of Wisconsin-Milwaukee, United States</i>	
Thermal Reduction Method of DC-Link Capacitors and SiC MOSFETs in Two-Level Inverters based on Discontinuous PWM [#134]	4190
Hye-Won Choi, Kyo-Beum Lee <i>Ajou University, Korea</i>	
Real-Time Simulation Study of Switch Open-Circuit Fault Detection and Localization Scheme for MMCs with High Submodule Count [#1011]	4195
Haoran Wang, Daniel Bowman, Mikael Schmidtke, Gregory Kish, Qing Zhao <i>University of Alberta, Canada</i>	
Online Reliability Estimation Technique for Ceramic Capacitors in a 24V-to-1V DC-DC Converter [#103]	4201
Zhaoqing Wang ¹ , Suhwan Kim ² , Nachiket Desai ² , Mausamjeet Khatua ² , Ram R. Krishnamurthy ² , Xin Zhang ³ , Mingoo Seok ¹ ¹ Columbia University, United States; ² Intel, United States; ³ IBM Research, United States	
Lifetime Prediction of Electrothermally-Stressed Semiconductor Devices in Si/SiC H-ANPC Inverter [#615]	4207
Nanditha Gajanur ¹ , Mohammad A. Abbaszade ¹ , Sudip K. Mazumder ¹ , Matt Ursino ² , Patrick McCluskey ³ ¹ University of Illinois Chicago, United States; ² Yaskawa Solectria Solar, United States; ³ University of Maryland, College Park, United States	
A Bidirectional "C-T-C" DC Solid-State Circuit Breaker (SSCB) for Capacitive DC Bus System [#1195]	4213
Yuliang Cao ¹ , Dong Dong ¹ , Rolando Burgos ¹ , Haoyang Zheng ¹ , Chunmeng Xu ² , Jing Xu ² , Pietro Cairoli ² ¹ Virginia Polytechnic Institute and State University, United States; ² ABB Ltd., United States	
Internal State Estimation of Multi-Capacitors in DC-Link of 4L-ANPC Inverters based on Data-Driven Method [#706]	4221
Dyan Puspita Apsari, Dong-Choon Lee <i>Yeungnam University, Korea</i>	
A Boost-Based Step-Up Converter Implementation to Charge Capacitor in an LCC Active Injection Current Circuits for SSCBs [#1160]	4227
Elias Nadi ¹ , Reza Kheirollahi ² , Shuyan Zhao ³ , Hua Zhang ¹ ¹ Rowan University, United States; ² Drexel University, United States; ³ ABB Ltd., United States	
Reliability of Power Devices and DC-Link Capacitors of Parallel-NPC Inverters under Different PWM Methods [#791]	4231
Dong-Jin Lee, Ui-Min Choi <i>Seoul National University of Science & Technology, Korea</i>	

Studying the Impact of IBR Modeling on the Commonly Applied Transmission Line Protective Elements [#1449]	4238
Soham Chakraborty ¹ , Paulo Henrique Pinheiro ² , Goncalves Bairy Romulo ² , Hangtian Lei ² , Brian K. Johnson ² , Scott Manson ³ , Jing Wang ¹ , Rasel Mahmud ¹ , Andy Hoke ¹ , Cameron J. Kruse ⁴	
¹ National Renewable Energy Laboratory, United States; ² University of Idaho, United States; ³ Schweitzer Engineering Laboratories, United States; ⁴ Kauai Island Utility Cooperative, United States	
Universal Reliability Assessment of Inverters in Photovoltaic Systems based on Real-Field Mission Profiles [#1246]	4246
Qiang Mu, Jiale Zhou, Luocheng Wang, Tiefu Zhao University of North Carolina at Charlotte, United States	
Analysing the Behavior of Solid State Protection System for Dual Active Bridge in Solid State Transformers under Short Circuit Faults [#1055]	4253
Kushan Tharuka Lulbadda, Ruvini De Seram, Tarlochan Sidhu, Sheldon S. Williamson Ontario Tech University, Canada	
Reliability-Oriented Design of DC-Link Capacitor Bank of NPC Inverter in PV Systems [#792]	4259
Gahyeon Yeo, Ui-Min Choi Seoul National University of Science & Technology, Korea	
An On-Line Capacitor Parameter Estimation Method for Parallel DC-DC Converters using Beat Frequency Components [#1874]	4265
Yeeun Ko, Suyong Chae Pohang University of Science & Technology, Korea	
Poster Session 3: Controller Design for Power Converters	
Chair(s): Tianqi Hong	
A THD Improving Method for a Single-Phase Grid-Tied Inverter with Boundary Conduction Mode Current Control [#901]	4268
Jiaxiong Xu, Mingzhi Gao, Jiawei Zhang, Miao Yu Zhejiang University, China	
A Carrier-Based Discontinuous PWM Method to Suppress Leakage Current and Reduce Switching Loss for T-Type Three-Level Inverters [#1599]	4273
Xin Zhang, Zeng Liu, Wenchen Wang, Jinjun Liu Xi'an Jiaotong University, China	
Quantifiable Trade-Off between Voltage Regulation and Active Power Sharing in Autonomous DC Microgrids: A Data-Driven Approach [#1829]	4280
Zhong Liu, Xiaonan Lu Purdue University, United States	
Gradient-Based Predictive Pulse Pattern Control for Medium-Voltage Drives with Very Fast Transients [#1818]	4283
Ilari Hilden ¹ , Petros Karamanakos ¹ , Tobias Geyer ² ¹ Tampere University, Finland; ² ABB Ltd., Switzerland	
Adaptive Control for Suppressing Power Oscillations in Multi-VSG Systems [#655]	4286
Yian Guo, Julian Chung Zhong Wei, Haoxin Yang, Fei Deng, Yi Tang Nanyang Technological University, Singapore	

Modular Soft-Switching EV Charger with Four-Leg PFC Stage and Transformerless On-Demand DC/DC Configuration [#1236]	4292
Manfredi Gangi, Matthias Preindl Columbia University, United States	
A Lifting Approach for Stability and Controller Design of Power Electronics with Constant Power Loads [#1566]	4299
Luis Herrera, Richard Tarbell State University of New York at Buffalo, United States	
A Frequency Response based Methodology for the Design and Analysis of Active Power Filters Current Control [#1118]	4304
Lidia Sánchez ¹ , David Reigosa ¹ , Javier Sola ² , Juan Luis Agorreta ² , Julian Balda ² , Fernando Briz ¹ ¹ Universidad de Oviedo, Spain; ² Ingeteam Power Technology, Spain	
A General Fully Distributed Control Scheme considering Time Delay Compensation for Three-Phase Grid-Tied Power Inverter Systems [#1332]	4312
Boya Wang, Matthias Preindl Columbia University, United States	
Unified Voltage and Torque Predictive Control for Induction Motor Drives Featuring Interleaved DC-DC Boost Converter [#989]	4317
Jacopo Riccio ¹ , Henry Zapata Fonseca ² , Luca Tarisciotti ² , Alireza Davari ³ , Freddy Flores Bahamonde ² , Michele Degano ¹ , Patrick Wheeler ¹ ¹ University of Nottingham, United Kingdom; ² University Andrés Bello, Chile; ³ Shahid Rajaei Teacher Training University, Iran	
A Simplified Current Control for a SiC Reverse Voltage Blocking-Based Current Source Inverter for High-Speed Motor Drive Applications [#1254]	4324
Sneha Narasimhan, Shubham Dhiman, Sathya Rupan Thirumoorthi, Partha Pratim Das, Subhashish Bhattacharya North Carolina State University, United States	
Developing a Novel Controller Hardware-in-the-Loop (CHIL) Platform for Validating ITCC Algorithm on Solid State Circuit Breaker (SSCB) [#1169]	4331
Shervin Salehi Rad ¹ , Elias Nadi ² , Shuyan Zhao ³ , Fei Lu ¹ ¹ Drexel University, United States; ² Rowan University, United States; ³ ABB Ltd., United States	
Robust Control of Uncertain DC Microgrids using SOS Programming [#34]	4335
Abhiram V. P. Premakumar, Ramtin Madani, Ali Davoudi University of Texas at Arlington, United States	
Control Method Selection Strategy with Peak Current and Efficiency of CLLC Resonant Converter in Step-Down Operation [#38]	4341
Won-Yong Jang, Issac Kim, Hyeonwoo Jung, Jung-Wook Park Yonsei University, Korea	
Model based Predictive Peak Current Control Scheme for LCLC Resonant Converter [#874]	4347
Nagesha Chitpadi, N. Lakshminarasamma Indian Institute of Technology Madras, India	

Fast Computation of Optimized Pulse Patterns for Multilevel Converters [#1810]	4352
Isavella Koukoulou ¹ , Petros Karamanakos ¹ , Tobias Geyer ²	
¹ Tampere University, Finland; ² ABB Ltd., Switzerland	
Model Predictive Current Control of a 4-Level Negev Rectifier [#116]	4355
Francisco Juarez-Leon, Sreejith Chakkalakkal, Mehdi Narimani	
McMaster University, Canada	
A Direct Vector Control Strategy for Single-Phase Differential Buck Inverter [#491]	4363
Yanli Gao ¹ , Junhui Lin ¹ , Peng Liu ¹ , Yonggao Zhang ¹ , Shuang Xu ² , Liuchen Chang ³	
¹ East China Jiaotong University, China; ² North China University of Technology, China;	
³ University of New Brunswick Fredericton, Canada	
A Simplified and Direct Carrier-Based PWM for Parallel Winding Current Source Inverter [#473]	4371
Yanchao Xiong, Dong Jiang, Yixuan Shuai, Zicheng Liu	
Huazhong University of Science & Technology, China	
Impact of the Distributed Current Controller on the Dynamic Performance of the Modular Multilevel Converter [#576]	4379
Max Dupont, Andrea Cervone, Dražen Dujić	
École Polytechnique Fédérale de Lausanne, Switzerland	
 Oral Session 52: Modeling and Control of Resonant Converters	
Chair(s): Petros Karamanakos, Sante Pugliese	
A Non-Approximated Steady State Model-Derived Semiconductor Loss Optimization for Resonant CLLC [#744]	4387
Shubham Munekar ¹ , Ayan Mallik ¹ , Akin Akturk ²	
¹ Arizona State University, United States; ² CoolCAD Electronics Inc., United States	
Time Domain Analysis for PWM Mode of CLLC Converter [#805]	4395
Dohong Lee, Bonggook Kim, Xuanxi Liu, Younghoon Cho	
Konkuk University, Korea	
Multi-Objective Optimal Design for LLC Converter based on TDA and Surrogate Model for High Accuracy and Low Computational Burden [#725]	4401
Su-Seong Park, Seon-Ho Yang, Rae-Young Kim	
Hanyang University, Korea	
Selective Secondary Phase-Shift Control for High Gain in LLC Converters with Matrix Transformers [#1377]	4408
Pranav Raj Prakash, Qiang Li	
Virginia Polytechnic Institute and State University, United States	
A Merged ZCS/ZVS Control Technique for Resonant Switched-Capacitor Converters [#1366]	4416
Haifah B. Sambo, Yicheng Zhu, Robert C. N. Pilawa-Podgurski	
University of California Berkeley, United States	

Oral Session 53: Machine Learning in Modeling and Control of Power Converters

Chair(s): Yonghao Gui, Qianwen Xu

- Feedback Control of CLLC Resonant DC-DC Converters using Deep Reinforcement Learning [#646] 4423**
Oroghene Oboreh-Snapps¹, Angshuman Sharma², Jonathan Saelens³, Arnold Fernandes³, Sophia A. Strathman³, Lauryn Morris³, Praneeth Uddarraju³, Jonathan W. Kimball³
¹1898 & Co., a Part of Burns & McDonnell, United States; ²TDK-Lambda Americas, United States;
³Missouri University of Science & Technology, United States
- Digital Twin based Identification of Passive Parameters of Three-Phase Boost Rectifier using a GRU Neural Network [#1301] 4431**
Giulia Di Nezio¹, Marco di Benedetto¹, Giorgia Ghione², Vincenzo Randazzo¹, Luca Solero¹
¹Università degli Studi Roma Tre, Italy; ²Politecnico di Torino, Italy
- Model Free Reinforcement Learning based Controller for Grid-Tied 9-Level Packed-E-Cell Multi-Level Inverter [#145] 4437**
Alamera Nouran Alquennah^{1,2}, Abdelbasset Krama³, Haitham Abu-Rub^{2,3}, Ali Ghrayeb², Sertac Bayhan^{2,3}
¹Texas A&M University, United States; ²Texas A&M University at Qatar, Qatar;
³Hamad Bin Khalifa University, Qatar
- Data-Driven Predictive Control for Power Converter with Multi-Step Reinforcement Learning [#1349] 4444**
Yihao Wan, Yang Zhang, Qianwen Xu
KTH Royal Institute of Technology, Sweden
- Deep Learning-Based Dynamic Modeling of Three-Phase Voltage Source Inverters [#1012] 4450**
Sunil Subedi¹, Liang Qiao², Yonghao Gui¹, Yaosuo Xue¹, Francis Tuffner³, Wei Du³
¹Oak Ridge National Laboratory, United States; ²The University of Tennessee, United States;
³Pacific Northwest National Laboratory, United States

Oral Session 64: Control of Power Converters I

Chair(s): Wenzong Wang, Andrea Formentini

- Deadbeat Control of Three-Phase Sinusoidal Output Y-Inverter for Automotive Powertrains [#420] 4457**
Federico Campanelli, Fabio Mandrile, Sandro Rubino, Eric Armando, Radu Bojoi
Politecnico di Torino, Italy
- Model Free Predictive Control of a Triple Active Bridge for High Dynamic Performance without the Decoupling Matrix [#1229] 4464**
Md Didarul Alam, Samuel Osei Fobi, Wensong Yu, Iqbal Husain, Srdjan Lukic
North Carolina State University, United States
- Virtual Input Dampers of Dual Active Bridge Converter [#720] 4472**
Lunbo Deng, Guohua Zhou, Wenjun Zeng, Nengmou Xu
Southwest Jiaotong University, China
- A Method for Stabilizing Dual Active Bridge-Based Energy Storage Systems [#1387] 4479**
Bhanu Shankar Babaiahgari, Md Habib Ullah
The Pennsylvania State University, United States

Digital Control of a Multilevel Interleaved DC-DC GaN Converter for Fuel Cell Traction Applications [#890]	4484
Stefano Savio, Simone Giuffrida, Fabio Mandrile, Fausto Stella, Eric Armando, Radu Bojoi Politecnico di Torino, Italy	

Oral Session 65: Reliability and Diagnostics of Power Converters

Chair(s): Dominik Koch, Mateja Novak

A Modulation Scheme for Dynamic AC Power Cycling based on the Opposition Method [#403]	4491
Tobias Fink, Kevin Muñoz Barón, Jeremy Nuzzo, Ruben Schnitzler, Dominik Koch, Ingmar Kallfass University of Stuttgart, Germany	

Impact of Environmental Conditions on the Remaining Useful Lifetime of SiC MOSFET [#1664] ...	4496
Md Zakir Hasan ¹ , Ashik Amin ¹ , Md Moniruzzaman ¹ , Seungdeog Choi ¹ , Prashant Singh ² , Chun-Hung Liu ¹ ¹ Mississippi State University, United States; ² The University of Tennessee, United States	

Online Estimation of MOSFET R_{on} through Extended Kalman Filter [#507]	4504
Miguel Fernandez-Costales ¹ , Jose Antonio Fernandez-Alvarez ¹ , Manuel Arias ¹ , Pablo F. Miaja ¹ , Jesus Oliver ² ¹ Universidad de Oviedo, Spain; ² European Space Agency, Netherlands	

A Novel Method for Locating Open-Circuit Fault of Three-Level FC Converters without Additional Sensors [#446]	4511
Jiewei He, Zicheng Liu, Dong Jiang, Xuan Zhao, Xiangwen Sun, Ronghai Qu Huazhong University of Science & Technology, China	

Thermal Stress Analysis of Dual Active Bridge DC-DC Converter under Battery Pulsed Current Charging Strategy [#375]	4516
Erdem Akboy ^{1,2} , Muhammad Usman Tahir ¹ , Ariya Sangwongwanich ¹ , Daniel Ioan Stroe ¹ , Frede Blaabjerg ¹ ¹ Aalborg University, Denmark; ² Yildiz Technical University, Turkey	

Oral Session 74: Stability Aspects in Power Electronics Systems

Chair(s): Sewan Choi, Heng Wu

Physical Interpretation of Synchronization Stability of Grid-Following Inverters from Two Reference Frames Perspective [#197]	4521
Liang Huang ¹ , Chao Wu ² , Dao Zhou ¹ , Frede Blaabjerg ¹ , Sanjay Chaudhary ¹ , Shan He ¹ ¹ Aalborg University, Denmark; ² Shanghai Jiao Tong University, China	

Capacitor Current Feedback Active Damping with Generalized Integrator-Based Differentiator for LCL-Type Inverters [#1163]	4527
Deokyong Woo, Sungmin Kim Hanyang University, Korea	

Robust Stability Analysis of P-HIL in Power Converters Testing under Asymmetrical Grid Faults [#141]	4534
Riccardo Sancio ¹ , Sante Pugliese ¹ , Marco Liserre ¹ , Finn Bathel ² ¹ Kiel University, Germany; ² nttb GmbH, Germany	

Comprehensive Modeling and Measurement of the Control Influence on Impedance at Critical LCL Frequencies for a 50 kHz SiC Converter [#603] 4541
Dominik Schulz, Rüdiger Schwendemann, Andreas Liske, Marc Hiller
Karlsruhe Institute of Technology, Germany

Stability Analysis of Grid-Connected VSC-HVDC Systems with Compensated Dq Domain Time Delay Models [#10] 4548
Shuai Wang, Robin Preece, Mike Barnes
The University of Manchester, United Kingdom

Oral Session 75: Control of Power Converters II

Chair(s): Wensong Yu, Minghui Lu

Split-Phase Inverter with Hybrid ZCS-ZVS Modulation for the DC-Link Voltage Balancer [#1087] 4555
Md Tanvir Ahammed, Wensong Yu
North Carolina State University, United States

A Single-Sensor Balancing Technique for Flying-Capacitor Odd-Level Converters [#502] 4563
Siddharth Iyer, Sayan Paul, Dragan Maksimović, Luca Corradini
University of Colorado Boulder, United States

Sensorless Oriented Control of PWM Rectifier using Kalman Filter and Proportional-Resonant Regulators [#605] 4571
Federico Centi, Andrea Credo, Giuseppe Fabri, Francesco Parasiliti Collazzo, Marco Tursini
University of L'Aquila, Italy

Frequency Domain Design Techniques in Voltage Mode Controlled Series Capacitor Buck Converters for Fast Dynamic Performance [#854] 4578
Prantik Majumder, Anirban Nanda, Santanu Kapat, Debaprasad Kastha
Indian Institute of Technology Kharagpur, India

A Constant Current Control Method for Primary Side-Regulation Flyback Converter without Low-Frequency Ripple and Sub-Harmonic Oscillation [#418] 4584
Chong Wang, Xu Wang, Hao Cheng, Daying Sun, Wenhua Gu
Nanjing University of Science & Technology, China

Oral Session 87: Converter Power Quality

Chair(s): Subham Sahoo, Ricardo Aguilera

Real-Time Computation of Optimized Pulse Patterns for Compensation of Estimated Grid Voltage Harmonics [#362] 4590
Ellis G. Tsekouras¹, Ricardo P. Aguilera¹, Tobias Geyer²
¹University of Technology Sydney, Australia; ²ABB Ltd., Switzerland

Selective Harmonic Elimination Model Predictive Control for a 3 Level Flying Capacitor Converter [#1524] 4598
Cristian Castillo¹, Victor Cabezas¹, Cristian Garcia¹, Santiago Maure¹, Pablo Acuna¹, Ricardo Aguilera²
¹Universidad de Talca, Chile; ²University of Technology Sydney, Australia

Transient Stability Analysis and Optimized Coordination Control Method for Multi-Parallel PLL-Synchronized Inverters under Grid Fault [#1238] 4604
Zhiheng Lin, Rui Liu, Yunwei Li
University of Alberta, Canada

A Frequency Response based Methodology for the Design and Analysis of Active Power Filters Current Control [#1141] 4610
Lidia Sánchez¹, David Reigosa¹, Javier Sola², Juan Luis Agorreta², Julian Balda², Fernando Briz¹
¹Universidad de Oviedo, Spain; ²Ingeteam Power Technology, Finland

A Transformerless Unified Power Quality Conditioner based on Four-Leg Converter [#977] 4618
Jean T. Cardoso, Cursino B. Jacobina, Alan S. Felinto, Ademar A. dos Santos Jr., Alexandre C. Oliveira
Federal University of Campina Grande, Brazil

Oral Session 98: Modelling, Design and Optimization for Power Converters
Chair(s): Giulia Tresca, Teng Long

A Modelling Method for Grid Filter Topology Optimization [#298] 4626
Tim Lackie¹, Gopal Mondal², Teng Long¹, Sebastian Nielebock²
¹University of Cambridge, United Kingdom; ²Siemens AG, Germany

