2023

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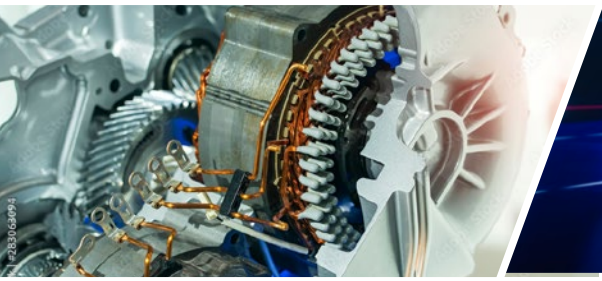
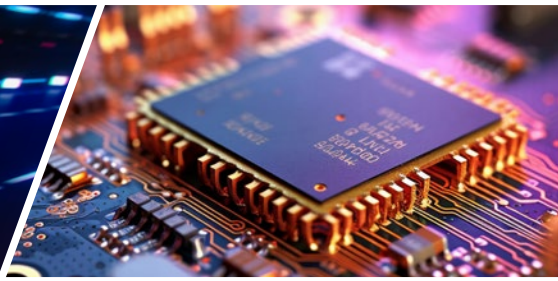
IEEE ENERGY CONVERSION CONGRESS & EXPO

PROGRAM





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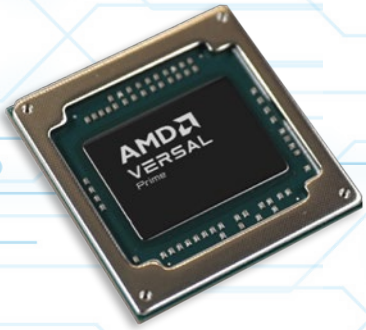

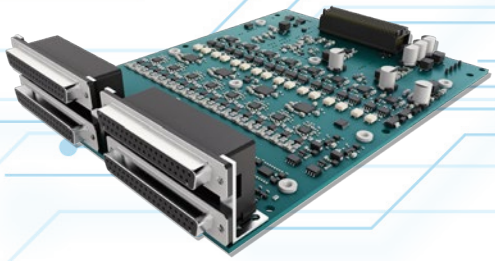

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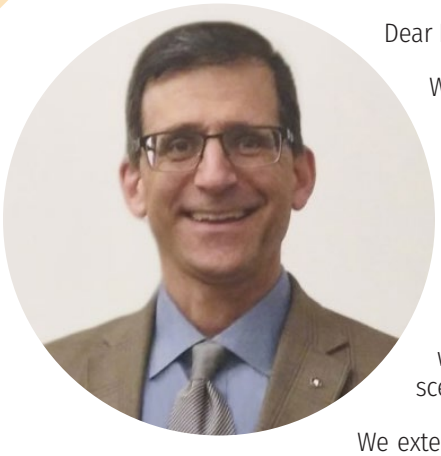


Dear Esteemed Colleagues and Friends,

Welcome to the vibrant city of Nashville, where innovation, technology, and music converge in perfect harmony. We are thrilled to invite you to the 2023 IEEE Energy Conversion Congress and Exposition (ECCE), jointly sponsored by the IEEE Power Electronics Society (PELS) and Industrial Applications Society (IAS), and proudly collocated with the IAS Annual Meeting.

Nashville, known as the "Music City," offers a backdrop of excitement both inside and outside the convention center. As we gather to celebrate the latest advancements in energy conversion and explore the future of power electronics and renewable energy, we encourage you to immerse yourself in the city's rich culture, from its legendary music scene to its vibrant culinary experiences.

We extend our heartfelt gratitude to our dedicated General Co-Chairs, Shanelle Foster, Joseph Ojo, and Jean-Luc Schanan, for their unwavering commitment to making this event possible. Our appreciation also goes out to the more than 70 organizing committee members whose tireless efforts have ensured the success of IEEE ECCE.

What makes IEEE ECCE 2023 in Nashville truly exceptional are the groundbreaking experiences we've prepared for you. For the first time ever, we present an all-women keynote panel featuring c-suite executives in power electronics and renewable energy. This panel will inspire and inform, and you'll have the chance to interact with these visionary leaders.

Our Women in Engineering lunch promises to be a highlight, featuring a panel discussion with our keynote speakers, offering insights on overcoming professional and societal barriers in their remarkable careers. Authors of IEEE ECCE papers will also enjoy new opportunities, including journal-to-conference presentations, 2-page late-breaking research briefs, and the chance to extend their conference papers into IEEE PELS or IEEE IAS journal submissions.

Attendees can look forward to Tuesday night's "Luminaries Special Sessions," honoring two pioneers of power electronics and electric machines, Fred Lee and Tom Jahns, respectively. Also, this year we have added two free tutorial sessions for all the attendees on Thursday afternoon.

PELS and IAS are committed to giving back to the community, and this year, we're excited to host a wind energy design contest for local high school students in collaboration with E4USA and Kidwind. Witness the next generation of renewable energy engineers in action at the exhibit hall on Monday, as they wind their own electric generators and compete with our wind tunnel to determine whose wind turbine has highest energy yield.