Model-Free Optimization of Isolated DC-DC Triple Active Bridge Converters for ZVS and Reduced RMS Current Operation [#696] 4634
Ahmed A. Ibrahim, Tommaso Caldognetto, Davide Biadene, Paolo Mattavelli
Università degli Studi di Padova, Italy

Stability Analysis of the Converter-Interfaced Remote Gas Field Power Generation [#1617] 4641
Wenze Li, Rui Liu, Yunwei (Ryan) Li
University of Alberta, Canada

Design of a Common-Mode Inductor for Medium-Voltage High Power SiC-Based Power Electronics Building Blocks (PEBB) [#1539] 4648
He Song, Joshua Stewart, Ashkan Barzkar, Boran Fan, Rolando Burgos, Dushan Boroyevich
Virginia Polytechnic Institute and State University, United States

Integrator Design for a Small Footprint Rogowski Coil based Current Sensor [#1329] 4656
Matthias Spieler, Che-Wei Chang, Dong Dong, Rolando Burgos
Virginia Polytechnic Institute and State University, United States

Oral Session 99: Control for Power Converters in Electric Vehicles Chargers
Chair(s): Mehdi Narimani, Rashmi Prasad

Experimental Implementation of a Fast Direct Digital Power Control Strategy for Single-Phase DAB Converters [#1773] 4662
Linton D. James¹, Carlos A. Teixeira¹, Richardt H. Wilkinson¹, Brendan P. McGrath¹, Marcos G. Judewicz², Sergio A. González², Peter Sokolowski³
¹RMIT University, Australia; ²Universidad Nacional de Mar del Plata, Argentina;
³The People Project Institute, Australia

State-Plane Control of DAB-Based Battery Chargers [#1094]	4670
Matteo Sposito, Nicolas Agüero Meineri, Ignacio Santana, Ignacio Galiano Zurbriggen University of Calgary, Canada	
A New Integrated Battery Charger (IBC) Architecture for 1200V Electric Vehicles [#283]	4676
Sreejith Chakkalakkal, Francisco Juarez-Leon, Mehdi Narimani McMaster University, Canada	
Control and Modulation Method for Leakage Current Mitigation in Single-Phase Non-Isolated EV Charger [#1270]	4683
Juwon Lee, Dongsu Lee, Seongil Lee, Jung-Ik Ha Seoul National University, Korea	
Power Ripple Minimization in Off-Board Battery Charger using Modified Direct Predictive Power Control [#934]	4691
Durga Prasad Pilli ¹ , Deepak Ronanki ¹ , Apparao Dekka ² , Jose Rodriguez ³ ¹ Indian Institute of Technology Madras, India; ² Lakehead University, Canada; ³ Universidad San Sebastián, Chile	
Poster Session 4: Stability and Power Quality of Power Converters/Systems Chair(s): Luca Tarisciotti	
One-Cycle Control of Vienna Rectifiers under Variable Switching Frequency with Improved Waveform Quality [#435]	4697
Zhou He ¹ , Hongfa Ding ¹ , Ziqi Zhang ¹ , Zibo Chen ² , Dandi Zhang ¹ , Yingzhe Liu ³ ¹ Huazhong University of Science & Technology, China; ² The University of Texas at Austin, United States; ³ Nanyang Technological, University, Singapore	
Enhanced Ride-Through Capability for Single-Phase Series Active Power Filter using an Auxiliary Leg [#1020]	4702
Gilielson F. da Paz ¹ , Cursino B. Jacobina ¹ , Isaac S. de Freitas ² , Jean T. Cardoso ¹ , Victor F.M.B. Melo ² ¹ Federal University of Campina Grande, Brazil; ² Federal University of Paraíba, Brazil	
Voltage and Current Feedforward Terms Impact in the Stability of Grid-Forming Inverter Systems [#1341]	4710
Oriana Benfatto ¹ , Giulia Tresca ¹ , Andrea Formentini ² , Norma Anglani ¹ , Simone Cossu ¹ , Pericle Zanchetta ¹ ¹ University of Pavia, Italy; ² Università di Genova, Italy	
A Zero-Crossing Detection-Based Adaptive Stabilization Method for Cascaded DC Systems [#971]	4718
Bi'an Zhao ¹ , Youlin Fan ¹ , Tonglu Wang ¹ , Yufei Li ¹ , Yue Wang ¹ , Xinyang Su ² , Qifeng Wang ³ , Jinli Hao ⁴ ¹ Xi'an Jiaotong University, China; ² Hong Kong Polytechnic University, China; ³ Huawei Technologies Co., Ltd., China; ⁴ Xi'an Huawei Technologies Co., Ltd., China	
Power-Response Matrix-Based Modeling of Converter Systems for Small-Signal Analysis [#1316]	4724
Anant Narula ¹ , Paul Imgart ¹ , Massimo Bongiorno ¹ , Paolo Mattavelli ² , Mebtu Beza ¹ , Jan R. Svensson ³ ¹ Chalmers University of Technology, Sweden; ² Università degli Studi di Padova, Italy; ³ Hitachi Energy, Sweden	

Simplified Modeling Method for DC-Side Impedance of MMC considering the Impact of Wind Farms [#1294]	4732
Peng Huang, Niancheng Zhou, Yongjie Luo, Xiuchao Duan, Qianggang Wang Chongqing University, China	
Qualitative Evaluation of Semi-Quantitative Design Guidelines concerning Transient Stability [#169]	4738
Chao Charles Liu ¹ , Zhenxi Wu ^{1,2} , Chi K. Tse ¹ , Hua Han ² , Jingxi Yang ¹ ¹ City University of Hong Kong, Hong Kong; ² Central South University, China	
Stability Analysis of DC-Coupled Converters with Impedance Spectroscopy [#400]	4744
Gernot Pammer, Oliver König, Alois Hirsch, Daniel Leidorfer, Lucas Rotava AVL List GmbH, Austria	
DVRs Analysis with Different Topologies and Control Methods [#1158]	4751
Arthur Costa ¹ , Elias Neto ¹ , Gregory Almeida ^{1,2} , Joao R. Martins ¹ , Darlan A. Fernandes ³ ¹ Federal Institute of Alagoas, Brazil; ² IRT Saint Exupéry, France; ³ Federal University of Paraíba, Brazil	
Robust Control Scheme based on PCC Voltage Feedforward and VPI Controller for LCL-Type Grid-Following Inverters under Weak Grid Condition [#1152]	4759
Xinghai Geng, Zeng Liu, Xincheng Dai, Xueling Yang, Jinjun Liu Xi'an Jiaotong University, China	
Stability Enhancement of DC Cascaded System including CPLs by using Nonlinear Inductor in Source-Interface DC-DC Converter [#481]	4768
Hongjian Lin, Henry Shu-Hung Chung, Ruihua Shen City University of Hong Kong, Hong Kong	
dq-Frame Input Impedance Characterization of a Five-Level Cascaded H-Bridge Robicon-Type Motor Drive [#1719]	4775
Mohammad Nair Aalam, Qing Lin, Ashkan Barzkar, Rolando Burgos Virginia Polytechnic Institute and State University, United States	
Impact of the Reactive Behavior of Grid-Connected Converters on Resonance Stability [#973]	4781
Amir Reza Zamani ¹ , Mebtu Beza ¹ , Massimo Bongiorno ¹ , Anant Narula ¹ , Jan R. Svensson ² ¹ Chalmers University of Technology, Sweden; ² Hitachi Energy, Sweden	
Grid-Forming Inverter Placement for Power Systems with High Inverter-Based Resource Penetration based on Participation Factors [#330]	4788
Tianwei Xia ¹ , Deepak Ramasubramanian ² , Wenzong Wang ² , Kai Sun ¹ , Kaiyang Huang ¹ ¹ The University of Tennessee, United States; ² Electric Power Research Institute, United States	
Instability Intersection Frequency Auto-Detection for the Virtual Impedance-Based Stabilization Method in Cascaded Systems [#203]	4795
Xueqi Liu, Xin Zhang Zhejiang University, China	
Zero-Current-Injection Control for Reducing AC Current Distortion in Unfolding-Bridge-Based Single-Phase Grid-Tied Inverters [#1543]	4799
Mojtaba Heydari ¹ , Emad Nazerian ¹ , Qingyun Huang ² , Alex Q. Huang ¹ ¹ The University of Texas at Austin, United States; ² University of Missouri, United States	

Predictive Current Control Strategy with Minimal Current Sensors for Shunt Active Power Filter using LCL Filter [#1058]	4806
Thales Martins Bezerra ¹ , Nady Rocha ¹ , Alvaro De Medeiros Maciel ¹ , Gregory Arthur De. Almeida Carlos ²	
¹ Universidade Federal da Paraíba, Brazil; ² Institut de Recherche Technologique Saint Exupéry, France	

Poster Session 4: Power Converter EMI

Chair(s): Mateja Novak

Evaluation and Design of Symmetrical Winding Configurations for Improved Common Mode Noise Reduction in Full Bridge Converters [#179]	4812
Philipp Marx, Marcel Probst, Andre Haspel, Philipp Ziegler, Joerg Haarer, Joerg Roth-Stielow	
University of Stuttgart, Germany	

A Passive Self Damping Busbar to Reduce DC-Link Ringing [#1102]	4819
Luke Shillaber ¹ , Yunlei Jiang ² , Ameer Janabi ¹ , Wei Mu ¹ , Teng Long ¹	
¹ University of Cambridge, United Kingdom; ² Space Exploration Technologies Corporation, United States	

Advanced Frequency-Dependent Modeling Techniques for Bus Parasitics of WBGs-Enabled Circuits [#1078]	4825
William Collings ¹ , Raghav Khanna ¹ , Alan Courtay ² , Andrew Lemmon ³	
¹ University of Toledo, United States; ² Synopsys, Inc., United States; ³ University of Alabama, United States	

Dead-Time Compensation to Reduce the Common Mode Voltage in a Three-Phase Four-Leg Inverter [#1127]	4832
Robert J. Tubbs Jr. ¹ , Alexander L. Julian ² , Giovanna Oriti ¹	
¹ Naval Postgraduate School, United States; ² Independent Researcher & Consultant, United States	

Modeling and Analysis of the Balance Network for Common Mode EMI Noise Suppression [#1189]	4840
Qiuzhe Yang, Shuo Wang, Qiang Li	
Virginia Polytechnic Institute and State University, United States	

A Virtual Capacitor based Transformerless Active Common-Mode EMI Filter [#412]	4845
Junzhao Zhang ¹ , Dong Jiang ¹ , Jianrui Liu ¹ , Yechi Zhang ²	
¹ Huazhong University of Science & Technology, China; ² Dalian Maritime University, China	

A Multi-Variable dv/dt Filter Design Approach in SiC-Based Integrated Motor Drive [#1777]	4851
Mohammad Arifur Rahman ¹ , Yilmaz Sozer ² , Alper Uzum ² , Syed Imam Hasan ²	
¹ Nexteer Automotive, United States; ² The University of Akron, United States	

EMI Frequency Model of a Low Power SMPS in Discontinuous Conduction Mode [#1641]	4859
Yandry Jacome ¹ , Ansley Jugoo ² , Mohamed Toure ¹ , Jean-Luc Schanen ²	
¹ Somfy, France; ² University Grenoble Alps - CNRS, France	

An EMI/EMC Test Bed for EMI Susceptibility Evaluation and Weakness Detection [#1222]	4867
Robb Raffaelli, Yuntao Xu, Di Zhang, Zachary Everhart, Michael C. Smith	
Naval Post Graduate School, United States	

Modeling, Analysis and Reduction of Radiated EMI Due to the Pulsating Voltage on PCB Ground Plane in a Non-Isolated Power Converter [#778]	4874
Yanwen Lai ¹ , Shuo Wang ¹ , Yirui Yang, Qinghui Huang ¹ , Zheng Luo ^{1,2}	
¹ University of Florida, United States; ² Monolithic Power System, Inc., United States	

Open-Air Test Setup Characterization for Radiated Emissions of Motors Drives [#1036] 4882

Roger Franchino, David Lechat
Schneider Electric, France

Common-Mode EMI Noise Modeling and Cancellation with Impedance Balance Technique for Three-Phase Three-Level Back-to-Back Bridge Interconnection-Based Converter [#1413] 4887

Tonglei Wang¹, Shin-Yu Chen², Ripunjoy Phukan³, Rolando Burgos¹,
Dong Dong¹, Gopal Mondal⁴, Henrik Krupp⁴

¹Virginia Polytechnic Institute and State University, United States; ²Texas Instruments, United States;

³Delta Electronics, Inc., United States; ⁴Siemens AG, Germany

Topic G: Electrical Machines

Oral Session 8: Electric Machines for Transportation

Chair(s): Alireza Fatemi, Gerd Bramerdorfer

Comparison of a Novel Stator Tooth Cooling System with High-Performance Alternatives for E-Motors in Electric Vehicles [#101] 4895

Gokhan Cakal¹, Alireza Fatemi², Peng Peng², Thomas Nehl², Xiofeng Yang²

¹University of Wisconsin-Madison, United States; ²General Motors, United States

Effect of Increasing Poles Number for 16000 rpm and 800V Rare-Earth Free Interior Permanent Magnet Traction Motor Equipped with Iron Nitride Magnets [#1723] 4901

Ali Al-Qarni¹, James Alexander², Ayman El-Refaie¹

¹Marquette University, United States; ²Spartan Engineering Design, United States

Design of a Novel Rare-Earth-Free Variable Flux Motor Combining Iron-Nitride and AlNiCo Magnets [#540] 4909

Bassam S. Abdel-Mageed¹, Benoit Blanchard St-Jacques², Ruisheng Shi², Pragasen Pillay¹

¹Concordia University, Canada; ²Dana TM4 inc., Canada

Modeling and Analysis of Dual-Three-Phase PMSMs for EV Drive Application [#1379] 4915

Peng Peng, Lei Hao, Renato Amorim Torres, Suresh Gopalakrishnan, Thomas Nehl

General Motors, United States

Driving Cycle based Optimisation and Comparison of Variable Flux Permanent Magnet Machines [#813] 4923

Gabriel Weissitsch, Thomas Krainer, Edmund Marth, Gerd Bramerdorfer

Johannes Kepler University Linz, Austria

Oral Session 19: Induction Machines

Chair(s): Andrea Cavagnino, Peng Peng

Influence of Stator Damping Coil on High-Frequency Stray Losses and High-Order Electromagnetic Forces of Induction Motors [#370] 4931

Chenbo Wang¹, Zhen He¹, Shuyang Xu¹, Jun Wang¹, Hongjin Guo¹,
Hassan H. Eldeeb², Mingji Liu¹, Guorui Xu¹, Haisen Zhao¹

¹North China Electric Power University, China; ²Ford Motor Company, United States

Design and Analysis of a Single-Sided 2.2kW Axial-Flux Induction Motor [#835] 4936

Zhi Cao¹, Amin Mahmoudi¹, Wen L. Soong², Solmaz Kahourzade³

¹Flinders University, Australia; ²University of Adelaide, Australia;

³University of South Australia, Australia

Analytical and FE Modeling of a Wound Rotor Induction Motor with Static Inclined Eccentricity [#271] 4944

Solihah Sharief Shiekh, Pragasen Pillay

Concordia University, Canada

Diagnosis of Rotor Asymmetries in Wound Rotor Induction Machines via PSH Analysis of Vibration Transients [#249] 4950

Jose E. Ruiz-Sarrio¹, Pedro Llovera-Segovia¹, Carlos Madariaga-Cifuentes², Angela Navarro-Navarro¹, Vicente Biot-Monterde¹, Jose A. Antonino-Daviu²

¹Universitat Politècnica de València, Spain; ²University of Concepción, Chile

A Design and Control Method for Pole Changing Induction Machine for Traction Application [#653] 4956

Kan Akatsu¹, Naoya Kato¹, Tsurube Masayoshi², Tomonari Mori², Masanori Watahiki²

¹Yokohama National University, Japan; ²Nidec Corporation, Japan

Oral Session 20: Axial Flux Machines

Chair(s): Matthew C. Gardner, Greg Heins

Non-Invasive Bar Breakage Diagnosis of Axial Flux Induction Machines through Steady-State Signal Analysis [#620] 4962

Carlos Madariaga-Cifuentes¹, Jose E. Ruiz-Sarrio², Jose A. Antonino-Daviu², Cesar Gallardo³, Juan A. Tapia¹

¹University of Concepcion, Chile; ²Universitat Politècnica de València, Spain;

³University of Nottingham, United Kingdom

Active Metal Brazed Windings for Coreless Axial-Flux Permanent-Magnet Machines [#1171] 4967

Federico Marcolini, Guido Rubino, Fabio Giulii Capponi, Federico Caricchi

Sapienza – Università di Roma, Italy

Axial Laminations for Eddy Current Mitigation in Unlaminated Rotors for Axial Flux Surface Permanent Magnet Synchronous Machines [#1590] 4975

Samuel French, Kelvin Wong, David Klink, Dean Patterson, Greg Heins, Behrooz Bahrani

Monash University, Australia

A Study on the Performance Improvement of Axial Flux Permanent Magnet Machines based on Stator and Rotor Design Modifications [#499] 4980

Jangho Yun, Brandon Grainger, Paul Ohodnicki

University of Pittsburgh, United States

Multi-Disk Coreless Axial Flux Permanent Magnet Synchronous Motors with Surface PM and Halbach Array Rotors for Electric Aircraft Propulsion [#960] 4986

Matin Vatani¹, John F. Eastham², Dan M. Ionel¹

¹University of Kentucky, United States; ²University of Bath, United Kingdom

Poster Session 1: Electric Machines 1

Chair(s): Alireza Fatemi

- A Study on Five-Phase Permanent Magnet Vernier Motor Superimposed Harmonic Current [#1697] 4993**
Kohei Aiso, Shoji Shimomura
Shibaura Institute of Technology, Japan
- Cost Efficient Iron Loss Calculation Process of Induction Motors considering Slot Harmonics using Scale Method [#1259] 4999**
Du-Ha Park¹, Jae-Hyun Kim², Hyun-Su Kim¹, Jin-Cheol Park¹, Yun-Jae Won¹, Myung-Seop Lim¹
¹Hanyang University, Korea; ²Yeungnam University, Korea
- Bearing Outer Race Fault Detection through the Analysis of Stray Flux Signals via CWT and CNN [#382] 5005**
Geovanni Díaz-Saldaña¹, Jonathan Cureño-Osornio¹, Israel Zamudio-Ramírez¹, Vicente Biot-Monterde², Roque A. Osornio-Rios¹, Jose A. Antonino-Daviu²
¹Universidad Autonoma de Querétaro, México; ²Universitat Politècnica de València, Spain
- Analysis of Frequency-Induced Current Displacement in Dual-Cage Induction Motors for Electromobility [#1430] 5011**
Felipe Santacruz Benavides¹, Carlos Madariaga¹, Cesar Gallardo², Juan A. Tapia¹, Michele Degano²
¹University of Concepcion, Chile; ²University of Nottingham, United Kingdom
- A High-Speed Rare-Earth Free IPM with Carbon Composite Wrapped Rotor [#1019] 5017**
MD Rashedur Rahman, Seungdeog Choi, Han-Gyu Kim
Mississippi State University, United States
- High-Speed Synchronous Reluctance Motors with Additively Manufactured Rotors [#1172] 5024**
Yulong Cui¹, Chiara Gianassi², Alessandro Fortunato², Luca Zarri², Andrea Cavagnino¹
¹Politecnico di Torino, Italy; ²Università di Bologna, Italy
- Current and Stray Flux Combined Analysis for the Detection of Misalignments in Synchronous Reluctance Machines [#251] 5032**
Angela Navarro-Navarro, Vicente Biot-Monterde, Jose E. Ruiz-Sarrio, Jose Antonino-Daviu
Universitat Politècnica de València, Spain
- Torque Ripple Cancellation with 4 Degree-of-Freedom [#637] 5037**
Cheng Gong, Le Chang, Song He, Vinod Peddi, Peng Zhang
General Motors, United States
- Developments of Reliable Analytical Models for Predicting Synchronous Reluctance Motor Operations with Cross-Coupling Effects [#87] 5042**
Cheng-Tsung Liu¹, Shih-Ting Hua¹, Sheng-Chan Yen², Kuan Yang², Pei-Chun Shih²
¹National Sun Yat-sen University, Taiwan; ²Nidec Taiwan Corporation, Taiwan
- Cogging Torque Minimization in Low-Speed Transverse Flux Permanent Magnet Generator using Improved Skewing Techniques [#288] 5049**
Maryam Salehi¹, Alireza Omid¹, Mohammad Farahzadi², Ahmad Darabi³, Mohammad Hoseintabar³, Vedanadam Mudumbai Acharya⁴, Madhav Manjrekar¹
¹University of North Carolina at Charlotte, United States; ²University of Science & Culture, Iran; ³Shahrood University of Technology, Iran; ⁴Powersys Inc., United States

Short-Circuit Model of Synchronous Machines based on Flux and Loss Maps [#657]	5056
Simone Ferrari ¹ , Andrei Bojoi ¹ , Maedeh Mirazimi ¹ , Paolo Pescetto ¹ , Davide Ronchetto ² , Paolo Cagnetta ² , Gianmario Pellegrino ¹ ¹ Politecnico di Torino, Italy; ² Avio Aero, Italy	
Estimation of Harmonic Losses and Current Distortion considering Magnetic Saturation and Coupling Inductance for Dual Three-Phase PMSM [#852]	5064
Ye-na Bai ¹ , Jun-Yeol Ryu ² , Myung-Seop Lim ¹ ¹ Hanyang University, Korea; ² Korea Automotive Technology Institute, Korea	
Dynamic Mechanical Stress Minimization Coupled Optimization of High-Speed 800-V Permanent Magnet-Assisted Synchronous Reluctance Motor with Blended Magnets [#1269]	5069
Robin Wilson, Praveen Kumar, Ayman El-Refaie Marquette University, United States	
The Speed-Independent Angle Tracking Observer(ATO) based on Second-Order Generalized Integrator(SOGI) Filter [#426]	5076
Pooreum Jang, Hyoung-Kyu Yang, Dongmyoung Joo, Byong Jo Hyon, Jun-Hyuk Choi Korea Electronics Technology Institute, Korea	
Design of 160 kW, 50000 R/Min Ultra-High Speed Traction Motor for Enhancing Output Power Density: Comparison of Different Rotor Core Materials [#659]	5083
Masaki Kimura, Ren Tsunata, Masatsugu Takemoto, Jun Imai Okayama University, Japan	
Design and Analysis of Single-Phase, Two-Speed, Line-Start Synchronous Reluctance Motor for Ceiling Fan Applications [#1315]	5090
Pramod Antony D'sa ¹ , Shovan Dey ¹ , Amarkumar Kushwaha ² , Baylon G. Fernandes ¹ ¹ Indian Institute of Technology Bombay, India; ² Manipal Academy of Higher Education, India; ³ Indian Institute of Technology Dharwad,	
A Transverse-Flux Constant Force Mechanism [#1186]	5098
Gozde Sivka ¹ , Bertrand Dechant ² , Colton Bruce ² , Jonathan Z. Bird ¹ ¹ Portland State University, United States; ² FluxMagic, Inc., United States	
Minimizing Both Leakage Inductance and Winding Capacitance in a 1:1 High-Frequency Transformer using Fully Interleaved and Interposed Winding [#1445]	5103
Annoy Kumar Das, Baylon G. Fernandes Indian Institute of Technology Bombay, India	
Synchronous Electrostatic Machines for Direct Drive Industrial Applications [#93]	5111
Daniel C. Ludois ^{1,2} , Peter Killeen ¹ , Aditya N. Ghule ¹ , Stewart Innes ¹ , Justin K. Reed ¹ ¹ C-Motive Technologies, United States; ² University of Wisconsin-Madison, United States	

Oral Session 32: IPM and Synchronous Reluctance Machines I

Chair(s): Nicola Bianchi, Gilsu Choi

Development of a PM-Assisted Synchronous Reluctance Machine with Asymmetrical Flux Barriers using Dy-Free Nd-Bonded Magnets [#1206]	5118
Junichi Asama, Mikito Kawamura, Ryota Sone Shizuoka University, Japan	

Torque Utility Enhancement of Permanent Magnet Assisted Synchronous Reluctance Machine using Asymmetrical Flux Barriers [#322]	5122
Seyyed Morteza Mousavi Bafrouei ¹ , Aliakbar Damaki Aliabad ¹ , Ebrahim Amiri ² ¹ Yazd University, Iran; ² California State University, Long Beach, United States	
Determination of Rotor-Angle Dependent, Differential Inductances of a Synchronous Reluctance Machine for Different Model Structures [#519]	5127
André Haspel, Vasken Ketchedjian, Philipp Marx, Jörg Haarer, Jörg Roth-Stielow University of Stuttgart, Germany	
Enhancing Demagnetization Resistance in Non-Rare-Earth PM-Assisted Synchronous Reluctance Machine using Asymmetric Halbach Array [#1231]	5135
Praveen Kumar, Robin Wilson, Ayman El-Refaie Marquette University, United States	
Investigating the Effects of Iron Ribs in Brushless Doubly Fed Reluctance Machine [#1457]	5143
Fatima Mahmoud, Hussain Hussain Kuwait University, Kuwait	
 Poster Session 2: Electric Machines 2 Chair(s): Greg Heins	
Robust Optimal Design Process for Minimizing the Deviation of Cogging Torque in PMSMs considering Interaction between Manufacturing Tolerances [#1754]	5151
Yun-Jae Won ¹ , Jae-Hyun Kim ² , Soo-Min An ¹ , Myung-Seop Lim ¹ ¹ Hanyang University, Korea; ² Yeungnam University, Korea	
2-D Analytical Modeling of Consequent-Pole Surface Mounted Permanent Magnet Machines with Outer Rotor Core [#321]	5157
Mohammad Alaei Faradonbeh ¹ , Vahid Zamani Faradonbeh ² , Ebrahim Amiri ³ ¹ Isfahan University of Technology, Iran; ² Shiraz University of Technology, Iran; ³ California State University, Long Beach, United States	
Axial-Assist Permanent Magnet Synchronous Machine with Halbach Array Magnetic Arrangement [#1233]	5162
Soheil Yousefnejad ¹ , Ebrahim Amiri ² , Parviz Rastgoufard ¹ ¹ University of New Orleans, United States; ² California State University, Long Beach, United States	
Impact of Magnet Shape and Thermal Effects on the Performance of Variable Flux Memory Motors [#1795]	5167
Daniel Fernandez, Diego G. Yanez, María Martínez, Juan Manuel Guerrero, Fernando Briz Universidad de Oviedo, Spain	
Two-Level Design Optimization of AC Machines with DC Stator Excitation and Minimal Torque Ripple using Reluctance Rotor Profile Shaping [#606]	5174
Ali Mohammadi, Oluwaseun A. Badewa, Yaser Chulaee, Dan M. Ionel University of Kentucky, United States	
Large Scale Optimization of Permanent Magnet Synchronous Motors Accounting for Switching Harmonics Losses using Field Oriented Control [#317]	5180
Ahmed Shoeb, Dheeraj Bobba, Vedanadam Mudumbai Acharya Powersys Inc., United States	

Design of an On-Axis Electrically Excited Synchronous Motor for Heavy Commercial Vehicles [#631]	5185
Fabio Filippini, Nicola Bianchi <i>Università degli Studi di Padova, Italy</i>	
A Novel Segmented-Rotor Hybrid-Excited Synchronous Motor for In-Wheel Two-Wheeler Applications [#972]	5193
Shovan Dey ¹ , Pramod Antony D'sa ² , Baylon G. Fernandes ¹ ¹ Indian Institute of Technology Bombay, India; ² Manipal Academy of Higher Education, India	
Multi-Wound Axial Flux Generators with Halbach Array Rotors [#1576]	5199
Matin Vatani ¹ , Yaser Chulaee ¹ , John F. Eastham ² , Xiaoze Pei ² , Dan M. Ionel ¹ ¹ University of Kentucky, United States; ² University of Bath, United Kingdom	
Analytical and FE Modeling for the Design of Coreless Axial Flux Machines with Halbach Array and Surface PM Rotors [#905]	5205
Matin Vatani ¹ , Yaser Chulaee ¹ , John F. Eastham ² , Dan M. Ionel ¹ ¹ University of Kentucky, United States; ² University of Bath, United Kingdom	
Axial Flux Permanent Magnet Vernier Machine with Advanced Auxiliary Slot Shape [#99]	5212
Jiayue Zhou, Xi Xiao, Haifeng Lu, Jianyun Chai <i>Tsinghua University, China</i>	
Comparative Study of Axial-Flux Machines between Double Stator and YASA Structures regarding Output Power Density and Efficiency in Traction Applications [#788]	5219
Yuki Nakano, Ren Tsunata, Masatsugu Takemoto, Jun Imai, Tatsuya Saito, Tomoyuki Ueno ¹ Okayama University, Japan; ² Sumitomo Electric Sintered Alloy, Ltd., Japan	
Iron Loss Calculation Method considering Slot Harmonic Components for Induction Motor using Virtual Blocked Rotor and Transfer Learning [#1258]	5226
Ji-Hyeon Lee ¹ , Hyun-Su Kim ¹ , Soo-Hwan Park ² , Jin-Cheol Park ¹ , Myung-Seop Lim ¹ ¹ Hanyang University, Korea; ² Dongguk University, Korea	
Simulation of Frequency and Power Control Strategy for Stator-Controlled DFIG Applied for Fractional Frequency Transmission System [#1093]	5231
Hongjing Deng ¹ , Shaofeng Jia ¹ , Zhidong Yuan ² , Jun Lin ¹ , Deliang Liang ¹ ¹ Xi'an Jiaotong University, China; ² Chengdu Power Supply Company, China	
Automated Testing of Rotor Faults in Wound Field Synchronous Motors for EV Applications [#1816]	5237
Seungmin Shin, Namhyuk Byun, Muhammad Faizan Shaikh, Jongwon Kim, Sang Bin Lee <i>Korea University, Korea</i>	

Poster Session 2: Electric Machines 3

Chair(s): Simone Ferrari

Analysis of Segmented Stator and Rotor Design in PMSM using a Physics-Based MEC Model [#1526]	5240
Bhuvan Khoshoo ¹ , Anmol Aggarwal ¹ , Morgan Barron ² , Shanell N. Foster ¹ ¹ Michigan State University, United States; ² US Army Ground Vehicle System Center, United States	

A More Accurate FEA Model for Machines with Segmented Stators Manufactured using Oriented Steel [#1532]	5247
Anmol Aggarwal ¹ , Bhuvan Khoshoo ² , John Agapiou ¹ , Shanelle N. Foster ² ¹ General Motors, United States; ² Michigan State University, United States	
Impact of Non-Idealities in Position Sensor for Electric Propulsion System [#984]	5255
William Jensen, Ajay Mehta, Brian Gallert, Mazharul Chowdury, Suresh Gopalakrishnan General Motors, United States	
Inductance based Lumped Parameter IPM Machine Model for Fast Simulation [#942]	5262
Claudio Bianchini ¹ , Giada Sala ¹ , Matteo Frigieri ² , Mattia Vogni ¹ , Nicola Giannotta ¹ , Alessandro Capitano ¹ ¹ University of Modena & Reggio Emilia, Italy; ² Raw Power Srl, Italy	
Effect of Partial Demagnetization on Speed in Permanent Magnet Synchronous Machine [#1620]	5269
Abdur Rahman ¹ , Rukmi Dutta ¹ , Guoyu Chu ¹ , Minghao Gao ¹ , Dan Xiao ² , Muhammed Fazlur Rahman ¹ ¹ University of New South Wales, Australia; ² Sungrow Australia Group Pty., Ltd., Australia	
Electromagnetic-Thermal Bidirectional Coupling Analysis based on LPTM for Rim-PM Motor [#794]	5275
Haoyu Wang ¹ , Xianglin Li ¹ , Yongjian Hao ¹ , Chaolin Li ² , Hao Wang ¹ , Kai Wang ³ ¹ Qingdao University, China; ² JieYuan DianQi (Qingdao) Co., LTD, China; ³ Nanjing University of Aeronautics & Astronautics, China	
Fast Model of a Hybrid Excitation Synchronous Machine using Equivalent Reluctance Networks for Parameter Design [#1321]	5281
Quentin Loeuillet ¹ , Christian Chillet ¹ , Laurent Gerbaud ¹ , Jean-Claude Mipo ² , Jean-Luc Schanen ¹ ¹ Université Grenoble Alpes, G2ELAB, France; ² Valeo Electrical Systems, France	
Efficient Calculation and Mitigation of AC Winding Losses in Axial Flux Permanent Magnet Machine [#79]	5289
Dae Yong Um ^{1,2} , Rajesh Kumar ³ , Tushar Batra ³ , Lars Sjöberg ³ , Glynn Atkinson ³ ¹ Gyeongsang National University, Korea; ² Newcastle University, United Kingdom; ³ Alvier Mechatronics AB, Sweden	
Finite Element Analysis Optimization Coupling the Control Simulation to Minimize PWM Loss [#573]	5297
Hiroyuki Sano, Shiro Yano, Tetsuo Ogawa, Kazuki Semba, Takashi Yamada JSOL Corporation, Japan	
Design of Slotless Permanent Magnet Synchronous Machines considering Harmonic-Induced Permanent Magnet Eddy Current Loss [#215]	5301
Junyeong Jung, Iqbal Husain North Carolina State University, United States	
Design and Optimization of a Multiphase PMSG for Wind Turbines Exploiting Different Harmonics [#1031]	5309
Mouna Oukrid, Nicolas Bernard, Mohamed-Fouad Benkhoris Nantes University, France	

Modeling and Experimental Analysis of SiC-Driven Form Wound Coil Insulation with Defects [#95]	5316
Benjamin Sirizzotti, Emmanuel Agamloh, Annette von Jouanne, Alex Yokochi Baylor University, United States	
Multi-Physics Coupling Simulation Analysis of DC-Link Capacitors under DC Superimposed Multi-Harmonic Voltage [#1249]	5324
Yingbin Li, Lingyu Zhu, Linzi Zheng, Xinyi Yan, Shengchang Ji Xi'an Jiaotong University, China	
Voltage-behind-Reactance Modelling and Emulation of Stator Inter-Turn Faults in Induction Machines [#200]	5331
Alla Koteswara Rao, Pragasen Pillay Concordia University, Canada	
Comparison between Flux Angle Mapping and Cycloidal Magnetic Gears for High Gear Ratio Applications [#13]	5337
Salek A. Khan, Parisa Afsari, Matthew C. Gardner The University of Texas at Dallas, United States	
Comparison of NdFeB and Ferrite Radial Flux Focusing Coaxial Magnetic Gears [#546]	5343
Parisa Afsari, Salek A. Khan, Matthew C. Gardner The University of Texas at Dallas, United States	
Vernier Permanent Magnet Motors for Small-Size Servo Drives: A Scalability Study and Discussion [#1124]	5350
Laura Homiller ¹ , Jixuan Feng ² , Lei Zhou ¹ ¹ University of Wisconsin-Madison, United States; ² The University of Texas at Austin, United States	
Design and Analysis of Double-Sided Axial Flux Coaxial Magnetic Gears [#1342]	5357
Shriekesh Sheshaprasad, Matthew Johnson, Hamid A. Toliyat Texas A&M University, United States	
A Review of Ring Motors with Integrated Loads [#1607]	5365
Adonay A. Asgodom ¹ , Takahiro Noguchi ¹ , Fnu Nishanth ² , Eric Severson ¹ ¹ University of Minnesota-Twin Cities, United States; ² University of Wisconsin-Madison, United States	
Poster Session 3: Electric Machines 4	
Chair(s): Silvio Vaschetto	
Hybrid Structure Shield for Shaft Voltage Reduction and Fault Diagnosis [#176]	5373
Sung-Won Lee, Jun-Hyeok Heo, Jun-Kyu Kang, Jin Hur Incheon National University, Korea	
Hybrid Shield Ring Structure for Shaft Voltage Reduction in IPMSM [#222]	5377
Dae-Hyeon Kim, Jun-Kyu Kang, Jun-Hyeok Heo, Jin Hur Incheon National University, Korea	
Induction Motor Fault Classification with Topological Data Analysis [#1734]	5381
Bingnan Wang Mitsubishi Electric Research Laboratories, United States	

A Comparison of Induction Motor Fault Detection using Single and Double-Channel Phase Currents [#639]	5387
Robert Wright ¹ , Poria Fajri ¹ , Xingang Fu ¹ , Arash Asrari ²	
¹ University of Nevada Reno, United States; ² Purdue University Northwest, United States	
Modeling Equivalent Circuit of Shaft Voltage for EV Motor with Ceramic Bearings [#487]	5394
Jun-Hyuk Im ¹ , Yong-Ha Choo ¹ , Sang-Hoon Lee ¹ , Jin Hur ² , Jun-Hyeok Heo ²	
¹ Daegu Mechatronics & Materials Institute, Korea; ² Incheon National University, Korea	
High-Frequency Pulse Generator for Medium Voltage Motor Insulation Testing [#538]	5398
Obinna Vitus Onodugo, Pascal Lingom, Emmanuel Agamloh, Annette von Jouanne, Alex Yokochi	
Baylor University, United States	
Demagnetization Fault Diagnosis of Vernier Permanent-Magnet Motor based on Wavelet Packet Analysis and MSCNN [#808]	5406
Hao Wang ¹ , Xianglin Li ¹ , Xuejiang Tian ¹ , Chaolin Li ² , Wei Hua ³ , Kai Wang ⁴	
¹ Qingdao University, China; ² JieYuan DianQi (Qingdao) Co., LTD, China;	
³ Southeast University, China; ⁴ Nanjing University of Aeronautics & Astronautics, China	
Analysis of Zero-Sequence Injection for Five-Phase Induction Motor under Open-Phase Fault [#1200]	5412
Xiangwen Sun, Zicheng Liu, Guangyu Wang, Dong Jiang, Ronghai Qu	
Huazhong University of Science & Technology, China	
High-Precision Adaptive Algorithm for Ball Bearing Fault Diagnosis under Low Incremental Encoder Sampling Rate [#220]	5417
Juntao Wang, Pinjia Zhang	
Tsinghua University, China	
Test Results of Transient Temperature Distribution of High Slot Fill Motor Winding with Infrared Thermography [#885]	5423
Hiroya Sugimoto, Jun Ebinuma, Yuto Yamada	
Tokyo Denki University, Japan	
Comparative Analysis of Electric Motor Cooling: Water Ethylene Glycol Housing Jacket vs Direct Stator Oil [#1076]	5429
Arthur Zajac ¹ , Andrew Botham ¹ , Sun Lee ¹ , Jigar Mistry ² , Reza Nasirizarandi ² ,	
Ofelia Jianu ¹ , Narayan C. Kar ¹	
¹ University of Windsor, Canada; ² Vitesco Technologies, Canada	
Comparison of Advanced Stator Cooling Techniques for High-Performance Electric Machines [#715]	5437
Gokhan Cakal, Thomas M. Jahns, Bulent Sarlioglu	
University of Wisconsin-Madison, United States	
A Novel Radial-Flux IPM Eddy-Current Coupler for Wind Generator Applications [#1868]	5444
Sajjad Mohammadi ¹ , Gholamreza Davarpanah ² , James L. Kirtley ¹	
¹ MIT, United States; ² Amirkabir University of Technology, Iran	
Greybox Thermal Parameter Identification of Electric Machine Stators [#1213]	5447
Nicholas Krause, Dominick Sossong, Ian P. Brown	
Illinois Institute of Technology, United States	

Poster Session 3: Electric Machines 5

Chair(s): Udochukwu B. Akuru

- Electromagnetic Performance Comparison of the Laminated- and Segmented-Rotor Double-Stator Wound-Field Flux Switching Machines [#1595] 5455**
Udochukwu B. Akuru¹, Wasiq Ullah², Wasiullah Khan³, Karen S. Garner⁴, Lesedi Masisi⁵, Faisal Khan³
¹Tshwane University of Technology, South Africa; ²Kabul Polytechnic University, Afghanistan;
³COMSATS University Islamabad, Pakistan; ⁴Stellenbosch University, South Africa;
⁵University of the Witwatersrand, South Africa
- Optimal Design and Comparison of Synchronous Machines with Inner and Outer Reluctance Rotors and PM or DC Stator Combined Excitation [#1004] 5461**
Oluwaseun A. Badewa, Ali Mohammadi, Donovan D. Lewis, Dan M. Ionel
University of Kentucky, United States
- Design, Analysis, and Implementation of Robust Two Degree of Freedom Current Regulator for Switched Reluctance Machines [#1105] 5466**
Nikunj Gupta¹, Siddharth Mehta², Prerit Pramod³, Iqbal Husain¹
¹North Carolina State University, United States; ²Lightship Energy Inc., United States;
³MicroVision Inc., United States
- Double-Integral Ramp Tracking Current Regulator Architecture for Switched Reluctance Machines [#1674] 5474**
Nikunj Gupta¹, Siddharth Mehta², Prerit Pramod³, Iqbal Husain¹
¹North Carolina State University, United States; ²Lightship Energy Inc., United States;
³MicroVision Inc., United States
- Boost Inverter for Switched Reluctance Motor Drive without Additional Inductor [#1120] 5481**
Satoshi Ohtaki, Hiroataka Kato, Hiroki Watanabe, Jun-ichi Itoh
Nagaoka University of Technology, Japan
- Superconductor Joint Methods and AC Losses in Electric Machine Applications [#201] 5487**
Nicholas Storti, Emmanuel Agamloh
Baylor University, United States
- Wound-Rotor Asynchronous Machines for use in Electrical Power Generation in Aviation [#276] 5495**
Conner Ozatalar¹, Jeremiah Vannest¹, Julia Zhang¹, Shengyi Liu², Lijun Gao²
¹The Ohio State University, United States; ²Boeing, United States
- Design and Performance Characteristics of a Four-Module Fault-Tolerant Modular PM Machine [#1686] 5502**
Ken Chen, Pengkun Tian, Xiaoyuan Zhang, Thomas M. Jahns, Bulent Sarlioglu
University of Wisconsin-Madison, United States
- Analysis of a Novel Phase-Unit Axial-Modular Permanent Magnet Machine with E-Core Stators for Electric Aircraft Propulsion System [#434] 5510**
Yanlei Yu¹, Candra Adi Wiguna¹, Yu Zeng¹, Qingxiang Liu¹, Josep Pou¹, James Wang¹, Armen Baronian², Huanqing Sun², Christopher H. T. Lee¹
¹Nanyang Technological University, Singapore; ²Eaton Corporation, Canada;
³Eaton Corporation, China