As always, IEEE ECCE offers an exceptional technical program with approximately 1000 papers published selected from ~1600 submissions, and numerous special sessions and tutorials covering a wide range of topics, particularly focusing on industry and application-oriented topics. Take advantage of many of the IAS or PELS open meetings, editor meetings, and technical committee gatherings to network, learn, and engage with colleagues who share your interests. Sunday afternoon PELS also holds its (open) Town Hall Meeting.

Of course, we value networking, and this year, we've extended the length of our coffee breaks to enhance your opportunities for professional development. Don't miss the huge Wednesday night networking evening, the Young Professional Event on Monday night, the Women in Engineering breakfast, and several other mentoring and network events.

IEEE ECCE 2023 in Nashville promises to be an unforgettable experience filled with innovation, networking, and fun. We are thrilled to have you join us.

Welcome!

Brad Lehman
General Chair IEEE ECCE 2023

WELCOME FROM
TECHNICAL PROGRAM CHAIRS

The future of our world – its social and economic progress and prosperity - to meet the challenges of the increasing population, to provide the ingredients of the more abundant life for the greatest majority of the peoples of this planet earth, not only in the developed but also in the developing parts of the world will be greatly influenced by the progress in the electrification technologies. The transformation of natural sources of energy to various forms, for various applications will mostly depend on the various branches of electrical technologies, especially power electronics and subsystems. Energy conversion processes therefore will continue to play frontline role in this emerging electrification-based environment and present new opportunities for technical advancement and innovations and wealth creation. It has become evident that the ECCE conference, which assembles the best in field of electrification technologies offers unique opportunities by providing an international from all the continents for collaboration between industry, academia and government research organizations. New ideas, latest technologies and probing future technologies will occupy the attention of those who attend.

One thousand, seven hundred and twelve (1,712) paper digests were submitted by authors all around the globe. The Program Technical Committee (TPC) consisting of Chairs, Vice Chairs and Topic Chairs, organized the paper review process organized in various Tracks. Each paper received between three to five reviews from experts drawn from around the world. The Vice Chairs for each Track met at various times virtually and made recommendation for papers to be accepted and the mode of presentation to the Technical Program Chair Committee which gave final approvals.

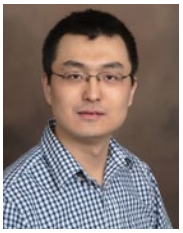
The conference program has one thousand and seven (1,007) technical papers to be presented in ninety-six (96) oral sessions and four (4) poster sessions. We have Journal-to-Conference presentations and Express Research Brief papers this year in the mix. There will be twenty-five (25) special and twenty-four (24) tutorial sessions. There are also three (3) sessions organized to recognize the contributions to the field of Power Electronics and the Power Electronics and Industry Application societies by Professors Fred Lee, Thomas Jahn and Po-Tai Cheng.

All papers presented at ECCE2023, will be uploaded to the IEEE Explore Digital Library and made available to the research community after the conference. Authors of the papers are encouraged to submit their papers for possible publication in the IEEE Transactions on Power Electronics, Industry Applications, Transportation Electrification and the Journal of Emerging and Selected Topics on Power Electronics. Please contact the editorial board of these publications for specific policies for accepting conference papers for possible publication.

On behalf of the Technical Program Committee, we are confident that you will enjoy the 2023 ECCE events in Nashville – the iconic country music city of the United States of America in the Volunteer State of Tennessee. If you are a fan of the various genres of the country music, bring your dance shoes to gyrate to evening live bands to be performed close to the conference hotel.

Hundreds of our colleagues all around the world have contributed their time, expertise in no small measures to make this conference a great success that it will be. Here is expressing the appreciation of the Technical program for your contributions. We are grateful and we applaud you all!

It remains for the Technical Program Chairs to appreciate the leadership of the Conference Chair, Professor Brad Lehman for his tireless inspirations and confidence in the team and finding us worthy to undertake the significant task of organizing the technical program**.**
Thank you and cheers All,



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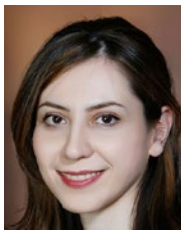

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Ehab Shoubaki, *UNC-Charlotte, USA*
Rahul Jaiswal, *NIT-Delhi, India*
Binesh Kumar, *Atom Power, USA*
Abhishek Anand, *CEERI Pilani India, India*
Mohd Alam, *VNIT Nagpur India, India*
Snehal Gawande, *YCCE Nagpur India, India*
Archakam Vijayaraghavulu Giridhar, *NIT Warangal India, India*
Perumal Parthiban, *NIT Surathkal India, India*
Amod Umarikar, *IIT Indore India, India*
Soumya Subhra Nag, *Indian Institute of Technology, Delhi, India*
Tianqi Hong, *University of Georgia, USA*
Haryani Nidhi, *Delta Electronic, USA*
Aswad Adib, *Oak Ridge National Laboratory, USA*
Xiaofan Cui, *Stanford University, USA*
Michele Mengoni, *University of Bologna, Italy*
Ludovico Ortombina, *University of Padova, Italy*
Elisabetta Tedeschi, *Norwegian University of Science and Technology, Norway*
Andrea Formentini, *University of Genova, Italy*
Lennart Harnefors, *ABB Corporate Research, Sweden*
Alessandro Lidozzi, *ROMA TRE University, Italy*
Diego Pérez-Estévez, *University of Vigo, Spain*