Switch Open Fault Detection of Asymmetric 6-Phase PMSM based on Normalized Stationary Reference Frame dq-Axis Currents [#1108]	5516
Myeongjae Kim ¹ , Yoengyu Bae ¹ , Soyoung Jun ¹ , Seonhwan Hwang ¹ , Kichang Lee ² , Hui Li ³	
¹ Kyungnam University, Korea; ² Korea Electrotechnology Research Institute, Korea;	
³ Florida State University, United States	

Effect of Integrated Stator Cooling Channels on the Electromagnetic-Thermal Performance of Traction Electric Motors [#748]	5523
Jigar Mistry, M. Hossain Mohammadi	
Shaeffler Group, Canada	

Trade-Offs and Performance Benefits of GaN Inverters in Low Inductance High-Speed PMSMs for Aerospace Applications [#1253]	5531
Theophilus Wakemeh, Junyeong Jung, Iqbal Husain	
North Carolina State University, United States	

Minimum Winding-Loss Design of Cryogenically-Cooled Hyper-Conducting PM Motors [#1694]	5538
Matteo F. Iacchetti ^{1,2} , Alexander C. Smith ¹ , Hongye Zhang ^{1,3} , Paul Tuohy ¹ , Alexandru-Vlad Rusu ¹	
¹ The University of Manchester, United Kingdom; ² Politecnico di Milano, Italy;	
³ University of Edinburgh, United Kingdom	

Sustainability-Centric Rare-Earth-Free Electric Machine Design for Traction Applications [#997]	5545
Mostafa Fereydoonian, Woongkul Lee	
Purdue University, United States	

Oral Session 42: IPM and Synchronous Reluctance Machines II

Chair(s): Narges Taran, Gerd Bramerdorfer

Study on Magnet Eddy Current Loss under Voltage Source Inverter Operation and Voltage Pulse Pattern for Its Loss Reduction [#668]	5551
Kensuke Sasaki ¹ , Kan Akatsu ²	
¹ Nissan Motor Co., Ltd., Japan; ² Yokohama National University, Japan	

MnBi IPMSM and PMASynRM Torque Density Limitations Due to Temperature-Dependent Demagnetization [#18]	5558
Ryan Brody, Paul Ohodnicki, Brandon Grainger	
University of Pittsburgh, United States	

Adaptive Laser Machining and Synchronous Reluctance Machine Design [#664]	5565
Alexander Stewart, Nick Simpson, Phil Mellor	
University of Bristol, United Kingdom	

Performance Derating of Multi-Three-Phase PM-Assisted Synchronous Reluctance Motors in Open-Three-Phase Fault Conditions [#656]	5573
Simone Ferrari, Sandro Rubino, Fabio Mandrile, Andrei Bojoi, Eric Armando, Gianmario Pellegrino	
Politecnico di Torino, Italy	

A Novel Dual-Layer PM Variable Leakage Flux Machine for Electrified Vehicle Applications [#626]	5581
Dabin Liu ¹ , Hui Yang ¹ , Xing Liu ¹ , Rui Tu ¹ , Ya Li ² , Xiping Liu ³ , Shuhua Fang ¹ , Yiming Shen ⁴ , Heyun Lin ¹	
¹ Southeast University, China; ² Anhui University, China; ³ Jiangxi University of Science & Technology, China; ⁴ Nanyang Technological University, Singapore	

Oral Session 54: Modeling and Analysis of Electrical Machines I

Chair(s): Prerit Pramod, Simone Ferrari

Dynamic Models for Electrically Excited Synchronous Machines based on Flux-to-Current and Current-to-Inductance Maps [#610] 5588

Lorenzo Perilli, Federica Graffeo, Sandro Rubino, Silvio Vaschetto
Politecnico di Torino, Italy

A Unified Circuit View of Multiphysics Finite Element Analysis via Discrete Exterior Calculus Part II: 2D Dynamic Fields [#104] 5596

Mehran Keivanimehr¹, Baoyun Ge²
¹University of Florida, United States; ²Georgia Institute of Technology, United States

Estimation of Heat Transfer Coefficients on Hairpin Windings for Automotive Traction Motors with Flooded Stator Cooling [#429] 5604

George Batho¹, Peter H. Connor¹, Tianjie Zou¹, Adam Walker¹, Liam Portanier Mifsud¹, Oliver Tweedy¹, Hailin Huang¹, Xiang Ren¹, Chris Gerada¹, Christian Egger²
¹University of Nottingham, United Kingdom; ²Robert Bosch GmbH, Germany

Life Cycle Assessment of Electrical Machines – a Case Study [#113] 5611

Rafal Wrobel, Mohammad Ali Rajaeifar, Barrie Mecrow
Newcastle University, United Kingdom

Novel Liquid Cooled Condenser Design for Non-Uniform Loss Distribution in Additively Manufactured Windings with Integrated Heat Pipes [#1769] 5619

Salar Koushan, Towhid Chowdhury, Ali Al-Qarni, Ayman El-Refaie
Marquette University, United States

Oral Session 55: Bearingless and High-Speed Machines

Chair(s): Eric Severson, Wolfgang Gruber

Damping Effect of Diamagnetic Bearingless Motor with Highly Oriented Pyrolytic Graphite Rotor [#1348] 5626

Shotaro Meki, Hiroya Sugimoto
Tokyo Denki University, Japan

Scaling of High-Speed Surface PM Bearingless Machines [#1157] 5631

WaiYan Chan¹, Takahiro Noguchi², Eric L. Severson²
¹University of Wisconsin-Madison, United States; ²University of Minnesota-Twin Cities, United States

Voltage Disturbance Compensation for Thrust Suspension using Zero-Sequence Current in 5-Axis Actively Controlled Bearingless Motor [#1642] 5639

Yusuke Fujii¹, Kaito Tanaka¹, Akira Chiba¹, Kenta Tagami², Takuya Sakuragi², Tatsuya Tonari², Yusuke Irino²
¹Tokyo Institute of Technology, Japan; ²Daikin Industries, Ltd, Japan

An Innovative Design of a Permanent Magnet-Assisted Synchronous Reluctance Motor to Improve Torque Performance for High Speed Applications [#591] 5645

Md Javed Hossain, Paxton Schroeder, Josef Frankhouse, Roy A. McCann
University of Arkansas, United States

Capacitive-Coupling Active Damper for LCL-Equipped HSPMSM Drives with Inverter-Current Feedback-Only [#623]	5652
Jiaxin Zhou, Fei Peng, Yunkai Huang, Yu Yao Southeast University, China	

Oral Session 66: Modeling and Analysis of Electrical Machines II

Chair(s): Shanelle Foster, Bingnan Wang

Design and Analysis of Asymmetric Flux Reversal Permanent Magnet Linear Machine with Halbach PM Array [#1306]	5660
Yiming Shen ¹ , Yanlei Yu ¹ , Xuhui Zhu ² , Christopher H. T. Lee ¹ ¹ Nanyang Technological University, Singapore; ² Nantong University, China	

Electric Drive System Analysis and Control Optimization with IPM Machines in Overmodulation and Six-Step Region [#1048]	5667
Le Chang, Cheng Gong, Song He, Daniel Berry, Mohammad Anwar General Motors, United States	

Tensor Representation of Electric Machine Windings and its Connection with Winding Functions [#584]	5675
J. Dillon Vann ¹ , Baoyun Ge ² ¹ University of Florida, United States; ² Georgia Institute of Technology, United States	

Implementation of Highly Non-Linear, Flux-Based Unified Machine Models on a Rapid Prototyping Controller-Hardware-in-the-Loop System [#930]	5682
Benedikt Schmitz-Rode, Leonard Geier, Lukas Stefanski, Sophie Knierim, Andreas Liske, Marc Hiller Karlsruhe Institute of Technology, Germany	

Hybrid Thermal Network Identification for Sensorless Temperature Monitoring of a PMSM considering Speed-Dependent Cooling Effects [#1153]	5690
Thomas Krainer ¹ , Daniel Wöckinger ¹ , Gerd Bramerdorfer ¹ , Stephen Chukwulobe ² ¹ Johannes Kepler University Linz, Austria; ² HANNING ELEKTRO-WERKE GmbH & Co. KG, Germany	

Oral Session 76: Materials, Losses, Thermal and Manufacturing Issues I

Chair(s): Takashi Kato, Md Sariful Islam

Reduction of the Circulating Current for Concentrated Winding Electrical Machines with Multi-Parallel Strands by Bundle Inversion [#1112]	5698
Junichi Asama ¹ , Takumi Kono ¹ , Hiroshi Shida ² ¹ Shizuoka University, Japan; ² Innovative Motor Design, Co., Ltd., Japan	

A Comparison of the Electrical Endurance of Plasma Sprayed Aluminum Oxide to Existing Insulation Materials [#709]	5702
Brian Wolhaupter, Anjana J. Samarakoon, Kiruba Haran University of Illinois at Urbana-Champaign, United States	

Computation of PWM Induced Winding AC Loss in Closely Integrated Motor Drives [#1399]	5708
Philp Mellor, Andrew Hopkins, Nick Simpson University of Bristol, United Kingdom	

Slot Wall Extensions for Improved Thermal Performance of Electric Machines [#150] 5716

Gokhan Cakal, Thomas M. Jahns, Bulent Sarlioglu
University of Wisconsin-Madison, United States

Comparison of Core Loss Characteristics of Interior PM and Flux-Switching PM Machines for EV Applications [#1267] 5721

Jaesung Choi¹, Gwan-Hui Jang¹, Jungmoon Kang¹, Gilsu Choi¹, Christoph Dobler², Gerd Bramerdorfer²
¹Inha University, Korea; ²Johannes Kepler University, Austria

Oral Session 77: Switched Reluctance and Flux Switching Machines

Chair(s): Kyohei Kiyota, Udochukwu B. Akuru

An Analytical Lumped Parameter Model for the Bearingless Separated-Stator Flux-Switching Slice Motor [#1398] 5727

Stefan Mallinger, Wolfgang Gruber
Johannes Kepler University Linz, Austria

A Novel Switched Reluctance Motor with Semi-Hard Material in Rotor for High-Speed Applications [#1260] 5735

Aydin Yousefi Javid¹, Alireza Sohrabzadeh², Hossein Torkaman²,
Solmaz Kahourzade³, Amin Mahmoudi⁴, Wen Soong⁵
¹Islamic Azad University, Iran; ²Shahid Beheshti University, Iran; ³University of South Australia, Australia; ⁴Flinders University, Australia; ⁵University of Adelaide, Australia

Proposal of 12-Pole 20-Slot Five-Phase Multi-Mode Reluctance Motor [#1489] 5742

Ryo Kokubu, Kyohei Kiyota
Tokyo Institute of Technology, Japan

High-Power Density Wound-Field Flux-Switching Machine with Modular Rotor Design for Traction Applications [#986] 5750

Mostafa Fereydoonian, Woongkul Lee
Purdue University, United States

Analysis and Design of Synchronous Machines with Reluctance Rotor and PM Stator Combined Excitation [#1005] 5756

Oluwaseun A. Badewa, Dan M. Ionel
University of Kentucky, United States

Oral Session 88: Diagnostics, Noise and Vibration in Electric Machines

Chair(s): Jose Antonino-Daviu, Antonio J. Marques Cardoso

Unsupervised Anomaly Detection of Reciprocating Compressors using Auto-Encoder [#601] 5762

Minha Kim¹, Jaehoon Shim¹, Juwon Lee¹, JongHyun Shin², Jung-Ik Ha²
¹Seoul National University, Korea; ²Samsung Electronics Company, Korea

Power Hardware-in-the-Loop Emulation of Induction Machine Stator Inter-Turn Fault using an Improved Mathematical Model [#61]	5768
Alla Koteswara Rao, Pragasen Pillay Concordia University, Canada	
Two-Phase Direct Vibration Modal Control of Ultrasonic Motors based on Active Disturbance Rejection Observer [#290]	5774
Bingxin Xu, Long Jin, Zhike Xu, Zhan Shen, Peiwen Tan Southeast University, China	
Detection of Trailing Edge Demagnetization in Surface PM Synchronous Machines based on High Frequency Equivalent Impedance [#217]	5782
YeEun Yoon ¹ , Marcos Orviz Zapico ² , Javier G. Tiemblo ² , Kibok Lee ¹ , David Diaz Reigosa ² , Chaewoong Lim ³ , Sang Bin Lee ¹ ¹ Korea University, Korea; ² Universidad de Oviedo, Spain; ³ SN Heavy Industry Company, Korea	
Novel Online Static Eccentricity Detection and Evaluation in Permanent Magnet Generators [#1778]	5788
Stefanos Karampas ¹ , Georgios Skarmoutsos ² , Markus Mueller ² , Konstantinos Gyftakis ¹ ¹ Technical University of Crete, Greece; ² University of Edinburgh, United Kingdom	
 Oral Session 89: Additive Manufacturing and other Advanced Manufacturing Technologies in Electric Machines Chair(s): Rafal Wrobel, Silvio Vaschetto	
A Double Three-Phase Axial-Flux Synchronous Reluctance Motor [#1142]	5794
Nicola Bianchi ¹ , Giada Sala ² , Claudio Bianchini ² ¹ Università degli Studi di Padova, Italy; ² University of Modena & Reggio Emilia, Italy	
Topology Optimization of Motor Windings for Coreless Electrical Machines [#11]	5802
Adrien Thabuis, Xiaotao Ren, Yves Perriard École Polytechnique Fédérale de Lausanne, Switzerland	
Efficient Processes and Tools for Twisting of Flat Wires in Hairpin Motors [#23]	5810
Alexander Kuehl Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany	
Development of a Conductor Shaping Algorithm for Reduced AC Loss in Electrical Machines [#1669]	5818
Nick Simpson, Phil Mellor University of Bristol, United Kingdom	
Investigation of Triply Periodic Minimal Surfaces to Lightweight Liquid Cooling Jackets for High-Performance Electrical Machines [#677]	5825
Harrison Mogg-Walls, Aydin Nassehi, Mark Goudswaard, Nick Simpson University of Bristol, United Kingdom	

Oral Session 100: Wound Field and PM Machines

Chair(s): Fabio Giulii Capponi, Antonio J. Marques Cardoso

Research on Improving the Maximum Efficiency Area according to Electric Multi-Stage Shifting of WFSM [#175] 5833

Jun-Hyeok Heo, Jin Hur
Incheon National University, Korea

Self-Magnetized Wound Rotor Non-Overlapping Winding Synchronous Wind Generator for MPPT Variable DC Grid System [#577] 5838

Lucky Dube, Karen S. Garner, Maarten J. Kamper
Stellenbosch University, South Africa

Analysis and Design of a Self-Excitation Scheme for an Open-End Armature Winding Wound-Rotor Synchronous Machine [#1458] 5846

Ghulam Jawad Sirewal^{1,2}, Gilsu Choi¹
¹*Inha University, Korea*; ²*The Benazir Bhutto Shaheed University of Technology and Skill Development, Pakistan*

Topology based Optimization of Wound Field Synchronous Machine with Hybrid Excitation for Traction Applications [#1760] 5852

Mohanraj Muthusamy¹, Sainan Xue², Vedanadam Mudumbai Acharya², Dheeraj Bobba²
¹*Powersys Inc., Canada*; ²*Powersys Inc., United States*

Doubly Salient Parallel Path Magnetic Motor: A Novel Doubly Salient Stator Permanent Magnet Machine [#287] 5860

Maryam Salehi, Madhav Manjrekar
University of North Carolina at Charlotte, United States

Oral Session 101: Materials, Losses, Thermal and Manufacturing Issues II

Chair(s): Federico Marcolini, Juan Manuel Guerrero

Experimental Evaluation of the Impact of using Oriented Steel in Proportion to Segmentation on Core Loss of AC Electric Machine Stator [#1534] 5868

Bhuvan Khoshoo¹, Anmol Aggarwal², John Agapiou², Shanelle N. Foster¹
¹*Michigan State University, United States*; ²*General Motors, United States*

Investigating the Effect of Multi-Level Inverter Excitation on Core Losses in Electromagnetic Devices [#1365] 5875

Hasnain Nisar, Shaya Abou Jawdeh, Ali M. Bazzi
University of Connecticut, United States

Modifying the Properties of Low Coercive Field Magnets for Improved Performance of Variable Flux Motors [#285] 5880

Bassam S. Abdel-Mageed¹, Benoit Blanchard St-Jacques², Ruisheng Shi², Pragasen Pillay¹
¹*Concordia University, Canada*; ²*Dana TM4 Inc., Canada*

Effects of Eccentricity Faults on Variable Flux Permanent Magnet Synchronous Machines [#39] 5886

Javier G.-A. Tiemblo, Marcos Orviz, Diego F. Laborda, David Reigosa
Universidad de Oviedo, Spain

Impact of Cryogenic Temperature on Iron Losses of Interlocked Laminated Stators [#806] 5892

Silvio Vaschetto¹, Zbigniew Gmyrek², Federica Graffeo¹, Andrea Cavagnino¹

¹Politecnico di Torino, Italy; ²Lodz University of Technology, Poland

Topic H: Electric Drives

Oral Session 9: Induction Motor Drives

Chair(s): Di Pan, Arshiah Yusuf Mirza

Robust OEWIM Drive for Optimized EV Powertrain Performance with DTC and ZSV Mitigation [#1138] 5899

Amit Kumar¹, Sesadri Bhusan Sahoo¹, Ranjan Kumar Behera¹, Khalifa Al Hosani², Utkal Ranjan Muduli²

¹Indian Institute of Technology Patna, India; ²Khalifa University, United Arab Emirates

Parameter Estimation of Induction Motors Using Data Fitting from Single-Axis Sinusoidal Excitation [#1523] 5905

Dongyeob Han, Sungmin Kim

Hanyang University, Korea

Model Modulated Speed and Current Predictive Control (M2PC) of Six-Phase Induction Motors including Magnetic Saturation and Iron Losses [#1199] 5913

Angelo Accetta¹, Maurizio Cirrincione^{2,3}, Massimiliano Luna¹, Marcello Pucci¹, Antonino Sferlazza⁴

¹National Research Council of Italy, Italy; ²University of South Pacific, Fiji;

³University of Belfort-Montbéliard, France; ⁴University of Palermo, Italy

2D Repetitive PI Control for Enhanced Harmonic Current Suppression in Induction Machines [#177] 5918

Johannes Stoss, Pierre Mader, Stephan Goehner, Leonard Geier,

Matthias Brodatzki, Andreas Liske, Marc Hiller

Karlsruhe Institute of Technology, Germany

Predictive Strategies for Mitigation of Common Mode Voltage in Three-Phase Induction Motor [#1133] 5925

Sofia M. A. Dias, Bruna S. Gehrke, Nady Rocha, Isaac Freitas

Federal University of Paraíba, Brazil

Oral Session 21: Control of Electric Drives

Chair(s): Sina Vahid, Luigi Danilo Tornello

Sensor-Less Drive for Ultra-Low Inductance Non-Salient Pole Machine using Single-Shunt Sensor [#183] 5933

Jun-Sik Hwang, Min-Seok Chae, Hyeon-Gyu Choi

Incheon National University, Korea

Switching Frequency Voltage Injection for Sensorless IPMSM Control using Current Derivative Measurements [#822] 5938

Byung Ryang Park, Gyu Cheol Lim, Jaehoon Shim, Jung-Ik Ha

Seoul National University, Korea

Volage Feedforward Control and Time Delay Compensation of WFSM for Eliminating Current Transient [#1041]	5944
Do-Hyeon Kim, Han-Vit Kim, Joon-Seok Kim, June-Seok Lee Dankook University, Korea	

Rotating Vector Holder for Wide Band-Gap based Inverters Switching at Very High Frequency [#702]	5950
Francesco Lelli, Fabio Giulii Capponi, Giulio De Donato Sapienza – Università di Roma, Italy	

Voltage Balancing in Double Three-Phase NPC Inverters for Powering Two Three-Phase Electric Motors with a Common DC Bus [#1693]	5957
Luca Vancini, Gabriele Boico, Michele Mengoni, Gabriele Rizzoli, Luca Zarri, Angelo Tani University of Bologna, Italy	