Electrical Machines

Vice Chair: Giulio De Donato, *Sapienza – University of Rome, Italy*
Vice Chair: Rukmi Dutta, *UNSW Sydney, Australia*
Vice Chair: Narges Taran, *Ford Motor Company, USA*
Simone Ferrari, *Politecnico di Torino, Italy*
Prerit Pramod, *Microvision, USA*
Avoki Omekanda, *General Motors, USA*
Hossein Ehya, *Norwegian University of Science and Technology, Norway*
Wolfgang Gruber, *Johannes Kepler University Linz., Austria*
Eric Severson, *University of Minnesotta, USA*
Takashi Kato, *Nissan, Japan*
Ali Fatemi, *General Motors, USA*
Gerd Bramerdorfer, *Johannes Kepler University Linz, Austria*
Athanasios Karlis, *Democritus University of Thrace, Greece*
Fan Wu, *Rivian, USA*
Luigi Alberti, *University of Padova, Italy*
Adam Skorek, *Université du Québec à Trois-Rivières, Canada*
Andrea Cavagnino, *Politecnico di Torino, Italy*
Rashmi Prasad, *General Motors, USA*

Hassan Eldeeb, *SLPT Global Pump Group, USA*
Konstantinos N Gyftakis, *Technical University of Crete, Greece*
Jose Alfonso Antonino Daviu, *Polytechnic University of Valencia, Spain*
Kyohei Kiyota, *Tokyo Institute of Technology, Japan*
Renato Lyra, *Aerotech, USA*
Matthew Gardner, *University of Texas at Dallas, USA*
Rajesh Deodhar, *HiSpeed Ltd, UK*
Wei Xu, *Huazhong University of Science and Technology, China*
Yao Duan, *Toshiba, USA*
Silvio Vaschetto, *Politecnico di Torino, Italy*
Roy Mccann, *University of Arkansas, USA*
Akuru Udochukwu, *Tshwane University of Technology, South Africa*
Zhongze Wu, *Southeast University, China*
Lakshmivaraha Iyer, *Magna, USA*
Maria Martinez, *University of Oviedo, Spain*
Nicola Bianchi, *University of Padova, Italy*
Hao Ding, *Rivian, USA*
Lavanya Vadamodala, *Altair, USA*

Electric Drives

Vice Chair: Ali Bazzi, *University of Connecticut, USA*
Vice Chair: Antonio J. Marques Cardoso, *CISE – University of Beira Interior, Portugal*
Vice Chair: Kevin Lee, *Eaton, USA*
Vice Chair: David Reigosa, *University of Oviedo, Spain*
Vice Chair: Sara Roggia, *magniX, USA*
Juan M. Guerrero, *University of Oviedo, Spain*
Ram Raja, *Halla Mechatronics, USA*
Jingbo Liu, *Rockwell Automation, USA*
Sandro Rubino, *Politecnico di Torino, Italy*
Roberto Petrella, *University of Udine, Italy*
Giacomo Scelba, *University of Catania, Italy*
Michele Mengoni, *University of Bologna, Italy*
Pinjia Zhang, *Tsinghua University, China*
Michael Harke, *Collins Aerospace, USA*
Shih-Chin Yang, *National Taiwan University, Taiwan*
Di Pan, *Rivian, USA*
Hao Lei, *General Motors, USA*
Prerit Pramod, *MicroVision, USA*
Mario Pulvirenti, *STMicroelectronics, Italy*
Arshiah Mirza, *Shell Techworks, USA*
Luca Vancini, *University of Bologna, Italy*

Power Semiconductor Devices, Passive Components, Packaging, Integration, and Materials

Vice Chair: Jungwon Choi, *University of Minnesota, USA*
Vice Chair: Francesco Iannuzzo, *Aalborg University, Denmark*
Vice Chair: Yushan Liu, *Beihang University, China*
Thomas Ebel, *University of Southern Denmark, Denmark*
Mona Ghassemi, *UT Dallas, USA*
Emre Gurpinar, *Sikorsky Innovations, USA*
Andrew Lemmon, *University of Alabama, USA*
Jose Ortiz Gonzalez, *University of Warwick, UK*
Srivatsa Raghunath, *Infineon Technologies AG, USA*
Ami Romero, *Wolfspeed, Inc., USA*
Adam Skorek, *Université du Québec à Trois-Rivières, Canada*
Hongfei Wu, *Nanjing University of Aeronautics and Astronautics, China*
Hengzhao Yang, *ShanghaiTech University, China*
Shu Yang, *University of Science and Technology of China, China*
Xiu Yao, *University at Buffalo, USA*

Energy Efficient Systems Applications and Lighting Technologies

Vice Chair: Padmanaban Sanjeevikumar, *University of South-Eastern Norway, Norway*

Applied Research and Emerging Technologies

Vice Chair: Qiang Wei, *Lakehead University, Canada*
Vice Chair: Hua Zhang, *Rowan University, USA*
Ding Li, *University of Alberta, Canada*
Li Yuzhuo, *University of Alberta, Canada*
Hou Nie, *University of Alberta, Canada*
Xiao Dianxun, *Hong Kong University of Science and Technology, China*
Abdullah Yousef, *Kuwait University, Kuwait*
Hu Boxue, *Delta Electronics, USA*
Kheirollahi Reza, *Drexel University, USA*
Dai Hang, *General Electric, USA*
Singh Sumeet, *EMWorks Inc., Canada*
Kumar Binesh, *Atom Power Inc, USA*
Patel Ankit, *University of Minho, Portugal*
Ding Hao, *Rivian, USA*

Conflict of Interest

Vice Chair: Dong Dong, *Virginia Tech, USA*

GENERAL **INFORMATION**

Registration Hours

2nd Floor Registration Area

Sunday, October 29 ..... 7:30AM – 7:00PM

Monday, October 30..... 7:30AM – 6:00PM

Tuesday, October 31..... 7:30AM – 5:00PM

Wednesday, November 1 ..... 7:30AM – 6:00PM

Thursday, November 2..... 7:30AM – 5:00PM

Expo Hall Hours

Exhibit Hall B

Monday, October 30..... 4:00PM – 7:30PM

Tuesday, October 31..... 10:30AM – 5:00PM

Job Fair Hours

Exhibit Hall B

Tuesday, October 31.....8:30AM – 11:30AM

RULES & **REGULATIONS**

Consent to Use of Photographic Images

Registration and attendance at, or participation in, ECCE constitutes an agreement by the registrant to ECCE's use and distribution (both now and in the future) of the registrant or attendee's image or voice in photographs, videotapes, electronic reproductions and audiotapes of such events and activities.

Cameras and Recording Devices

The use of cameras and/or recorders is strictly prohibited during the oral and poster sessions. Limited use is allowed for Exhibitors in their own booth area. Personal photography is allowed at social functions.

Distributing Commercial Material at ECCE

Exhibitors: Exhibitors may only distribute commercial materials in their booth. ECCE reserves the right to remove without notice any materials not in compliance with this policy. Active recruiting is prohibited at all times except during the Job Fair Hours.

Non-Exhibitors: Distribution of commercial material in the ECCE 2023 hotel space (including directly to the hotel rooms of ECCE participants), meeting space and Exhibit Hall by people or organizations not participating in the Exposition is prohibited. ECCE reserves the right to remove without notice any materials not in compliance with this policy.

Job Recruiting

The IEEE Energy Conversion Conference and Expo will arrange a Career Fair for attendees Tuesday, October 31 8:30AM – 11:30AM. All exhibitors and sponsors are invited to attend the Career Fair, but should sign up beforehand. Companies not exhibiting but that want to recruit at the job fair can do so for a fee. No other job recruiting will be permitted at the conference.

Creative Digressions

Sunday through Thursday

Room 401A

The Creative Digression room is available to attendees requiring a break from busy conference activities. This room will have tables and chairs in order to facilitate one-on-one discussions, idea generations sessions, business meetings, or social interactions. Coffee and tea will also be available.

Prayer Room

Sunday through Thursday

Room 403

Prayer room is available to attendees requiring a break from busy conference activities. This space allows for individuals or small groups to come together in a quiet space for prayer, meditation, and/or reflection throughout the day. The prayer room is not to be used as a lounge, study room, meeting room or for other purposes not involved with prayer/meditation. Please respect the requirement for a peaceful, quiet atmosphere.

Kiddie Corp

Monday through Thursday | 9:00AM – 5:00PM

Room 103B

KiddieCorp is pleased to provide a children's program during ECCE 2023. KiddieCorp is in its thirty-seventh year of providing high-quality children's programs and youth services to conventions, trade shows, and events.

The program is for children ages eight weeks through 12 years old. Activities include exciting themes, arts & crafts, group games, music & movement, board games, story time, dramatic play, etc. KiddieCorp provides activities appropriate for each age group, using safe and sturdy equipment. Children can make their own choices within KiddieCorp's program.

Cost = $8 an hour per child

Wi-Fi

Attendees have full access to Wi-Fi in the meeting space, foyer, and exhibit hall.

Network: MCC WiFi

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Visit the Apple Store or Google Play Store and search ECCE 2023

SCHEDULE-AT-A-GLANCE

Sunday, October 29th

7:30AM – 7:00PM	**Registration**	*Level 2 Registration Area*
7:00AM – 6:00PM	**Prayer Room**	*403*
7:30AM – 3:30PM	**Speaker Ready Room**	*206B*
8:00AM – 6:00PM	**Creative Digressions**	*401A*

Tutorial • 8:30AM – 10:00AM

209B
T9: HVDC Transmission Systems and DC Grids: Developments and Challenges

Tutorials • 8:30AM – 11:50AM

202A	202B	202C	204	205A	205B	205C	209A
T1: Grid Forming Power Converters. Concepts, Implementation and Analysis	**T2:** Shallow Neural Networks and Deep Learning Applications in Power Electronics and Electrical Drives	**T3:** GaN FETs and GaN Integrated Circuits for DCDC and Motor Drives Applications	**T4:** SiC Unleashed: Are SiC Technology High Performances Reliable Enough for Your Application?	**T5:** Aviation Class Propulsion Solution: Additively Manufactured Motor Coils, Integrated with Modular Motor Drive & Advanced Cooling	**T6:** Integrated Motor Drives, State of the Art, Challenges, and Emerging Technologies	**T7:** Advances in Wireless Power Technology for Electric Vehicles and Smart Devices	**T8:** Electromagnetic Compatibility of Switched-Mode Power Supplies