Poster Session 1: Electric Drives: Control and State Estimation

Chair(s): Luca Zarri

A Two-Steps Approach for Full Parameters Identification of Induction Machines at Standstill Operation [#911]	5965
Mojtaba Ayaz Khoshhava ¹ , Hamidreza Mosaddegh-Hesar ¹ , Simon Caron ² , Amir Khazaei ¹ , Kamal Al-Haddad ¹ ¹ École de Technologie Supérieure, Canada; ² Smartd Technologies Inc., Canada	

Discrete-Time Analysis and use of CVCR and SFBD Type Current Regulators in Saturated Salient AC Machines [#523]	5969
Vinod Chowdary Peddi, Anmol Aggarwal, Brent S. Gagas General Motors, United States	

An Improved Generalized Multiple-Vector-Based Model Predictive Control with Current Harmonic Suppression for PMSM Drives [#243]	5977
Yubin Wang ¹ , Yongchang Zhang ¹ , Haitao Yang ² , Jose Rodriguez ³ , Chenbo Wang ¹ , Hongjin Guo ¹ , Haisen Zhao ¹ , Guorui Xu ¹ ¹ North China Electric Power University, China; ² North China University of Technology, China; ³ Universidad San Sebastián, Chile	

Improved Power Current Control for Current Ripple Suppression of PMSM Drives under Large DC-Link Voltage Fluctuations [#1148]	5985
Jian Xiong ¹ , Jianzhong Zhang ¹ , Ning Wang ¹ , Chen Tang ¹ , Yanbo Wang ² , Hongjun Fu ³ ¹ Southeast University, China; ² Aalborg University, Denmark; ³ Jiangsu Yuanfang Power Technology Co., Ltd., China	

Sensorless Control of AC Motor Drives with Adaptive Extended Kalman Filter [#604]	5991
Saverio Rigon ¹ , Riccardo Antonello ¹ , Paolo Mercorelli ² , Mauro Zigliotto ¹ ¹ Università degli Studi di Padova, Italy; ² Leuphana University of Lüneburg, Germany	

Initial Rotor Position Detection with Eight Zones for BDCMs with Single Hall Position Sensor [#129]	5999
Hung-Chi Chen, Chun-Ya Chan, Yi-Ping Chao National Yang Ming Chiao Tung University, Taiwan	

Analog Accelerated Model Reference Adaptive System-Based Speed Estimation for Motor Control [#1290]	6005
Henil Shah, Anupama Kowli, Mukul Chandorkar Indian Institute of Technology Bombay, India	
Dynamic Current Control of Rare Earth Free Biaxial Excitation Synchronous Machines [#1452]	6011
Krishna MPK Namburi ¹ , Prerit Pramod ² , Ion Boldea ³ , Iqbal Husain ⁴ ¹ Nexteer Automotive Corporation, United States; ² MicroVision, Inc., United States; ³ Politehnica University of Timișoara, Romania; ⁴ North Carolina State University, United States	
Implementation of Low Speed Sensorless Control using ANN on General-Purpose MCU [#396]	6019
Yanyu Xia, Sari Maekawa Meiji University, Japan	
TLS EXIN based Sensorless Control of a Synchronous Reluctance Motor [#902]	6025
Angelo Accetta ¹ , Maurizio Cirrincione ^{2,3} , Massimiliano Luna ¹ , Marcello Pucci ¹ ¹ National Research Council of Italy, Italy; ² University of South Pacific, Fiji; ³ University of Belfort-Montbéliard, France	
Active Flux Position Observer for Sensorless Direct-Flux-Vector-Control at Low Speed [#1370]	6030
Andrei Bojoi, Paolo Pescetto, Gianmario Pellegrino Politecnico di Torino, Italy	
Flux Saturation Model and Self-Identification Method of Permanent Magnet Synchronous Motor considering the Magnetic Flux of Permanent Magnet [#923]	6038
Sung-Ho Kang ¹ , Tae-Gyeom Woo ¹ , Seung-Cheol Choi ² , Il-Oun Lee ³ , Young-Doo Yoon ¹ ¹ Hanyang University, Korea; ² LS ELECTRIC, Korea; ³ Myongji University, Korea	
Rotor Angle Estimation Error Compensation Algorithm based on Extended Back-EMF Sensorless for Low-Speed Operation in Washing Machines [#1569]	6045
Yujin Shin, Jaehyeok Jang, Jung-Yong Lee, Younghoon Cho Konkuk University, Korea	
Real-Time Estimation of Permanent Magnet Synchronous Motor Stator Winding Resistance and Temperature Reflecting Permanent Magnet Variations [#1116]	6051
Areum Kang, JungHyeon Han, Jae Suk Lee Jeonbuk National University, Korea	
Full Speed Range Drive with Sensorless Field-Oriented Control on 3.4kw Drone Motor [#1578]	6055
Chen-Pei Yi ¹ , Yi-En Chen ¹ , Chen-Yen Yu ² , Hsin-Tien Yeh ³ , Cheng-Hsuan Lin ³ , Shih-Chin Yang ¹ ¹ National Taiwan University, Taiwan; ² Archer Aviation, Taiwan; ³ Industrial Technology Research Institute, Taiwan	
A Gain Design Strategy for an Active Damping Controller of a MIDP Permanent Magnet Synchronous Motors Drive System [#135]	6060
Gi-Jung Nam, Hyung-Woo Lee, Kyo-Beum Lee Ajou University, Korea	
I-F Startup with Reactive Power-Based MRAS for Model Predictive Current Controlled SPMSM Drive [#451]	6065
Hyeonseong Kim, Junhyuk Song, Kibok Lee Korea University, Korea	

Extracting Spatial Harmonic Flux Linkages from an Unstructured Measurement of a PMSM [#1865]	6070
Alexander Oerder, Stephan Goehner, Andreas Liske, Marc Hiller Karlsruhe Institute of Technology, Germany	

Oral Session 33: PMSM Drives

Chair(s): Roberto Petrella, Mehdi Farasat

Enhanced Harmonic Current Controller based on Multiple Synchronous Reference Frame considering Saliency and Magnetic Flux Saturation of IPMSMs [#796]	6073
Yun-jae Lee ¹ , Hwigo Kim ² , Sung-ho Kang ¹ , Young-doo Yoon ¹ ¹ Hanyang University, Korea; ² Seoul National University, Korea	

Pulse Pattern Optimization for IPMSM considering Voltage, Current and Power Harmonics [#1727]	6080
Maria Martinez ¹ , Javier Fuente ¹ , Michael Saur ² , Daniel F. Alonso ¹ , J.M. Guerrero ¹ , Fernando Briz ¹ ¹ Universidad de Oviedo, Spain; ² Mercedes-Benz AG, Germany	

Modular and Self-Decoupled Torque Control of Multi-Three-Phase Synchronous Motor Drives [#476]	6088
Luisa Tolosano, Sandro Rubino, Eric Armando, Fabio Mandrile, Radu Bojoi Politecnico di Torino, Italy	

Dual Signal Injection-Based Online Parameter Estimation of Surface-Mounted PMSMs under Sensorless Control [#59]	6096
Peng Wang ¹ , Z.Q. Zhu ¹ , Dawei Liang ¹ , N.M.A. Freire ² , Ziad Azar ² ¹ The University of Sheffield, United Kingdom; ² Siemens Gamesa, Denmark	

Error Compensation Strategy in Encoderless Surface Mounted PMSM Drives [#682]	6104
Milad Bahrami-Fard, Majid Ghasemi Korrani, Mohammad Rastegar, Poras Balsara, Babak Fahimi The University of Texas at Dallas, United States	

Poster Session 2: Electric Drives for Transportation and Emerging Applications

Chair(s): Hassan Eldeeb

A Novel ZSC Suppression Strategy with Third-Harmonic Back-EMF Estimation for OW-PMSM Fed by Dual Inverter with a Common DC-Bus [#338]	6110
Kibok Lee, Hyeonseong Kim Korea University, Korea	

Hybrid Modular Multilevel Converter with Reduced Energy Storage for Medium Voltage Variable Speed Drives [#1313]	6116
Aditya Rao ¹ , Jian Liu ¹ , Jayesh Kumar Motwani ¹ , Rolando Burgos ¹ , Zhi Zhou ² , Dong Dong ¹ ¹ Virginia Polytechnic Institute and State University, United States; ² GE Power Conversion of GE Vernova, United States	

Control of Modular Multilevel Converter using Full-Bridge Submodules for Induction Machine Drives with Enhanced Speed Range Operation [#980]	6124
Nageswara Rao Karaka, Ibhan Chand Rath, Anshuman Shukla Indian Institute of Technology Bombay, India	
Ripple-Free Phase-Pole Modulation of a Multiphase Induction Machine [#661]	6130
Omer Ikram ul Haq ¹ , R.S. Kanchan ¹ , Luca Peretti ² , Sjoerd G. Bosga ¹ ¹ ABB Ltd., Sweden; ² KTH Royal Institute of Technology, Sweden	
An Improved Modulation Technique with Reduced Switching Frequency for Dual Three-Phase PMSM System [#1296]	6136
Wei Hu, Cong Huang, Kan Liu, Na Chai Hunan University, China	
Enhanced Predictive Torque Control Strategy for Six-Phase Induction Machines: A Comparative Study [#483]	6141
Osvaldo Gonzalez ¹ , Jesus Doval-Gandoy ² , Magno Ayala ¹ , Paola Maidana ¹ , Christian Medina ¹ , Jorge Rodas ¹ , Carlos Romero ¹ , Larizza Delorme ¹ , Raul Gregor ¹ ¹ Universidad Nacional de Asuncion, Paraguay; ² Universidad de Vigo, Spain	
Efficient Predictive Control Strategy for EV Powertrains based on Multiphase Motors Drives with Three-Level Inverters [#1712]	6146
João Serra, João Dinis, Fernando Bento, Khaled Laadjal, Antonio J. Marques Cardoso University of Beira Interior, Portugal	
Active Torque Control System for Electric Bikes considering External Load Changes [#1121]	6152
Ping-Jui Ho ¹ , Chen-Pei Yi ¹ , Yi-Jen Lin ¹ , Wei-Der Chung ² , Po-Huan Chou ² , Shih-Chin Yang ¹ ¹ National Taiwan University, Taiwan; ² Industrial Technology Research Institute, Taiwan	
2D Structure Pushing Nanocrystalline Common Mode Inductor First Resonant Frequency above 10 MHz [#333]	6158
Rongrong Zhang ¹ , Hui Zhao ¹ , Chaoqiang Jiang ² , Shuo Wang ³ , Teng Long ⁴ , Kefu Liu ¹ , Jian Qiu ¹ ¹ Fudan University, China; ² City University of Hong Kong, Hong Kong; ³ University of Florida, United States; ⁴ University of Cambridge, United Kingdom	
Open-End Winding SyncRel Motor Drive with a Floating Capacitor Bridge for High-Speed Applications [#1714]	6163
Riccardo Testa ¹ , Antonio Femia ² , Luca Vancini ² , Gabriele Rizzoli ² , Michele Mengoni ² , Luca Zarri ² , Andrea Cavagnino ³ ¹ OCEM Power Electronics, Italy; ² University of Bologna, Italy; ³ Politecnico di Torino, Italy	
13kW Motor Drive with Top-Side Cooled SiC MOSFETs for HVAC E-Compressor in EVs [#455]	6170
Zongzeng Hu ¹ , Yuequan Hu ² , Fulin Zhang ¹ , Joanne Wu ² , Haiming Zhan ¹ , Bhaskar Pariti ³ ¹ Wolfspeed, China; ² Wolfspeed, United States; ³ Wolfspeed, Germany	
A Research Overview on Household Refrigerator Hermetic Reciprocating Compressor Drives [#293]	6175
Andrés Carvajal, Annette Muetze Graz University of Technology, Austria	

Stacked Polyphase Bridges Converter having Common-Duty-Ratio Control with Gate Signal Delay [#541]	6181
Slavko Mocevic, Eddy Aeloiza, Pietro Cairoli ABB Ltd., United States	
Hardware Design of SiC-Based 3 kV High-Power Four-Level Hybrid Clamped Converter [#485]	6188
Xiaojie Fu ¹ , Sheng Yan ¹ , Yujia Guo ¹ , Junwei Xiao ¹ , Jie Yang ¹ , Ziwei Ke ² , Hao Feng ¹ , Jianyu Pan ¹ ¹ Chongqing University, China; ² Guangdong University of Technology, China	
Increased Common-Mode Current and Power Losses in Medium Voltage Machines enabled by 10 kV SiC MOSFETs [#614]	6194
Gao Liu ¹ , Zhixing Yan ¹ , Morten Rahr Nielsen ¹ , Shaokang Luan ¹ , Bjørn Rannestad ² , Hongbo Zhao ¹ , Stig Munk-Nielsen ¹ , Michael Moller Bech ¹ ¹ Aalborg University, Denmark; ² KK Wind Solutions, Denmark	
Maximizing Linear Modulation Region of a Three-Phase Inverter for Single-Phase and Three-Phase Motor Drive [#376]	6199
Da-Hye Park, Wook-Jin Lee Chungnam National University, Korea	
Reducing Voltage Overshoot in SiC Drives with Asymmetrical PWM [#1333]	6206
Yang Xu, Ji Wu, Nurani S. Chandrasekhar, Yongtian Liu, Kevin Lin, Nicholas Fava Ford Motor Company, United States	
A Generalized Multilevel Inverter and Slotless Permanent Magnet Motor-Drive Co-Design Framework [#774]	6212
Anubhav Bose, Arjit Bali, Kiruba Haran, Andrew Stillwell University of Illinois Urbana-Champaign, United States	
Characterization and Control of a Superconducting Homopolar Motor with Cryogenic GaN Inverter for Electric Aircrafts [#405]	6220
Felix Gliese ¹ , Matthew G.S. Pearce ² , Mohammad Siamaki ³ , Grant Lumsden ⁴ , Duleepa J. Thrimawithana ² , Rod Badcock ⁴ , Joerg Roth-Stielow ⁵ , Martin Neuburger ¹ ¹ Esslingen University, Germany; ² University of Auckland, New Zealand; ³ OpenStar Technologies, New Zealand; ⁴ Victoria University of Wellington, New Zealand; ⁵ University of Stuttgart, Germany	

Poster Session 3: Modeling and Reliability of Electric Drives

Chair(s): David Reigosa

A Low-Cost and Highly Reliable Configuration for Multi-Axis Electric Drive Systems [#50]	6226
David Blow ¹ , Baoyun Ge ² ¹ University of Florida, United States; ² Georgia Institute of Technology, United States	
Position Sensing Fault Detection and Compensation of BLDC Motors based on Fault Index Functions [#1242]	6234
Taehyung Kim, Sahithya Parvathareddy, Anuj Shah University of Michigan-Dearborn, United States	
Novel PSO-Based Speed-Controlled IM Fed by PS and LS PWM 9L-MMC with Mitigative Study of CMV and Bearing Current [#941]	6239
Asad Hussain, Rohit Raj, Jyoti Ranjan Dash, Pramod Agarwal Indian Institute of Technology, Roorkee, India	

High-Bandwidth Dynamic Load Emulation of Mechanical Systems using Electric Drives [#1083]	6245
Pranav Chandran, Brian Johnson <i>The University of Texas at Austin, United States</i>	
Study of Current Third-Order Harmonics Control to Reduce Iron Loss in Permanent Magnet Synchronous Motors [#324]	6252
Kaiki Akizuki ¹ , Toshiyuki Fujita ¹ , Hiroshi Fujimoto ¹ , Michihiro Nakagawa ² , Naoya Yamashita ² , Takayuki Miyajima ² , Yoshiki Yasuda ² , Akio Yamagiwa ² ¹ University of Tokyo, Japan; ² Daikin Industries, Ltd., Japan	
Maximum-Emission Operating Setpoint for the Electromagnetic Compliance of a Variable-Frequency, Soft-Switching Converter [#793]	6258
Elliott Fix, Matthias Preindl <i>Columbia University, United States</i>	
Neural Network-Based MTPA Control considering Temperature Variation in IPMSMs [#798]	6264
Jun-hyeok Lee ¹ , Tae-gyeom Woo ¹ , Dong-sup Jin ² , Young-doo Yoon ² ¹ Hanyang University, Korea; ² Ulsan University, Korea	
Permutation Entropy Applied to Fault Identification in Soft-Started Induction Motors [#207]	6270
Vicente Biot-Monterde, Ángela Navarro-Navarro, Jose Enrique Ruiz-Sarrio, Jose A. Antonino-Daviu <i>Universitat Politècnica de València, Spain</i>	
Dual Phase-Shifts for Common-Mode Noise Mitigation of Dual-Winding Motor [#1681]	6275
Xingchen Zhao, Boran Fan, Junming Liang, Rolando Burgos, Dong Dong <i>Virginia Polytechnic Institute and State University, United States</i>	
Advanced Pre-Charge Circuit Protection for Variable Speed Drives [#1291]	6280
Jijun Cao ¹ , Jiangang Hu ¹ , Changqing Chen ¹ , Junsheng Mu ¹ Rockwell Automation, China; ² Rockwell Automation, United States	
MW-Rated Induction Motor Control Equipped with Fault-Ride-Through Capability for an Electric Propulsion Ship using Model Predictive Control [#257]	6285
Jongseok Kim ¹ , Seongil Kim ² , Duck-Su Lee ³ , Heejin Ahn ¹ , Ki-Bum Park ¹ ¹ Korea Advanced Institute of Science & Technology, Korea; ² HD Korea Shipbuilding & Offshore Engineering, Korea; ³ HD Hyundai Electric, Korea	
Super-Twisting Sliding Mode Control of DFIG in Wind Energy Conversion Systems for Improved Fault Ride-Through Capability [#1636]	6293
Norah A. Alazemi, Hussain A. Hussain <i>Kuwait University, Kuwait</i>	
Unbalanced Current Control in Electric Drives for Thermal Management of Inverter Power Devices [#1720]	6301
Luigi Danilo Tornello ¹ , Tommaso Scimone ¹ , Giuseppe Scarcella ¹ , Giacomo Scelba ¹ , Salvatore Foti ² , Antonio Testa ² ¹ University of Catania, Italy; ² University of Messina, Italy	
Torque Pulsations in Variable-Flux Memory Motors [#279]	6308
Akrem Mohamed Aljehaimi, Pragasen Pillay <i>Concordia University, Canada</i>	

Advanced Control Platform for Integrated Modular Motor Drives based on the Fast Serial Interface [#617]	6313
Armin Ebrahimian, Seyed Iman Hosseini Sabzevari, Nathan Weise Marquette University, United States	

Analysis of Time Optimal Control Strategies for Electrically Excited Synchronous Machines using Dynamic Optimization [#733]	6321
Leonard Geier, Johannes Stoss, Andreas Liske, Marc Hiller Karlsruhe Institute of Technology, Germany	

Oral Session 43: Predictive Control of Motor Drives

Chair(s): Marcello Pucci, Weiqiang Chen

High-Precision Discrete-Time Model Free Predictive Control considering Disturbance Frequency under Low Carrier Ratio [#453]	6329
Zhihao Song ¹ , Wenxi Yao ¹ , Wuhua Li ¹ , Kevin Lee ² ¹ Zhejiang University, China; ² Eaton Corporation, United States	

A Simplified Active Vector Pre-Selection Method for Direct and Modulated Predictive Torque Control with Extended Voltage Set in PMSM Drives [#1508]	6334
Sodiq Agoro ¹ , Samuel Osei Fobi ² , Iqbal Husain ² ¹ ABB Ltd., United States; ² North Carolina State University, United States	

Fixed-Switching Frequency Model Predictive Current Control of PMSM: Closed-Form Solution in the Rotating Reference Frame Suitable for Salient Machines [#1764]	6341
Riccardo Breda ^{1,2} , Erik Colavitto ¹ , Sandro Calligaro ¹ , Roberto Petrella ^{1,3} , Bulent Sarlioglu ³ ¹ University of Udine, Italy; ² University of Wisconsin-Madison, United States; ³ Silicon Austria Labs, Austria	

Model Predictive Control for Wound Rotor Synchronous Machines based on Closed-Form Solution and Fixed Switching Frequency [#1574]	6349
Riccardo Breda ^{1,2} , Erik Colavitto ¹ , Sandro Calligaro ¹ , Roberto Petrella ^{1,3} , Bulent Sarlioglu ² ¹ University of Udine, Italy; ² University of Wisconsin-Madison, United States; ³ Silicon Austria Labs, Austria	

Simplified Model Predictive Current Control of a Mono-Inverter Dual Parallel Permanent Magnet Synchronous Motors [#133]	6357
Hyung-Woo Lee, Kyo-Beum Lee Ajou University, Korea	

Oral Session 56: Modulation Strategies in Electric Drives

Chair(s): Di Zhang, Luca Vancini

Harmonic Voltage Feed-Forward Compensation for Torque Ripple Reduction of PMSMs Operating in Overmodulation Region [#860]	6362
Tae-hoon Chin ¹ , Sungmin Lee ¹ , Jae-Sang Lim ² , Jin-Wook Kang ² , Younghoon Cho ¹ ¹ Konkuk University, Korea; ² Hyundai Motor Company, Korea	