Tutorial • 10:20AM – 11:50AM

209B
T10: Gallium Nitride: Device Technologies and Applications

Tutorial • 1:00PM – 2:30PM

201A
T21: Wide Bandgap Device based Power Electronics for Aerospace Applications

Tutorials • 1:00PM – 4:20PM

202A	202B	202C	204	205A	205B	205C	209A	209B
T11: Z-Source DC Solid-State Circuit Breakers	**T12:** Model Predictive Control: From Theory to Industrial Applications	**T13:** Power Electronics Intensive Power Systems: Dynamic Modeling and Control, Hardware Testing, and Standardization	**T14:** Artificial Neural Networks for Power Electronics – A Hands-On Approach	**T15:** Design for Reliability: The Origin of Aging and Degradation in Advanced Power Modules and Emerging State of Health (SOH) Estimation Techniques	**T16:** Cryogenic Power Electronics Design for Electrified Aircraft Propulsion	**T17:** Reliability Requirements and Qualification of Automotive Power Semiconductors	**T18:** Advanced Data-driven and Digital-twin Enabled Power-electronics-intensive Battery Management Systems and Fast Charging	**T19:** Next-Generation Medium- and High-Voltage High-Power All Silicon Carbide Modules: Design, Characterization, and Applications

Tutorials • 2:50PM – 4:20PM

209C	201B
T20: General Airgap Field Modulation Theory for Electrical Machines and Its Applications in Automotive and Aerospace Industries	**T22:** Understanding of Observed Switching Waveform for High-Speed SiC Devices: From Application Perspectives with Analytical Insights

6:00PM – 8:00PM	**Welcome Reception**	*Karl F. Dean Ballroom*
8:00PM – 8:30PM	**ECCE Newcomers Reception**	*204*

Monday, October 30th

7:30AM – 6:00PM	**Registration**	*2nd Floor Registration*
7:00AM – 6:00PM	**Prayer Room**	*403*
7:00AM – 8:00AM	**Speakers Breakfast**	*207*
7:30AM – 8:30AM	**Keynote Breakfast**	*402*
7:30AM – 3:30PM	**Speaker Ready Room**	*206B*
8:30AM – 11:15AM	**Keynotes**	*Karl F. Dean Ballroom*
8:30AM – 1:30PM	**High School Student Outreach: Wind Energy Generator Design Contest**	*Back of Exhibit Hall B*
9:00AM – 5:00PM	**Kiddie Corp**	*103B*
9:00AM – 6:00PM	**Creative Digressions**	*401A*
11:15AM – 12:45PM	**Lunch On Your Own**	
11:15AM –12:45PM	**WIE Keynote Panel and Luncheon**	*207*

Oral Sessions • 12:50PM – 2:30PM

201B	208B	201A	202A	202B	202C	204	208A	209A	209B	209C	205A
S1: Photovoltaic Systems	**S2:** Renewable Energy Grid Integration I	**S3:** Enhanced Control of Grid-Forming Converters	**S4:** DC-DC Converters I	**S5:** DC-DC Isolated I	**S6:** Power Converter Modeling	**S7:** Control of Three-Phase Converters	**S8:** Induction Machines	**S9:** Electric Machines for Transportation	**S10:** Diagnostics, Noise and Vibration in Electric Machines	**S11:** Medium Voltage and High-Power Drives	**S12:** SiC Devices I - Modeling and New Concepts

Special Sessions • 12:50PM – 2:30PM

205B	205C
SS1: Grid-Interactive Power Converters –Technological Advancements and Opportunities	**SS2:** Unlocking the Potential of HVDC Technology for Future Grids

2:30PM – 3:00PM	**Coffee Break**	*200's Hallways*

Oral Sessions • 3:00PM – 4:40PM

201B	204	208B	205C	202C	202A	202B	205B	201A	209A	205A	208A
S13: Power Converters for Electric Vehicles	**S14:** Distributed Energy Integration	**S15:** Renewable Energy Grid Integration II	**S16:** Power Converter Modeling, Analysis and Design	**S17:** Power Converters and Motor Drives for Transporation Electrification	**S18:** DC-DC Converters II	**S19:** DC-DC Isolated II	**S20:** Multiphase AC-DC Converters	**S21:** Industrial Power Converters – Topology, Design, and Control	**S22:** Electrical Drives for Aerospace and Traction Applications	**S23:** SiC Devices II – Abnormal Conditions	**S24:** GaN and Other Semiconductor Devices

Special Sessions • 3:00PM – 4:40PM

209B	209C
SS3: Introduction to Futuristic Grid Architectures:Solid State Power Substation (SSPS)	**SS4:** Intelligence and Digitalization in Sustainable Energy Systems

4:00PM	**Expo Hall Opens**	*Exhibit Hall B*
5:00PM – 7:30PM	**Expo Hall Reception**	*Exhibit Hall B*
5:00PM – 7:30PM	**Student Demos**	*Exhibit Hall B*
5:30PM – 7:10PM	**Poster Session 1**	*Exhibit Hall B*
6:00PM – 8:00PM	**Organizing Committee Dinner**	*Show Managers Office B*
7:00PM – 9:00PM	**YP Event**	*Bode Nashville*

Schedule-at-a-Glance (continued)

Tuesday, October 31st

7:30AM – 5:00PM	**Registration**	*2nd Floor Registration*
7:00AM – 6:00PM	**Prayer Room**	*403*
7:00AM – 8:00AM	**Speakers Breakfast**	*207*
7:30AM – 10:30AM	**Speaker Ready Room**	*206B*
8:30AM – 11:30AM	**Student Job Fair**	*Exhibit Hall B*
9:00AM – 5:00PM	**Kiddie Corp**	*103B*

Oral Sessions • 8:30AM – 10:10AM

201B	208B	201A	202A	202B	202C	208A	209A	209B	209C	205A	205B
S25: Photovoltaic Power Converters	**S26:** Electronic Power Grid Systems	**S27:** Microgrids and Active Distribution Networks	**S28:** Grid Stability and Power Quality	**S29:** Single-Phase AC-DC Converters	**S30:** Converter Stability	**S31:** Axial Flux Machines	**S32:** Modelling and Analysis of Electrical Machines I	**S33:** Materials, Losses, Thermal and Manufacturing Issues I	**S34:** IM Drives	**S35:** Gate Drivers	**S36:** Power Electronics and Electric Machines in Space Applications

Special Sessions • 8:30AM – 10:10AM

205C	204
SS9: Smart Inverter Security and Resilience byDesign: Industry Best Practices, Standard and Security Certification, and Research	**SS10:** Advancements in Wide Band Gap Technolgies

10:00AM – 11:00AM	**RCA Studio B Tour**	
10:30AM – 12:10PM	**Poster Session 2**	*Exhibit Hall B*
10:30AM – 5:00PM	**Expo Hall Open**	*Exhibit Hall B*
11:15AM – 1:00PM	**Country Music Hall of Fame Tour**	
12:00PM – 2:30PM	**Expo Hall Lunch**	*Exhibit Hall B*
1:30PM – 5:00PM	**Student Demonstrations**	*Exhibit Hall B*
2:00PM – 3:00PM	**Ryman Auditorium Tour**	
2:30PM – 4:10PM	**Poster Session 3**	*Exhibit Hall B*
5:00PM – 5:30PM	**Luminaries Special Sessions Light Reception**	*Level 2 Prefunction*
5:30PM – 7:10PM	**Luminaries Special Sessions**	*207 & 209*

Wednesday, November 1st

7:30AM – 6:00PM	**Registration**	*2nd Floor Registration*
7:00AM – 6:00PM	**Prayer Room**	*403*
7:00AM – 8:00AM	**Speakers Breakfast**	*207*
7:30AM – 5:00PM	**Speaker Ready Room**	*206B*
8:00AM – 6:00PM	**Creative Digressions**	*401A*
9:00AM – 5:00PM	**Kiddie Corp**	*103B*

Oral Sessions • 8:30AM – 10:10AM

201B	208B	201A	202A	202B	202C	208A	209A	209B	209C
S37: Converter-Based Resources	**S38:** Energy Storage and Harvesting	**S39:** DC Grids and Hybrid AC/DC Grids	**S40:** Wireless Power Transfer I	**S41:** Single-Phase DC-AC Converters	**S42:** Other Topics in Control of Power Converters	**S43:** Switched Reluctance and Flux Switching Machines	**S44:** Bearingless and High-Speed Machines	**S45:** PM Drives I	**S46:** Packaging I - Modeling and Design

Special Sessions • 8:30AM – 10:10AM

205B	209C	205A	205C
SS11: Specific Electrification Challenges and Potential Solutions for Various Transportation Industries	**SS12:** Wide-Bandgap Technologies: Reliability, Developments and Next Challenges	**SS14: Part 1:** The Role of Power Hardware-in-the-Loop Simulation in the Successful Rollout of New Power Electronics Solutions	**SS23:** High-Performance Electric Motors and Power Electronics for On- and Off-Road Electric Vehicles

Wednesday, November 1st (continued)

10:10AM – 10:40AM **Coffee Break**

Oral Sessions • 10:40AM – 12:20PM

201B	208B	202A	202B	202C	208A	209A	209B	204	205B
S47: Power Converters for Grid Applications	**S48:** Battery Energy Storage Systems	**S49:** Wireless Power Transfer II	**S50:** DC-AC Multi-phase Inverter	**S51:** Modern Control Aspects in Power Electronics	**S52:** IPM and Synchronous Reluctance Machines I	**S53:** Additive Manufacturing in Electric Machines	**S54:** PM Drives II	**S55:** Packaging II – New Concepts	**S56:** Industry Design and Testing

Special Sessions • 10:40AM – 12:20PM

209C	201A	205C	205A	102A
SS15: Battery Tech vs. Charging Infrastructure: Driving Towards a Sustainable e-mobility Future	**SS19: Part 1:** Bidirectional Switches are Coming. Are You Ready?	**SS13: Part 1:** Transient and Dynamic Modeling and Control of Large-Scale, Resilient Distribution Systems with High Penetration of Inverter-based Distributed Energy Resources and Loads	**SS14: Part 2:** The Role of Power Hardware-in-the-Loop Simulation in the Successful Rollout of New Power Electronics Solutions	**SS8:** Future of EM Design-Manufacturing Advancements