Selection of Position Sensor Resolution for Variable Speed Drives based on Quantization Harmonic Rejection [#1665]	6369
Luigi Danilo Tornello ¹ , Giacomo Scelba ¹ , Giulio De Donato ¹ ¹ University of Catania, Italy; ² University of Rome - Sapienza, Italy	
A Separated Switching PWM Method to Reduce Bearing Currents [#1023]	6376
Kerrie Spaven, Brent S. Gagas, Brian Gallert, Brian Welchko General Motors, United States	
Optimizing Vector Selection for Model Predictive Direct Torque Control [#1338]	6383
Gustavo R. Adelino, Nady Rocha, Bruna S. Gehrke, Darlan Fernandes, Edison R. da Silva Federal University of Paraíba, Brazil	
Increasing Inverter Current Capability Utilizing Junction Temperature-Based Discontinuous PWM [#945]	6391
Ujjwal Kumar, Siddharth Ballal, Caleb W. Secrest BorgWarner Inc., United States	
 Oral Session 67: Electric Drives General	
Chair(s): Rashmi Prasad, Ali Bazzi	
Power Compensation Strategy for Dual Inverter with Small Capacitors Driven by Single-Phase Power to Extend Motor Operating Region [#413]	6397
Taiju Sakurai, Haga Hitoshi Shizuoka University, Japan	
Extended MTPA Control of Adjustable Field Permanent Magnet Synchronous Motor using Zero-Sequence Current [#359]	6404
Kiyohiro Iwama, Yutaro Hiyoshi, Toshihiko Noguchi Shizuoka University, Japan	
Improved Single Active Vector PWM for Low Carrier Ratios to Achieve Linear Gain over the Entire Modulation Region [#488]	6410
Wenjing Zhang ¹ , Wenxi Yao ¹ , Shan Li ¹ , Donald Grahame Holmes ² ¹ Zhejiang University, China; ² RMIT University, Australia	
Comprehensive Flux-Weakening and Analytical Extended MTPA Control Featuring Transient Torque Compensation for Hybrid Excited Synchronous Machines [#1736]	6417
Riccardo Breda ¹ , Nicola Andreon ¹ , Sandro Calligaro ¹ , Roberto Petrella ^{1,2} ¹ University of Udine, Italy; ² Silicon Austria Labs GmbH, Austria	
Copper-Loss-Minimizing Strategy based on Single Look-Up Table for Wound Field Synchronous Machine [#838]	6425
Joon-Seok Kim ¹ , Do-Hyeon Kim ¹ , June-Hee Lee ² , June-Seok Lee ² ¹ Dankook University, Korea; ² Korea Railroad Research Institute, Korea	

Oral Session 78: Traction and Aircraft Drives

Chair(s): Chen-Yen Yu, Ahmed Hembel

- Direct Flux Vector Control of Electrically Excited Synchronous Machines for Electrical Vehicles [#419]** 6431
Alessandro Ionta, Sandro Rubino, Fabio Mandrile, Federica Graffeo, Radu Bojoi, Eric Armando
Politecnico di Torino, Italy
- Nonlinear, Bidirectional Control of Three-Stage Aircraft Generators [#64]** 6439
Jonathan Hall¹, Ethan Kowalski², José Del Castillo³, Julia Zhang¹
¹The Ohio State University, United States; ²University of Wisconsin-Madison, United States;
³Safran Electrical & Power, United States
- Current Ripple Reduction Control for Ultra-Multipole Permanent Magnet Synchronous Motors for Electric Vehicle Traction Motors [#14]** 6447
Takafumi Hara¹, Toshifumi Sakai¹, Shun Taniguchi¹, Toshiyuki Ajima¹,
Makoto Ito¹, Tetsuya Suto¹, Akeshi Takahashi²
¹Hitachi, Ltd., Japan; ²Hitachi Astemo, Ltd., Japan
- Development and Testing of a Fault-Tolerant Modular Motor Drive using a PM Machine with Isolated Modules [#1557]** 6452
Pengkun Tian, Xiaoyuan Zhang, Ken Chen, Thomas M. Jahns, Bulent Sarlioglu
University of Wisconsin-Madison, United States
- Fault-Ride Through in a Dual-Lane Fault Tolerant PMSM Drive [#190]** 6460
Stephen P. McDonald¹, Dave Winterborne¹, Barrie C. Mecrow¹, Maamar Benarous²
¹Newcastle University, United Kingdom; ²Collins Aerospace, United Kingdom

Oral Session 79: Monitoring and State Estimation of Electric Drives

Chair(s): Siddharth Ballal, Huangjie Gong

- Online Detection of Resistance in Each Phase of Multi-Sector PMSM for Condition Monitoring [#961]** 6467
Shusen Ni¹, Yuzhi Chen¹, Chaohui Liu², Zedong Zheng¹
¹Tsinghua University, China; ²National New Energy Vehicle Technology Innovation Center, China
- Flux Observer based Demagnetization Detection Inaccuracy under Position Sensor Faults [#15]** 6472
Ramitha K. Dissanayake, Sandun S. Kuruppu
Western Michigan University, United States
- A Novel 1D-CNN Open Circuit Fault Diagnosis for PMSM Drives using Normalized Current Space Vector Sorting [#286]** 6478
Weiqian Li, Huanyu Li, Xiao Chen, Antonio Griffo, Xiangyu Sun
The University of Sheffield, United Kingdom
- Inverter-Fed based Electrical Machine Stator Winding Moisture Condensation Detection [#1796]** 6484
Diego F. Laborda¹, Marcos Orviz Zapico¹, Javier G-A. Tiemblo¹, Sang Bin Lee²,
Muhammad Faizan Shaikh², David Reigosa¹
¹University of Oviedo, Spain; ²Korea University, Korea

Natural Fault-Tolerant Model Predictive Voltage Control for Symmetrical Six-Phase Vernier Permanent Magnet Motor with Open-Phase Fault [#817]	6489
Wenbo Dai ¹ , Xianglin Li ¹ , Jun Dai ¹ , Yujian Zhao ² , Chen Tang ³ , Kai Wang ⁴	
¹ Qingdao University, China; ² Ningbo Geely Luoyou Engine Parts Co., LTD, China;	
³ Southeast University, China; ⁴ Nanjing University of Aeronautics & Astronautics, China	

Oral Session 90: Motor Drive Reliability

Chair(s): Baoyun Ge, Giacomo Scelba

Tracking Insulation Degradation of Railway Traction Induction Motors using High-Frequency Differential Current [#492]	6496
Eduardo Rodriguez Montero ¹ , Markus Vogelsberger ² , Thomas Wolbank ¹	
¹ TU Wien, Austria; ² ALSTOM Transport Austria GmbH, Austria	

Enhancing Bearing Reliability in Inverter-Fed IPMSMs Drive: Control Method for Low-Speed Operation [#421]	6503
Sung Jun Lee ¹ , Jonghun Choi ¹ , Gyu Cheol Lim ¹ , Sang Min Kim ² , Eun Kyung Kim ³ , Jung-Ik Ha ¹	
¹ Seoul National University, Korea; ² Ford Motor Company, United States; ³ Hyundai Mobis, Korea	

Fault-Tolerant Control Method for Modular Four-Unit Permanent Magnet Synchronous Hub Machine Utilizing Current Reconstruction [#354]	6510
Chen Tang ¹ , Ying Fan ¹ , Yang Zheng ¹ , Wei Hua ¹ , Xianglin Li ² , Christopher H. T. Lee ³	
¹ Southeast University, China; ² Qingdao University, China;	
³ Nanyang Technological University, Singapore	

Mitigation of DVDT Reflected Wave and Common Mode Current for Industrial Motor Drive System with Long Cable [#1050]	6516
Haider Mohomad A R, Manish Saraf, Paul Baker, Sanela Ligata	
Hammond Power Solutions, Canada	

Impact of Open-Switch Fault in Five-Phase Three-Level NPC Inverters [#1692]	6523
Luca Vancini, Michele Mengoni, Gabriele Rizzoli, Luca Zarri, Angelo Tani	
University of Bologna, Italy	

Oral Session 102: Sensorless Drives

Chair(s): Jae Suk Lee, Anitra Wilson

Finite Position Set Sensorless Predictive Torque and Active Flux Control of IPMSM using an Enhanced Binary Search [#1657]	6530
Samuel Osei Fobi ¹ , Sodiq Agoro ² , Rajib Mikail ² , Iqbal Husain ¹	
¹ North Carolina State University, United States; ² ABB Ltd., United States	

Position Estimation and Sensorless Control of PMSM using Neural Network in Low-Speed Region [#314]	6536
Jaehoon Shim, Minha Kim, Byung Ryang Park, Jung-Ik Ha	
Seoul National University, Korea	

Parameter-Free Sensorless Control for Permanent Magnet Synchronous Motor [#1228]	6543
Samuel Osei Fobi ¹ , Sodiq Agoro ² , Rajib Mikail ² , Iqbal Husain ¹	
¹ North Carolina State University, United States; ² ABB Ltd., United States	

Sensorless Very Low-Speed Trajectory Tracking Sliding Mode Controller based on Identification Back-EMF Parameter for a PMSM [#1643] 6549
J. Linares-Flores, A. Hernández-Méndez, V. Ortega García, J.A. Juárez-Abad, I.F. Castillo-Aguilar
Universidad Tecnológica de la Mixteca, México

Seamless Transition to Sensorless Control of EV Traction IPM Motors using Virtual High-Frequency Voltage Injection [#282] 6554
Andras Holczer¹, Francisco D. Freijedo¹, Radu Bojoi²
¹Huawei Technologies Duesseldorf GmbH, Germany; ²Politecnico di Torino, Italy

Topic I: Power Semiconductor Devices, Passive Components, Packaging, Integration and Materials

Oral Session 10: Gate Drivers

Chair(s): Tanya Gachovska, Jessica Boles

Ultra-Fast Gate Drivers with Nanosecond Propagation Delays for GaN FETs [#667] 6562
Duy T. Nguyen, Soham Roy, Elijah Macias, Alex J. Hanson
The University of Texas at Austin, United States

A Multilevel Gate Driver Operating with a Single Voltage Supply and Simple Control Signals for Monolithic Integration of Power GaN HEMT [#815] 6570
Takumi Takehisa, Takehiro Takahashi, Jun Furuta, Michihiro Shintani, Kazutoshi Kobayashi
Kyoto Institute of Technology, Japan

Wireless Pulse-Width Modulation Control of Power Converters using Ultra-Wideband Technology for Distributed High-Voltage Systems [#1140] 6576
Sarwar Islam, Faisal Khan
National Renewable Energy Laboratory, United States

Natural Active Gate Driving for Breaking Trade-Off between Switching Loss and Current Overshoot using Ordinary Gate Driver [#328] 6581
Yaogan Liang, Haoxi Zhou, Dibo Zhang, Katsuhiko Hata, Makoto Takamiya
University of Tokyo, Japan

Optimal Point Derive for SiC MOSFET Switching Ringing Damping with Active Gate Driver Control [#1221] 6587
Liyang Du, Xia Du, Yuxiang Chen, Haodong Yang, H. Alan Mantooth
University of Arkansas, United States

Oral Session 22: Thermal Management in Power Electronics

Chair(s): Xiaoqing Song, Shajjad Chowdhury

A Novel Thermal Modeling Analysis for Liquid Cooled High-Power EV Chargers [#1103] 6593
Paul Bradford, Aditya Zade, Shubhangi Gurudiwan, Hongjie Wang
Utah State University, United States

Determination of Suitable Heatsink Layout for a High-Density Integrated Motor Drive through an Effective Comparison Method [#654] 6600
 Venkata Raghavendra Itte¹, Yanda Lyu¹, Fred Wang¹, Debanjan Chatterjee², Pietro Cairoli²
¹The University of Tennessee, United States; ²ABB Ltd., United States

Heat Pipe Enhanced Thermal Management System for GaN Switches in an Integrated Modular Motor Drive for Aircraft Propulsion [#640] 6608
 Towhidul Chowdhury¹, Salar Koushan¹, Seyed Iman Hosseini Sabzevari¹, Armin Ebrahimian¹, Xuhui Feng², Ayman El-Refaie¹, Nathan Weise¹
¹Marquette University, United States; ²National Renewable Energy Laboratory, United States

Hybrid Solution based on Ceramic 3D Printing for Thermal Management in Power Application [#892] 6614
 Emmanuel Marcault, Charlotte Meuly, Lucile Mage, Marie Beaujard, Noé Seksik, Régis Delsol
 CEA, France

Multi-Tier Cooling Solution for 10 kV SiC MOSFET Power Module Featuring Stacked Substrates [#1462] 6618
 Xiaoling Li, Hari Pandey, Stephen Pierson, Qiang Wu, Ethan Weems, Sudharsan Chinnaiyan, Yuxiang Chen, Hu Han, Alan Mantooth
 University of Arkansas, United States

Oral Session 23: Medium/High-Frequency Transformer Design and Integration

Chair(s): Haiguo Li, Dakai Wang

Design and Assembly of a Low-Parasitic-Capacitance Medium-Frequency Medium-Voltage Transformer [#849] 6624
 Zhixing Yan¹, Shaokang Luan¹, Gao Liu¹, Huan Luo¹, Hongbo Zhao¹
¹Aalborg University, Denmark; ²Sichuan University, China

WITHDRAWN

Insulation Design of a Loosely Coupled High Isolation Medium Frequency Transformer for Medium Voltage Power Converters [#687] 6629
 Fei Teng, Andrew Galamb, Srdjan Lukic
 North Carolina State University, United States

A 100kHz 15kW Planar DAB Converter Transformer for Medium Voltage Solid State Transformer Applications [#1571] 6635
 Mark Nations, Subhashish Bhattacharya
 North Carolina State University, United States

LLC Transformer Design with Independent Inductance Tuning and Reduced Winding Loss [#1309] 6642
 Zhihao Zhang, Han Cui, Lingxiao Xue, Bo Chen, Yifeng Wang
 Tianjin University, China

Design Method of an Integrated Transformer for a Two-Phase Interleaved Flyback PFC Rectifier [#442] 6650
 Haruki Hirasawa, Karl Raymond Dela Cruz Roque, Sihoon Choi, Yu Yonezawa, Jun Imaoka, Masayoshi Yamamoto
 Nagoya University, Japan

Poster Session 1: Packaging

Chair(s): Jun Wang

Spring-Loaded GaN Packaging for Cryogenic Thermal Cycling [#1609] 6657

Ching-Hsiang Yang¹, Shimul K. Dam¹, Zhou Dong², Dehao Qin³,
Ruirui Chen¹, Fred Wang¹, Hua Bai¹, Zheyu Zhang⁴

¹The University of Tennessee, United States; ²ABB Inc., United States; ³Clemson University, United States; ⁴Rensselaer Polytechnic Institute, United States

Achieving Low Inductance Power Loops on Rigid-Flex Substrates for Efficient MHz Switching in GaN Half-Bridges [#1439] 6662

Manuel Rueß, Dominik Koch, Ingmar Kallfass
University of Stuttgart, Germany

A Compact Three-Phase Chip-on-Chip SiC Integrated Power Module with Low Thermal Resistance and Gate Signal Interference [#705] 6668

Jiaxin Liu¹, Chenhang Zeng¹, Heng Zhang¹, Cai Chen¹, Yong Kang¹,
Heng Liu², Cheng Liu², Yuwei Zhang², Laifeng Shi²

¹Huazhong University of Science & Technology, China; ²Dongfeng Motor Corporation, China

A Wire-Bonded Multichip SiC Power Module with Low Parasitic Inductance and High Current Sharing Characteristic [#236] 6674

Heng Zhang¹, Shuangxi Zhu¹, Sijia Liu¹, Zexiang Zheng¹, Linhao Ren¹, Jiaxin Liu¹, Cai Chen¹,
Yong Kang¹, Zhuanmin Liu², Heng Liu², Cheng Liu², Qinjie Huang², Yahao Zhang²

¹Huazhong University of Science & Technology, China; ²Dongfeng Motor Corporation Research & Development Institute, China

A 1.7 kV Full-SiC Reverse-Blocking Module Enabling Efficient Multiport Operation in Soft-Switching Current Source Converters [#1535] 6680

Aniruddh Marellapudi, Mickael J. Mauger, Joseph Benzaquen, Deepak Divan
Georgia Institute of Technology, United States

Double-Side Cooled 3.3 kV, 100 a SiC MOSFET Phase-Leg Modules for Traction Applications [#1021] 6685

Qingrui Yuchi¹, Zichen Zhang², Serge Bontemps³, Kaixuan Li¹, Joshua Gardner¹, Guo-Quan Lu¹

¹Virginia Polytechnic Institute and State University, United States; ²Microchip Technology Inc., United States; ³Microchip Technology Inc., France

Demonstration of a SiC Power Module with Integrated Hexagonal Boron Nitride (h-BN) Substrate for Direct-Cooling [#1680] 6691

Yunlei Jiang¹, Wei Mu², Borong Hu², Luke Shillaber², Teng Long²

¹Space Exploration Technologies Corp., United States; ²University of Cambridge, United Kingdom

Effect of Power Module Architecture on Common Mode Electromagnetic Interference [#1443] 6696

Taha Moaz¹, Christina DiMarino¹, Narayanan Rajagopal¹, Richard Zhang¹,
Dushan Boroyevich¹, Michael Fish²

¹Virginia Polytechnic Institute and State University, United States; ²Army Research Lab, United States

An Equivalent Chip Neighborhood Range Modelling Method for Medium-Voltage SiC MOSFET Power Module Electric Field Analysis [#1380] 6704

Sun Peiyuan¹, Laili Wang¹, Tianshu Yuan¹, Dingkun Ma¹, Lei Li¹,
Jiacheng Guo¹, Peiyang Ding¹, Kai Gao²

¹Xi'an Jiaotong University, China; ²State Grid Shanghai Electric Power Research Institute, China

A 1200V/400A/2.2mΩ SiC Power Module with Insulated Metal Substrate (IMS) and Improved Electromagnetic Interference (EMI) [#27] 6709
 Zibo Chen, Alex Q. Huang
The University of Texas at Austin, United States

Intelligent Power Module for Optically Triggered Adaptive Zero Voltage Switching [#1500] 6715
 Borong Hu¹, Xufu Ren¹, Liang Wang², Luke Shillaber¹, Yunlei Jiang¹, Jiayu Li¹, Teng Long¹
¹University of Cambridge, United Kingdom; ²Chongqing University, China

Oral Session 34: GaN Device Modeling and Characterization

Chair(s): Jingcun Liu, Shiqi Ji

Evaluation of Crosstalk-Induced Dynamic R_{ON} in GaN-on-Si Monolithic Half-Bridge Power IC [#909] 6720
 Xin Yang, Matthew Porter, Qihao Song, Yuhao Zhang
Virginia Polytechnic Institute and State University, United States

Gate Switching Lifetime of P-Gate GaN HEMT: Circuit Characterization and Generalized Model [#1611] 6725
 Bixuan Wang, Qihao Song, Yuhao Zhang
Virginia Polytechnic Institute and State University, United States

Modeling of a Novel GaN-on-AlN/SiC HEMT including Thermal Effects for Circuit Simulation [#469] 6731
 Xiaomeng Geng¹, Nick Wiecezorek¹, Mihaela Wolf², Oliver Hilt², Sibylle Dieckerhoff¹
¹Technische Universitaet Berlin, Germany; ²Ferdinand-Braun-Institut, Germany

Enhancing the Stability of GaN HEMT with a Multi-Functional Monolithic Gate Protection Circuit [#1375] 6738
 Qihao Song¹, Xin Yang¹, Bixuan Wang¹, Everest Litchford¹, Yi Sun², Pengju Kong², Qiang Li¹, Yuhao Zhang¹
¹Virginia Polytechnic Institute and State University, United States; ²Innoscence America, United States

Application of 1.2kV Vertical GaN JFET in MHz Buck Converter [#915] 6744
 Xin Yang¹, Qiuzhe Yang¹, Ruizhe Zhang¹, Qihao Song¹, Everest Litchford¹, Andy Walker², Subhash Pidaparathi², Yuhao Zhang¹
¹Virginia Polytechnic Institute and State University, United States; ²NexGen Power Systems, United States

Poster Session 2: Devices and Gate Drivers

Chair(s): Christian Xiao

Surge Current Conduction Mechanisms of SiC MOFETs under Third-Quadrant Operation [#180] 6749
 Man Zhang, Helong Li, Zhiqing Yang, Shuang Zhao, Lijian Ding
Hefei University of Technology, China

Novel Cell-Level Insights into Third Quadrant Current Paths of Power SiC MOSFET [#632] 6754
 Yuzhi Chen, Chi Li, Shusen Ni, Zedong Zheng
Tsinghua University, China

Impacts of Parasitic Power Loop Inductance on 10 kV SiC MOSFETs [#962]	6759
Gao Liu, Zhixing Yan, Morten Rahr Nielsen, Jannick Kjaer Jørgensen, Hongbo Zhao, Stig Munk-Nielsen, Michael Møller Bech Aalborg University, Denmark	
Analysis and Performance Trade-Offs of State-of-the-Art 4H-SiC Trench MOSFET Technology [#724]	6764
Kyrylo Melnyk, Peter Michael Gammon, Arne Benjamin Renz, Qinze Cao, Vishal Ajit Shah, Marina Antoniou University of Warwick, United Kingdom	
Impact of External Gate Resistance on Dynamic ON-Resistance Behavior in GaN HEMTs using Multiple Pulse Test [#1385]	6771
Lee Gill ^{1,2} , Luciano Andres Garcia Rodriguez ¹ , Mihai Negoita ¹ , Sandeepan DasGupta ¹ , Robert Kaplar ¹ , Alan J. Michaels ² ¹ Sandia National Laboratories, United States; ² Virginia Polytechnic Institute and State University, United States	
3D Modelling and Experimental Results of Multi-Channel Monolithic-Cascode HEMT (MC²-HEMT) [#114]	6777
Quanbo He ¹ , Hengyu Wang ² , Vasantha Pathirana ¹ , Ming Xiao ³ , Yuhao Zhang ³ , Florin Udrea ¹ ¹ University of Cambridge, United Kingdom; ² Zhejiang University, China; ³ Virginia Polytechnic Institute and State University, United States	
Contactless Measurement-Based Modeling of a 4-MHz GaN Pulsed Power System While Considering Common Source Inductance [#568]	6782
Zhaoxia Yang ¹ , Mark Broman ¹ , Jianwu Zeng ² ¹ Thin Film Technology Corporation, United States; ² Minnesota State University, Mankato, United States	
Short-Circuit Protection for 650 v P-Gate GaN HEMTs based on Gate Current Sensing [#1297]	6786
Simone Palazzo ¹ , Yoann Pascal ² , Thiago Pereira ³ , Giovanni Busatto ¹ , Marco Liserre ³ ¹ University of Cassino & Southern Lazio, Italy; ² Fraunhofer ISIT, Germany; ³ Kiel University, Germany	
Damping Effect of Internal Gate Resistance for Cascode GaN HEMT [#1417]	6792
Yin Fang ¹ , Carl Ngai Man Ho ¹ , Jimmy Liu ² ¹ University of Manitoba, Canada; ² Power Integrations Inc., Canada	
A Cryogenic Gallium Nitride Full Bridge for use in a Thermally Insulating Dual Active Bridge [#966]	6798
S.R. Frank, T. Stroebele, P. Swoboda, R. Schwendemann, M. Hiller Karlsruhe Institute of Technology, Germany	
Automated Static Characterization Platform for Multi-GaN Devices across Cryogenic and High-Temperatures [#1086]	6806
Purushottam Khadka ¹ , Cheng Wan ² , Zheyu Zhang ¹ , Tian Qiu ¹ , Ahmed Siraj ¹ ¹ Rensselaer Polytechnic Institute, United States; ² Clemson University, United States	
Use of Current Mirror for Real-Time Gate-Source Leakage Current Detection [#478]	6814
Ho-Tin Tang, Henry Shu-hung Chung City University of Hong Kong, Hong Kong	

Protection Scheme Analysis of LLC Series Connected Auxiliary Power Supply for HV SiC Grid-Connected Inverters [#105]	6822
Min Lin ¹ , Leon M. Tolbert ¹ , Brian Rowden ²	
¹ The University of Tennessee, United States; ² Oak Ridge National Laboratory, United States	
Centralized Short-Circuit Protection of SiC Modules Connected in Parallel [#1072]	6827
Chengmin Li ¹ , Dražen Dujic ²	
¹ Eindhoven University of Technology, Netherlands; ² École Polytechnique Fédérale de Lausanne, Switzerland	
Single Gate-Drive GaN Power Electronics Building Block for Scalable and Fast-Switching High-Current Systems [#1154]	6835
Dominik Koch, Mathias C.J. Weiser, Tobias Fink, Jeremy Nuzzo, Aline Reck, Manuel Ruess, Ingmar Kallfass	
University of Stuttgart, Germany	
Partial Discharge Improvements of Isolated Transformer in Medium-Voltage Gate-Driver Power Supply [#666]	6841
Zhixing Yan ¹ , Yuan Gao ¹ , Gao Liu ¹ , Shaokang Luan ¹ , Morten Rahr Nielsen ¹ , Bjørn Rannestad ² , Hongbo Zhao ¹ , Stig Munk-Nielsen ¹	
¹ Aalborg University, Denmark; ² KK Wind Solution, Denmark	
Active Gate Driver Combining Current Source and Active Gate Resistors to Reduce Turn-On Switching Loss and Surge Voltage [#383]	6846
Kiyotaka Ono, Sihoon Choi, Yu Yonezawa, Jun Imaoka, Masayoshi Yamamoto	
Nagoya University, Japan	
Self-Reverse-Blocking Normally-On/Off-Dual-Gate Monolithic Bidirectional GaN Transistor [#1835]	6853
Neha Nain ¹ , Patrick Ziegler ¹ , David Menzi ¹ , Kennith Kin Leong ² , Johann W. Kolar ¹ , Jonas Huber ¹	
¹ ETH Zurich, Switzerland; ² Infineon Technologies, Austria	
TCAD-Based Analysis of Dynamic Transients of 4H-SiC Vertical NPN BJT [#1858]	6856
Mana Hosseinzadehlis ¹ , Saeed Jahdi ¹ , Xibo Yuan ¹ , Konstantinos Floros ²	
¹ University of Bristol, United Kingdom; ² Compound Semiconductors Applications Catapult, United Kingdom	
Equivalent Capacitance of Nonlinear Capacitance in GaN-FET for Improving Accuracy in Suppressing Conditions of Oscillatory False Triggering [#250]	6859
Yuki Fushino, Kazuhiro Umetani, Masataka Ishihara, Eiji Hiraki	
Okayama University, Japan	

Poster Session 3: Components and Converter-Level Packaging

Chair(s): Dakshina Murthy-Bellur

SiC Switching Cell as ZVS Enabler for Si Phase-Leg [#1305]	6866
Xiaonan Dong ¹ , Chen Wang ² , Zhongjie Wang ¹ , Jian Zhou ¹ , Xiaoyong Ma ¹ , Yifeng Wang ¹ , Lingxiao Xue ¹	
¹ Tianjin University, China; ² Tianjin Entar Energy Technology Co., Ltd, China	

Analysis and Experimental Evaluation of Short-Circuit Energy Variation with Split Inductance [#358]	6871
Hongyi Gao ¹ , Dong Hai ¹ , Fujun Zheng ¹ , Bin Yu ¹ , Yuhang Yang ² , Yuanye Xia ² , Haoze Luo ¹ , Wuhua Li ¹ , Xiangning He ¹	
¹ Zhejiang University, China; ² Hangzhou Silan Microelectronics Company Limited, China	
Core Desaturation via Crisscross Switches for Maximal Magnetic Energy Harvesting [#868]	6878
Min Gao, Jinyeong Moon	
Florida State University, United States	
Influence of Excitation Processes on Minor Loop Characteristics and Core Losses in Inductors [#1625]	6885
Keiji Wada, Kosuke Oda, Koshi Takano	
Tokyo Metropolitan University, Japan	
Analysis and Comparison of Integrated Planar Transformers for CLLC Resonant Converters [#191]	6890
Tianlong Yuan, Feng Jin, Gibum Yu, Qiang Li	
Virginia Polytechnic Institute and State University, United States	
Coil Optimization for Common-Mode Choke in Over-Molded GaN Power Modules [#679]	6897
Niu Jia ¹ , Han Cui ² , Leon M. Tolbert ¹	
¹ The University of Tennessee, United States; ² Tianjin University, China	
An Integrated Magnetics Design in a PWM Active Clamp Ćuk Converter to Increase Power Density [#1792]	6904
Sadegh Esmaeili Rad, Amir Hossein Masoumi, Shantanu Gupta, Sudip K. Mazumder	
University of Illinois Chicago, United States	
Automated Core Loss Tester Error Characterization for New Contributions to Large-Scale Datasets [#567]	6910
Emmanuel Havugimana, Mike K. Ranjram	
Arizona State University, United States	
Multi-Objective Optimization of High-Frequency Transformer for Dual-Active-Bridge using Multilayer Perceptron-Genetic Algorithm [#579]	6918
Xiaobing Shen, Diego Bernal Cobaleda, Hans Wouters, Fanghao Tian, Hassan Pervaiz, Wilmar Martinez	
KU Leuven - EnergyVille, Belgium	
Variable Inductor with Adjustable Air Gaps [#1359]	6924
Yu-Sheng Chen, Boyi Zhang, Peter Barbosa, Feng Jin	
Delta Electronics, Inc., United States	
Process Optimization of a Novel Soft Magnetic Composite Inductor Cores [#1842]	6930
Cody Krawczyk ¹ , Lauren Walker ¹ , Jean Lee ¹ , Todd C. Monson ²	
¹ California Polytechnic State University at San Luis Obispo, United States;	
² Sandia National Laboratories, United States	
Basic Study on the Structural Design for Large-Capacity Litz Wires using an Equivalent Circuit Model considering the Path of All Strands [#256]	6933
Ryota Inoue, Ryuichi Takada, Hiroshi Ueda, SeokBeom Kim	
Okayama University, Japan	

High-Frequency PCB Resonator Designs with Quality Factor Exceeding 1000 [#1389]	6939
Jiayang Wu, Kerui Li, Siew-Chong Tan, Shu-Yuen Ron Hui <i>The University of Hong Kong, Hong Kong</i>	
Design and Performance Analysis of a Thermal Management System based on Heat Pipe for GaN-Based Integrated Motor Drives [#619]	6944
Seyed Iman Hosseini Sabzevari, Salar Koushan, Armin Ebrahimiyan, Towhid Chowdhury, Nathan Weise, Ayman El-Refaie <i>Marquette University, United States</i>	
High Power Density Submodule Development for a 20 kV T-Type Modular DC Circuit Breaker with a 3.3 kV SiC Power Module [#1255]	6951
Yizhou Cong, Yue Zhang, Xiao Li, Zhining Zhang, Pengyu Fu, Jin Wang <i>The Ohio State University, United States</i>	
Design and Experimental Tests of Thermal Performances of a 10 kV SiC Power Module-Based Submodule of a Modular Multilevel Converter [#1589]	6957
Qichen Yang ¹ , Sihun Song ¹ , Nash Bonaventura ¹ , Isabel Barnola ¹ , John Hauer ¹ , Zhehui Guo ² , Matthew Bosworth ¹ , Karl Schoder ¹ , Michael Steurer ¹ , Peng Fang ¹ , Hui Li ¹ ¹ Florida State University, United States; ² Delta Electronics, Inc., United States	
A Novel Method for Predicting the Lifetime of Film Capacitor Bank considering Thermal Coupling and Variation in Ambient Temperature [#121]	6965
Kaining Kuang, Yuhao Lan, Zhengyan Zhou <i>The University of Sheffield, United Kingdom</i>	
A Dual-Output Differential Tunnel Magnetoresistance Current Sensor for High-Frequency Application [#841]	6971
Aozu Luan ¹ , Shuai Shao ¹ , Jiakun Du ¹ , Hui Chen ² , Chunyao Hou ¹ , Junming Zhang ¹ ¹ Zhejiang University, China; ² Hangzhou City University, China	
Novel Low-Loss Filter for Overvoltage Mitigation in WBG-Based Hard Switching Electric Drives with AC Cables [#1053]	6978
Renato Amorim Torres, Suresh Gopalakrishnan, Chandra Namuduri, Thomas Luo <i>General Motors, United States</i>	
Electrical and Thermal Evaluation of Ga₂O₃ Devices in MMC-HVDC Systems [#1567]	6985
Arindam Sircar, Sudipto Saha, Uttam Singiseti, Xiu Yao <i>State University of New York at Buffalo, United States</i>	

Oral Session 41: EMI Design and Considerations in Power Electronics

Chair(s): Dong Dong, Subham Sahoo

CM EMI Evaluation of Totem-Pole and HERIC Single-Phase PFC Converters [#921]	6990
Theo Gruber ¹ , Franz Vollmaier ¹ , Thomas Langbauer ¹ , Roberto Petrella ^{1,2} , Michael Hartmann ³ ¹ Silicon Austria Labs GmbH, Austria; ² Università degli Studi di Udine, Italy; ³ Graz University of Technology, Austria	
Solid State Transformer Design to Reduce Common Mode Conducted EMI [#595]	6998
Colin P. Ball ¹ , Alexander L. Julian ² , Giovanna Oriti ¹ ¹ Naval Postgraduate School, United States; ² Independent Researcher & Consultant, United States	

Investigation of Conducted EMI Emissions in Auxiliary Circuitry of 10 kV SiC MOSFET based Power Electronics Building Blocks (PEBB) [#832] 7005
 Ashkan Barzkar, He Song, Mamoru Sasaki, Arthur Mendes, Mingze Gao, Rolando Burgos,
 Vladimir Mitrovic, Dong Dong, Dushan Boroyevich
Virginia Polytechnic Institute and State University, United States

Modeling and Reduction of Radiated Emission Caused by Isolated Gate Drivers in Wide Bandgap Half-Bridge-Based Power Modules [#726] 7013
 Yirui Yang, Yanwen Lai, Qinghui Huang, Shuo Wang
University of Florida, United States

Experimental Investigation of Common Mode Current Generation in a Novel Dual Active Bridge Converter ZVS Modulation Pattern [#1165] 7021
 Kubilay Sahin¹, Jean-Luc Schanen², Sébastien Mariéthoz¹, Yann Cuenin³
¹Bern University of Applied Sciences, Switzerland; ²Grenoble Alpes University, France;
³Studer Innotec SA, Switzerland

Oral Session 44: Packaging and Integration of WBG Devices **Chair(s): Francesco Iannuzzo, Dingrui Li**

A Non-Linear Damping Technique for Gate Voltage Oscillation Mitigation in SiC MOSFET Parallel Operation [#1715] 7027
 Boyi Zhang¹, Ruxi Wang¹, Peter Barbosa¹, Po-Chun Huang²
¹Delta Electronics, Inc., United States; ²Delta Electronics Inc., Taiwan

Multi-Layer Organic Substrate-Based SiC Full-Bridge Module for a Power Electronics Building Block [#1066] 7034
 Narayanan Rajagopal, Taha Moaz, Vladimir Mitrovic, Marie Lawson,
 Christina DiMarino, Dushan Boroyevich
Virginia Polytechnic Institute and State University, United States

SiC Power Module Design using Flip Chip Configuration to Reduce Common-Mode Noise [#398] 7042
 Thiya Warnakulasooriya, Sihoon Choi, Yu Yonezawa, Koichi Shigematsu,
 Jun Imaoka, Masayoshi Yamamoto
Nagoya University, Japan

Design of Integrated Gate Drivers for High-Frequency Press-Pack SiC Switch Cells [#1487] 7048
 Ekaterina Muravleva, Youssef Abotaleb, Jun Wang, Jerry Hudgins
University of Nebraska-Lincoln, United States

Design and Characterization of 1.2 kV Optically-Isolated Half-Bridge Modules for High Temperature Operation [#520] 7055
 Sudharsan Chinnaiyan, Pengyu Lai, Salahaldeen Ahmed, Xiaoling Li, Colin Sim,
 Md Helal Uddin Maruf, Yuxiang Chen, Morgan E. Ware, Zhong Chen, H. Alan Mantooth
University of Arkansas, United States

**Oral Session 57: SiC Device Modeling,
Sensing, and Characterization**
Chair(s): Jose Ortiz Gonzalez, Amy Romero

PINN-Assisted Physical Model of SiC MOSFETs: A Leap in Efficiency and Accuracy [#284] 7062

Xinlian Li¹, Chong Zhu¹, Yansong Lu¹, Xu Lu¹, Fei Lu², Xi Zhang¹
¹Shanghai Jiao Tong University, China; ²Drexel University, United States

**Improvement Turn On Loss Simulation Accuracy by Nonlinear Voltage
Dependence Modeling of Gate Source Capacitance [#247] 7068**

Takuto Hayashi¹, Kazuhiro Umetani¹, Masataka Ishihara¹, Hiroto Sakai²,
Yuta Okawauchi², Kotaro Kobashi¹, Eiji Hiraki¹
¹Okayama University, Japan; ²ROHM Co., Ltd., Japan

**An Improved di/dt-Based Dynamic Current RC Sensing Method for
Paralleled SiC MOSFETs [#862] 7075**

Che-Wei Chang¹, Matthias Spieler¹, Rolando Burgos¹, Ayman El-Refaie²,
Renato Amorim Torres³, Dong Dong¹
¹Virginia Polytechnic Institute and State University, United States; ²Marquette University, United States;
³General Motors, United States

**A Novel Multi-Stage Ensemble Method for Online Junction Temperature
Estimation of SiC MOSFET [#770] 7081**

Zekun Li, Puzhen Yu, Bing Ji
University of Leicester, United Kingdom

Performance Evaluation of SiC MOSFET Hybrid Switches with Reverse Conducting IGBTs [#510] 7087

Arkadeep Deb¹, Jose Ortiz Gonzalez¹, Saeed Jahdi², Richard McMahon¹,
Ruizhu Wu³, Olayiwola Alatise¹
¹University of Warwick, United Kingdom; ²University of Bristol, United Kingdom;
³Chongqing Jinkang Powertrain New Energy Co., Ltd., China

Oral Session 68: PCB-Based Components and Integration
Chair(s): Dong Dong, Xin Zan

**Millimeter Thick Magnetic Print Circuit Boards with a High Relative Permeability of
50~150 and Related Devices [#1372] 7095**

Xiaoling Shi¹, Hwaider Lin¹, Hui Lu¹, Rui Huang², Nian X. Sun²
¹Winchester Technologies, LLC, United States; ²Northeastern University, United States

**Design and Modelling of a Mega-Hertz PCB Resonator with Hybrid Inductive and
Capacitive Wireless Power Transfer Capability [#494] 7100**

Kerui Li¹, Jiayang Wu¹, Siew Chong Tan¹, Shu Yuen Ron Hui^{1,2}
¹The University of Hong Kong, Hong Kong; ²Imperial College London, United Kingdom

Winding Loss Analysis of PCB Winding Litz Wire [#1596] 7105

Zhangwei Xiang, Zheqing Li, Jung-Soo Bae, Qiang Li
Virginia Polytechnic Institute and State University, United States

The Standard Cell SiC Die Embedding High Performance and Scalable Power Electronics Integration Approach [#1730] 7112
Ameer Janabi, Luke Shillaber, Wucheng Ying, Wei Mu, Borong Hu, Xufu Ren, Teng Long
University of Cambridge, United Kingdom

A SiC Power Module in PCB-DBC Hybrid Packaging for Ultra-Low Parasitics and Flexible Integration [#700] 7116
Jinpeng Cheng¹, Liyu Yao¹, Hao Feng¹, Li Ran²
¹Chongqing University, China; ²University of Warwick, United Kingdom

Oral Session 80: Loss Characterization and Modeling for Active and Magnetic Components
Chair(s): Han Cui, Ruirui Chen

Calorimetric Evaluation of Soft-Switching Mechanisms in MOSFET-Based Converters [#1070] 7122
Antonios Mavromatakis, Konstantinos Manos, Antonios Antonopoulos
National Technical University of Athens, Greece

Load Test Method for High-Frequency Transformers using Two Power Supplies and a Capacitor [#1775] 7129
Koji Orikawa¹, Shion Soeda¹, Satoshi Ogasawara²
¹Hokkaido University, Japan; ²Nagoya University, Japan

Magnetization Mechanism-Inspired Neural Network for Core Loss Estimation [#649] 7137
Qiuji Huang¹, Sinan Li¹, Yang Li², Jianguo Zhu¹
¹University of Sydney, Australia; ²Tsinghua University, China

Extrapolation Ability for Generative Adversarial Network based High-Frequency Inductor Iron Loss Model with DC Bias [#578] 7145
Xiaobing Shen, Yu Zuo, Diego Bernal Cobaleda, Jiaze Kong, Wilmar Martinez
KU Leuven - EnergyVille, Belgium

Beyond Two-Dimensional Losses in Solenoidal Inductors with Distributed Gaps [#1043] 7151
Rajaie Nassar, Qingrui Yuchi, Aakash Kamalapur, Mark Cairnie,
Guo-Quan Lu, Christina DiMarino, Khai Ngo
Virginia Polytechnic Institute and State University, United States

Oral Session 91: Materials, Modeling, and Characterization for Magnetics and Capacitors
Chair(s): Guo-Quan Lu, Zheyu Zhang

A Generalized Physics-Based Circuit Model for Predicting Nonlinear Properties of Magnetic Materials [#1218] 7159
Sadiah Binte Sohid, Anwasha Mukhopadhyay, Christian Harmon,
Daniel Costinett, Gong Gu, Leon M. Tolbert
The University of Tennessee, United States