12:20PM – 2:00PM **Lunch On Your Own**

Oral Sessions • 2:00PM – 3:40PM

208B	201B	202B	202C	204	205A	208A	209A	209C	205B
S57: Energy Storage: System Integration and Control	**S58:** Solid-State Transformers	**S59:** Battery Management for Electric Vehicles	**S60:** Charging for Electric Vehicles	**S61:** Multilevel Converters I	**S62:** Modulation Methods for Power Converters	**S63:** Materials, Losses, Thermal and Manufacturing Issues II	**S64:** Wound Field and PM Machines I	**S65:** Control of Electric Drives I	**S66:** Emerging Concepts on Devices, Topologies, Thermal Management and Control

Special Sessions • 2:00PM – 3:40PM

202A	205C	201A	209B	102A
SS17: Transmission Expansion Planning Models for Offshore Wind Energy in the U.S.	**SS13: Part 2:** Transient and Dynamic Modeling and Control of Large-Scale, Resilient Distribution Systems with High Penetration of Inverter-based Distributed Energy Resources and Loads	**SS19: Part 2:** Bidirectional Switches are Coming. Are You Ready?	**SS22: Part 1:** Challenges and Opportunities for Aviation Electrification and ARPA-E Aviation-class Synergistically Cooled Electric-Motors with Integrated Drives Program (ASCEND)	**SS18:** Future of Electric Machines Design Materials Advancement

3:40PM – 4:10PM **Coffee Break**

Oral Sessions • 4:10PM – 5:50PM

201B	208B	202A	202B	204	205A	205B	209C	205C	209A
S67: Electronic Grid Infrastructrure	**S68:** Advances in Grid-Forming Technologies	**S69:** Modeling and Analysis of Energy and Storage Applications	**S70:** Solid State Circuit Breaker for Transporation Applications	**S71:** Multilevel Converters II	**S72:** AC Link Converter Control	**S73:** Converter Power Quality	**S74:** Control of Electric Drives II	**S75:** Device Testing and Monitoring Methods	**S76:** Latest Applications of Power Electronics and Electric Machines

Special Sessions • 4:10PM – 5:50PM

208A	202C	209B	201A
SS20: Powering the Blue Economy: An Emerging Timefor Wave, Hydro, and Current Energy	**SS21:** Ultra Wide Band Gap (UWBG) Semiconductors: Status and Potentialities for Power Electronics	**SS22: Part 2:** Challenges and Opportunities for Aviation Electrification and ARPA-E Aviation-class Synergistically Cooled Electric-Motors with Integrated Drives Program (ASCEND)	**SS: Part 1:** PELS/IAS Journal Award Papers

6:00PM – 8:00PM **Networking Dinner** *Karl F. Dean Ballroom*

Schedule-at-a-Glance (continued)

Thursday, November 2nd

7:30AM – 5:00PM	**Registration**	*2nd Floor Registration*
7:00AM – 6:00PM	**Prayer Room**	*403*
7:00AM – 8:00AM	**Speakers Breakfast**	*207*
7:30AM – 12:00PM	**Speaker Ready Room**	*206B*
8:00AM – 6:00PM	**Creative Digressions**	*401A*
9:00AM – 5:00PM	**Kiddie Corp**	*103B*

Oral Sessions • 8:30AM – 10:10AM

201B	208B	201A	202A	205B	208A	209A	209B	204	202C
S77: Control of Renewable Energy Systems	**S78:** Smart Grid and Utility Applications	**S79:** Grid-Forming Inverters for Microgrids	**S80:** Electric Machine for Transportation Electrification	**S81:** Converter Fault Detection, Protection, and Online Health Diagnosis	**S82:** IPM and Synchronous Reluctance Machines II	**S83:** Modelling and Analysis of Electrical Machines II	**S84:** Sensorless Drives	**S85:** Packaging III - Optimization	**S86:** Magnetics I - Transformers

Special Sessions • 8:30AM – 10:10AM

205C	209C	202B	205A
SS5: Future of Electric Machines Design-Computational Advancements	**SS6: Part 1:** Design Automation for Power Electronics – from Device to Systems Design, Verification and Certification	**SS16:** Emerging Applications of Inductive Power Transfer Technology	**SS24: Part 1:** Finger on the Pulse: Sustainable & Robust Data Centers

10:10AM – 10:40AM	**Coffee Break**	

Oral Sessions • 10:40AM – 12:20PM

201B	208B	202B	202C	202A	204	205A	209A	209B	205C
S87: Wind Power	**S88:** FACTS Devices and Technologies	**S89:** Power System Modeling and Analysis	**S90:** System Monitoring, Diagnosis and Security	**S91:** Motor Drive for Transportation Applications	**S92:** AC-AC Converters	**S93:** Power Converter EMI	**S94:** Wound Field and PM Machines II	**S95:** Monitoring, Diagnostics, Reliability and EMI	**S96:** Magnetics II – Inductors

Special Sessions • 10:40AM – 12:20PM

209C	205B	205A	208A
SS6: Part 2: Design Automation for Power Electronics – from Device to Systems Design, Verification and Certification	**SS7:** All-DC Wind Generation Systems: High-Voltage Wind Turbine Conversion, MVDC Collector and HVDC Transmission Grid Technologies	**SS24: Part 2:** Finger on the Pulse: Sustainable & Robust Data Centers	**SS: Part 2:** PELS/IAS Journal Award Papers