Ferrite Shielding for Eddy Current Suppression on Inductors and Transformers using Ribbon-Based Magnetic Cores [#1763]	7167
Zihan Gao ¹ , Fred Wang ^{1,2}	
¹ The University of Tennessee, United States; ² Oak Ridge National Laboratory, United States	
Ceramic-Based Coils for Magnetic Components: Ideas and Challenges [#665]	7175
Hongbo Zhao, Zhixing Yan, Shaokang Luan	
Aalborg University, Denmark	
Mitigating Partial Discharge in Motor Winding and Preventing Surface Flashover in Power Electronic Substrates Through Field Grading Composites [#67]	7181
Omar Faruqe ¹ , Pradip Chandra Saha ¹ , Asif Muhammad Juber ¹ , Woongje Sung ² , Chanyeop Park ³	
¹ University of Wisconsin-Milwaukee, United States; ² University at Albany, United States;	
³ Arizona State University, United States	
Experimental Validation of Capacitor Damage Accumulation in Varying Operating Conditions [#820]	7186
Mateja Novak, Huai Wang, Frede Blaabjerg	
Aalborg University, Denmark	
 Oral Session 103: Power Modules	
Chair(s): Christina DiMarino, Christian Shamar	
Stacked-Die SiC Half-Bridge Module with Minimum Loop Inductance [#1356]	7192
Pedro Ribeiro, Lingxiao Xue, Burak Ozturk, Shajjad Chowdhury,	
Veda Galigekere, Gui-Jia Su, Himel Barua	
Oak Ridge National Laboratory, United States	
Design of Experiment for Wedge-to-Wedge Aluminum Wire Bonding Parameters [#1414]	7197
Lester López, Jack Knoll, Narayanan Rajagopal, Christina DiMarino	
Virginia Polytechnic Institute and State University, United States	
Computationally Efficient Approach for Junction Temperature Estimation of SiC Power Modules based on Temperature-Dependent Lumped Thermal Model [#903]	7205
Yizheng Tang ¹ , Lingyu Zhu ¹ , Cao Zhan ² , Weicheng Wang ¹ , Shengchang Ji ¹	
¹ Xi'an Jiaotong University, China; ² Virginia Polytechnic Institute and State University, United States	
Extraction of Parasitic Inductances in Three-Phase SiC MOSFET Modules through Enhanced Two-Port-S-Parameter Measurement [#976]	7213
Fanfu Wu, Yunting Liu	
The Pennsylvania State University, United States	
Methodology for Evaluating Commercial High-Power Silicon Carbide Modules at Consistent Switching Speeds [#173]	7220
Yikang Xiao ¹ , Shiqi Ji ¹ , Zhengming Zhao ¹ , Wenhao Xie ¹ , Mingyu Yang ¹ , Chao Sheng ² , Weitao Yang ²	
¹ Tsinghua University, China; ² China Southern Power Grid Technology Co. Ltd., China	

Topic J: Energy Efficient Systems Applications and Lighting Technologies

Poster Session 2: Lighting Technologies

Chair(s): Ashish Kumar

Dimmable LED Assembly Driven by Passive LED Driver for Smart Lampposts [#83] 7227

Albert Ting Leung Lee, Wing Hang Chan, Ron Shu Yuen Hui
The University of Hong Kong, Hong Kong

A Synchronous Switching Method for a Variable Frequency ZVS Boost Converter [#259] 7233

Ben Stainthorpe, Mohamed Dahidah, Volker Pickert
Newcastle University, United Kingdom

Analysis of a Dimmable Quasi-Resonant LED Driver with Variable Inductor Magnetic Control [#728] 7241

Pablo Quintana-Barcia¹, Sarah Saeed¹, Javier Ribas¹, Jorge Garcia¹, Marina Perdigo^{2,3}
¹Universidad de Oviedo, Spain; ²Polytechnic University of Coimbra, Portugal;
³Instituto de Telecomunicações, Portugal

Analysis of the Impact of Transients from Dimmable LED Lighting on Residential Electronics [#1391] 7249

Jeet Panchal, Lakshmi Ravi, Dong Dong, Rolando Burgos
Virginia Polytechnic Institute and State University, United States

Topic K: Applied Research and Emerging Technologies

Oral Session 11: Emerging Technologies 1

Chair(s): David Perreault, Mausamjeet Khatua

1.5-kV, 1.5-kW, High Voltage Ratio, Bidirectional DC/DC Converters for Power Distribution on the Moon [#1465] 7256

Yuzhou Yao, Junchong Fan, Zhining Zhang, Yifan Shi, Jin Kwon, Pengyu Fu, Jin Wang
The Ohio State University, United States

Modular DCX Blocks with Autonomous Synchronization for Power Distribution Subsystem of Satellites [#922] 7261

Theyllor Hentschke de Oliveira¹, Abraham López Antuña¹, José Antonio Villarejo Mañas², Pablo Fernandez Miaja¹, Manuel Arias¹
¹Universidad de Oviedo, Spain; ²Universidad Politecnica de Cartagena, Spain

Multi-Level Coupled Electronic and Magnetic System for Wide-Gain Constant Power Conversion [#690] 7268

Ian D. Willows, Sritharini Radhakrishnan, Mike K. Ranjram
Arizona State University, United States

Development and Demonstration of MW Modular Multilevel Converter based Reconfigurable Load Emulator [#1787] 7276

Jingxin Wang, Yang Xu, Fred Wang, Bob Martin
The University of Tennessee, United States

Small-Gain Stability of P-HIL for Evaluating Grid-Connected Converters during Asymmetric Grid Faults [#143]	7282
Sante Pugliese, Md Mohiuddin Al-Mahmud, Marco Liserre Kiel University, Germany	

Poster Session 2: Emerging Technologies

Chair(s): Ashish Kumar

Power Hardware-in-the-Loop Emulator for Rotor Inter-Turn Faults of a Wound Rotor Induction Machine [#60]	7290
Alla Koteswara Rao, Pragasen Pillay Concordia University, Canada	

Design of a New Magnetic Coupling Structure for High-Speed Rotating Wireless Power Transmission System [#85]	7296
Mingzhen Wang, Longyuan Fan, Zicheng Liu, Dong Jiang, Ronghai Qu Huazhong University of Science & Technology, China	

Parasitic Capacitance Analysis of Integrated Transformers with Parallel Windings [#219]	7303
Tianlong Yuan, Feng Jin, Qiang Li Virginia Polytechnic Institute and State University, United States	

An HTRB Tester with a Novel Heating System for TO-247 Packaged Power Semiconductor Devices [#232]	7309
Junhong Tong, Qingxuan Ma, Alex Q. Huang The University of Texas at Austin, United States	

Characterization of Desaturation based Fault Trip Unit for Ultra-Fast Fault Isolation [#303]	7314
Lakshmi Ravi ¹ , Chunmeng Xu ¹ , Gioele Gregis ² , Tiff Scott ¹ , Pietro Cairolì ¹ ¹ ABB Ltd., United States; ² ABB Ltd., Italy	

Boosting Wireless Power Transfer Efficiency in Capsule Endoscopy through Pulse Frequency Modulation [#335]	7320
Heng Zhang ¹ , Jiali Zhou ¹ , Chi-Kwan Lee ² ¹ The University of Hong Kong, Hong Kong; ² University of Technology Sydney, Australia	

Magnetic Voltage Isolator for the Feedback Loop of Power Converters for Space Applications [#441]	7324
J. Antonio Fernández ¹ , Abraham López ¹ , Theyllor H. Oliveira ¹ , Pablo F. Miaja ¹ , Manuel Arias ¹ , Arturo Fernández ² ¹ Universidad de Oviedo, Spain; ² European Space Agency, Netherlands	

Active Thermal Control for Power Semiconductors using Peltier-Devices [#844]	7332
Masamichi Yamaguchi ¹ , Hiroki Watanabe ¹ , Jun-ichi Itoh ¹ , Kyo-Beum Lee ² ¹ Nagaoka University of Technology, Japan; ² Ajou University, Korea	

Systematic Robust Controller Design for Induction Motor Drives using the Coefficient Diagram Method [#1212]	7338
Hanady A. Krieshan, Shaya Abou Jawdeh, Ali M. Bazzi University of Connecticut, United States	

Towards Switching Cycle based Holistic Accurate Estimation and Simulation of Power Losses of Components in Power Electronics Converters [#1252]	7345
Haisu Jiang ¹ , Xibo Yuan ¹ , Kefei Chen ¹ , Ruijie Zhu ¹ , Wenzhi Zhou ² , Quanrui Liu ¹ , Yonglei Zhang ¹ , Cheng Guo ¹ , Yi Li ¹ ¹ China University of Mining & Technology, China; ² Coventry University, United Kingdom	
Modular Flat-Top High-Current Compensator for Flywheel Energy Storage System in Magnetic Confinement Fusion Applications [#1381]	7352
Hyeongmeen Baik, Jinia Roy University of Wisconsin-Madison, United States	
A Controller Hardware-in-the-Loop Microgrid Testbed with Industrial BESS Switching Dynamics [#1468]	7359
Harish Suryanarayana, Aniket Joshi, Jacob Miscio ABB Ltd., United States	
Investigation of Coordination Limits between SiC-Based and IGCT-Based SSCBs [#1502]	7365
Abhinav Patni, Govind Chavan, Chunmeng Xu, Zhou Dong, Pietro Cairoli ABB Ltd., United States	
New Cryogenic T-Type Three-Switch Low-Voltage High-Current 4Q Power Supply for HTS Magnets [#1870]	7370
Mücahid Akbas, Johann W. Kolar, Jonas Huber ETH Zurich, Switzerland	
A Critical Exploration of Loss Optimization Techniques in Non-Inverting Buck-Boost Converters [#1613]	7373
Nitish Jolly ¹ , Ayan Mallik ¹ , Connor Reece ¹ , Chris Darmody ² , Akin Akturk ² ¹ Arizona State University, United States; ² CoolCAD Electronics, LLC, United States	
Design Optimization of High-Torque BLDC Motors with Various Slot/Pole Combinations for Robotic Applications [#1699]	7380
Mohamed Y. Metwly, Landon Clark, Biyun Xie, JiangBiao He University of Kentucky, United States	
A Comprehensive Study on An Enhanced Overmodulation Strategy for Motor Drives [#82]	7386
Zhe Zhang, Kevin Lee Eaton Corporation, United States	

Oral Session 45: Emerging Technologies 2

Chair(s): Ashish Kumar, Hongbo Zhao

Soft Switched MEMS Power Relay using a Resonant Auxiliary Circuit [#1304]	7392
Mohammed Agamy ¹ , Maja Harfman Todorovic ² , Ahmed Khamis ¹ ¹ State University of New York at Albany, United States; ² Menlo Microsystems Inc., United States	
Conduction Lead Design and Optimization for Cryogenic Characterization of GaN HEMTs [#1049]	7398
Tian Qiu, Zheyu Zhang, Purushottam Khadka Rensselaer Polytechnic Institute, United States	

Junction Temperature Ripple Modeling and Validation for SiC MOSFETs [#1107]	7405
Veera Bharath Gandluru, Yuequan Hu Wolfspeed, United States	
Design Considerations for Layout and Testing of SiC Three-Level T-Type Phase-Leg [#1286]	7412
Jingjie Xu, Youjun Yue, Li Zhang, Yuhao Wang, Jian Yang, Tianxiang Yin, Lei Lin Huazhong University of Science & Technology, China	
A Novel Grounding Resistance based Active Common-Mode EMI Filter with Enhanced Safety [#414]	7417
Junzhao Zhang ¹ , Dong Jiang ¹ , Jianrui Liu ¹ , Yechi Zhang ² ¹ Huazhong University of Science & Technology, China; ² Dalian Maritime University, China	
 Oral Session 92: Emerging Technologies 3	
Chair(s): Dehong Xu, Mausamjeet Khatua	
Real-Time Position Sensor Fault Detection with Control Reconfiguration for PMSM Drives [#937]	7423
Shaya Abou Jawdeh, Pengwei Li, Ali Bazzi University of Connecticut, United States	
New Optimum Rotor Flux Model for Field Oriented Control of Induction Motor Drives [#1521] ...	7428
Abbas Hassan ¹ , Ali M. Bazzi ² , Sami Karaki ¹ American University of Beirut, Lebanon; ² University of Connecticut, United States	
Emulation of Interturn Short Circuit Faults in Electric Power Steering Motors [#92]	7434
Neetusha Kalarikkal ¹ , Mathews Bobby ¹ , Raja Ramakrishnan ² , Pragasen Pillay ¹ ¹ Concordia University, Canada; ² Halla Mechantronics, United States	
Transformer Application for Power Hardware-in-the-Loop Emulation [#91]	7440
Mathews Bobby, Neetusha Kalarikkal, Pragasen Pillay Concordia University, Canada	
Conducted EMI Modeling and Analysis of Adjustable Speed Drive Systems with DC Chokes [#123]	7446
Kevin Lee, Zhe Zhang Eaton Corporation, United States	

Post Journal Presentation

Post Journal Presentation 1

Chair(s): Satish Belkhode, Andrea Formentini

Control of Grid-Forming VSCs: A Perspective of Adaptive Fast/Slow Internal Voltage Source [#1847]	JP1847
Heng Wu ¹ , Xiongfei Wang ^{1,2} ¹ Aalborg University, Denmark; ² KTH Royal Institute of Technology, Sweden	
Simplified Virtual Synchronous Compensator with Grid-Forming Capability [#1860]	JP1860
Vincenzo Mallemaci, Fabio Mandrile, Enrico Carpaneto, Radu Bojoi Politecnico di Torino, Italy	

Virtual Friction Subjected to Communication Delays in a Microgrid of Virtual Synchronous Machines [#1853] JP1853
 Florian Reißner¹, Vincenzo Mallemaci², Fabio Mandrile², Radu Bojoi², George Weiss¹
¹Tel Aviv University, Israel; ²Politecnico di Torino, Italy

Lead-Lag Filter-Based Damping of Virtual Synchronous Machines [#1859] JP1859
 Fabio Mandrile, Vincenzo Mallemaci, Enrico Carpaneto, Radu Bojoi
 Politecnico di Torino, Italy

Post Journal Presentation 2

Chair(s): Hongbo Zhao, Shafiq Odhano

Effects of Airgaps on Parasitic Capacitance of Magnetic Components [#1815] JP1815
 Shaokang Luan, Zhixing Yan, Hongbo Zhao
 Aalborg University, Denmark

Semi-Analytical and Data-Driven Models of Electric Field Strength considering the Actual Structure of Medium Frequency Transformers [#1819] JP1819
 Xuan Guo¹, Xu Cheng², Yunhao Xiao¹, Jianfu Chen², Chi Li¹, Xiaoyan Zhao²,
 Zedong Zheng¹, Yong Chen², Yongdong Li¹, Fei Zhao³
¹Tsinghua University, China; ²Guangdong Power Grid Co., Ltd., China;
³Advanced Materials Technology Co., Ltd., China

Artificial Intelligence Applications in High-Frequency Magnetic Components Design for Power Electronics Systems: An Overview [#1850] JP1850
 Xiaobing Shen, Yu Zuo, Jiaze Kong, Wilmar Martinez
 KU Leuven, Belgium

Electromagnetic Side-Channel Noise Intrusion on Solid-State Transformer [#1813] JP1813
 Mateo D. Roig Greidanus, Silvanus D'Silva, Shantanu Gupta, Debotrinya Sur,
 Sudip K. Mazumder, Mohammad B. Shadmand
 University of Illinois Chicago, United States

Post Journal Presentation 3

Chair(s): AK Arafat, Stefano Bifaretti

Coordinated Charging Scheme for Electric Vehicle Fast-Charging Station with Demand-Based Priority [#1856] JP1856
 Dingsong Cui¹, Zhenpo Wang¹, Peng Liu¹, Zhaosheng Zhang¹,
 Shuo Wang¹, Yiwen Zhao¹, David G. Dorrell²
¹Beijing Institute of Technology, China; ²University of Witwatersrand at Johannesburg, South Africa

Bidirectional Onboard Chargers for Electric Vehicles: State-of-the-Art and Future Trends [#1840] JP1840
 Hans Wouters, Wilmar Martinez
 KU Leuven - EnergyVille, Belgium

A Simplified Large-Signal Model-Based Control for Dual Active Bridge Series Resonant Converter to Achieve Uniform Dynamic Response [#1864] JP1864
 Kousik Ghosh¹, Surja Sekhar Chakraborty¹, P. Ganesan², Kamalesh Hatua¹
¹IIT Madras, India; ²Power Electronics Group, India

Data-Light Physics-Informed Modeling for the Modulation Optimization of a Dual-Active-Bridge Converter [#1844] JP1844
Xinze Li¹, Fanfan Lin^{2,3}, Xin Zhang³, Hao Ma³, Frede Blaabjerg⁴
¹Nanyang Technological University, Singapore; ²University of Illinois Urbana-Champaign Institute, United States; ³Zhejiang University, China; ⁴Aalborg University, Denmark

Post Journal Presentation 4

Chair(s): Minghui Lu, Francesco Iannuzzo

Comprehensive Modeling of a Back-to-Back Diodes-Based Linear Variable Capacitor [#1845] JP1845
Ujjwal Pratik, Zeljko Pantic
North Carolina State University at Raleigh, United States

Minimizing Output Capacitance Loss in GaN Power HEMT [#1821] JP1821
Qihao Song¹, Adam Briga², Valery Veprinsky², Roman Volkov², Qiang Li¹, Yuhao Zhang¹
¹Virginia Polytechnic Institute and State University, United States; ²VisIC Technologies, Israel

Integrated Common-Mode Filter for GaN Power Module with Improved High-Frequency EMI Performance [#1826] JP1826
Niu Jia¹, Xingyue Tian¹, Lingxiao Xue², Hua Bai¹, Leon M. Tolbert¹, Han Cui¹
¹The University of Tennessee, United States; ²Oak Ridge National Laboratory, United States

Design Considerations, Development, and Experimental Validation of a 3 .3 kV SiC-Based Reverse Voltage Blocking Half Bridge Module for Current Source Inverter Application [#1867] JP1867
Sneha Narasimhan¹, Sagar Kumar Rastogi¹, Colton Sisson², Scott Leslie², Subhashish Bhattacharya¹
¹North Carolina State University, United States; ²Powerex, United States

Post Journal Presentation 5

Chair(s): Petros Karamanakos, Luca Tarisciotti

Magnetically Controlled Transformer: Analysis and Implementation in a Dual Active Bridge Converter [#1811] JP1811
Camilo Suarez Buitrago, Wilmar Martinez
KU Leuven, Belgium

Sigma-Delta Modulation on a Three-Phase Four-Leg VSI to Eliminate the Common Mode Voltage and Comply with the Military Standards [#1836] JP1836
Matthew P. Storm, Alexander L. Julian, Giovanna Oriti
Naval Postgraduate School, United States

Model-Free Predictive Control of DC-DC Boost Converters: Sensor Noise Suppression with Hybrid Extended State Observers [#1833] JP1833
Oluleke Babayomi¹, Zhenbin Zhang², Zhen Li²
¹Korea Advanced Institute of Science & Technology, Korea; ²Shandong University, China

Robust Predictive Current Control using Discrete-Time Integral Action for Induction Motors [#1817] JP1817
Igor Oliani, Rafael Figueiredo, Luís F. Normandia Lourenço, Ademir Pelizari, Alfeu J. Sguarezi Filho
Federal University of ABC, Brazil

Post Journal Presentation 6

Chair(s): Wenkang Huang, Stefano Bifaretti

A New Class of Modular Multilevel Converter for Direct AC-AC Conversion [#1866] JP1866

Anjana Wijesekera, Yuan Li², Gregory Kish¹

¹University of Alberta, Canada; ²AltaLink, Canada

Adaptive Damping Control of MMC to Suppress High-Frequency Resonance [#1827] JP1827

Pengxiang Huang, Luigi Vanfretti

Rensselaer Polytechnic Institute, United States

A Bidirectional Current-Fed Isolated MMC with Partial Soft-Switching for High Step Ratio DC-DC Applications [#1830] JP1830

Philippe A. Gray^{1,2}, Noah J.B. Hosein¹, Xi Lan¹, Peter W. Lehn¹

¹University of Toronto, Canada; ²University of Calgary, Canada

PV-BESS DC-Series Integration for Regulated DC Systems [#1854] JP1854

Namwon Kim¹, Chondon Roy², Babak Parkhideh²

¹Oak Ridge National Laboratory, United States; ²University of North Carolina at Charlotte, United States

Challenges and Implementation of Online In-Situ $R_{DS(on)}$ Measurement in a Three-Phase Inverter [#1857] JP1857

Chondon Roy, Namwon Kim, Daniel Evans, James Gafford, Babak Parkhideh

University of North Carolina at Charlotte, United States

Addendum

Polyphase Rotary Transformer for Field Excitation of Electric Machines [#1882] 7453

Emrullah Aydin, Mostak Mohammad, Omer C. Onar, Burak Ozpineci

Oak Ridge National Laboratory, United States

Virtual Synchronous Machine Integration on a Commercial Flywheel for Frequency Grid Support

Giovanni De Carne¹, Florian Reissner²

¹Karlsruhe Institute of Technology, Germany; ²Tel Aviv University, Israel