12:20PM – 2:00PM	**PELS & IAS Awards Luncheon**	*Karl F. Dean Ballroom*
2:00PM – 3:40PM	**Poster Session 4**	*4th Floor Prefunction*
3:30PM – 4:00PM	**Coffee Break**	

Free Tutorials • 4:00PM – 5:30PM

209AB	208AB
T23: Advancements in Digital Design and Manufacture of Electric Propulsion Motors	**T24:** New Advances and Trends on Model Predictive Control for Power Electronics and Electrical Drives

5:40PM – 7:00PM	**Closing Reception**	*4th Floor Prefunction*

COMMITTEE MEETINGS

Do you want to get more involved in IEEE IAS and/or IEEE PELS? Then we enthusiastically invite you to attend many of the IAS or PELS open meetings, editor meetings, and technical committee gatherings. You will network, learn, and engage with colleagues who share your technical interests. Unless indicated as an "invitation only," the meetings below are generally open to society members.

IAS Committee Meetings at ECCE

Sunday, October 29	
2:00PM – 3:00PM	**IAS-IPCSD Standards Meeting** ..... *Room 102A*
3:00PM – 4:00PM	**IAS-IPCSD Editorial Meeting** ..... *Room 102A*
4:00PM – 6:00PM	**IAS-IPCSD General Meeting** ..... *Room 102A*
Tuesday, October 31	
2:00PM – 3:00PM	**IAS Renewable and Sustainable Energy Conversion Systems Committee (RESC) Meeting** ..... *Room 204*
2:00PM – 3:00PM	**IAS Industrial Drives Committee (IDC) Meeting** ..... *Room 201AB*
3:00PM – 4:00PM	**IAS Transportation Systems Committee (TSC) Meeting** ..... *Room 204*
4:00PM – 5:30PM	**IAS Electrical Machines Committee (EMC) Meeting** ..... *Room 201AB*
5:00PM – 6:00PM	**IAS Power Electronics Devices and Components Committee (PEDCC) Meeting** ..... *Room 204*
7:00PM – 8:00PM	**IAS Industrial Power Converters Committee (IPCC) Meeting** ..... *Room 204*

ECCE Committee Meetings

Sunday, October 29	
8:00PM – 8:30PM	**ECCE Newcomers Reception** ..... *Room 204*
Tuesday, October 31	
7:30AM – 8:30AM	**ECCE 2023, 2024 and 2025 Handoff** (Invitation Only) ..... *Room 102A*
8:30AM – 9:30AM	**ECCE 2024 Organizing Committee Meeting** (Invitation Only) ..... *Room 102A*
10:00AM – 12:00PM	**ECCE Steering Committee Meeting** (Invitation Only) ..... *Room 102A*

PELS Meetings (open to everyone, unless specifically indicated otherwise)

Sunday, October 29

4:00PM – 4:30PM	PELS Members' Townhall Reception	Room 101 Hallway
4:30PM – 6:00PM	PELS Members' Townhall Meeting	Room 101AB

Monday, October 30

11:30AM – 1:00PM	PELS TC6 : High Performance and Emerging Technologies Meeting	Room 101AB
11:30AM – 3:30PM	PELS VP of Membership	Room 101C
11:30AM – 1:00PM	PELS TC 10: Design Methodologies	Room 101D
11:30AM – 1:00PM	Asian Power Electronics Coordinate Committee	Room 101E
1:00PM – 2:00PM	International Future Energy Challenge (IFEC) Information Session	Room 101AB
1:00PM – 2:30PM	PELS TC 1 – Control and Modeling of Power Electronics	Room 101D
2:00PM – 4:30PM	ITRW	Room 101AB
2:30PM – 3:30PM	PELS Members Congress Meeting	Room 101E
3:00PM – 4:30PM	PELS TC 11: Aerospace Power	Room 101D
3:30PM – 4:30PM	PELS Chapter Chair Forum	Room 101C
3:30PM – 4:30PM	PELS History Committee Meeting	Room 101E
7:00PM – 9:00PM	PELS/IAS YP Reception	Hotel Bode

Tuesday, October 31

8:00AM – 9:30AM	PELS TC 7: Communication Energy Systems	Room 101C
8:00AM – 9:30AM	IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE) Steering Committee	Room 101E
9:30AM – 11:00AM	ECCE Asia Coordination Committee Meeting	Room 101AB
9:30AM – 11:00AM	PELS TC 2: Power Conversion Sys and Components	Room 101C
9:30AM – 10:30AM	Standard Initiative about Solid State Transformer (P3105)	Room 101D
9:30AM – 11:00AM	IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE) Steering Committee	Room 101E
10:30AM – 11:30AM	PELS TC 8: Electronic Power Grid Systems	Room 101D
11:30AM – 12:30PM	eGrid Steering Commitee Meeting	Room 101D
11:00AM – 12:00PM	PELS DE&I Committee	Room 101C
12:00PM – 2:00PM	PELS Mentorship Roundtable Luncheon	Room 101AB
12:30PM – 1:30PM	PELS TC 3: Electrical Machines, Drives, and Automation	Room 101E
12:30PM – 1:30PM	PELS Region 1-3 Chapter Chair Meeting	Room 101C
12:30PM – 1:15PM	Energy Access Committee/EBL Luncheon	Room 101D
1:30PM – 2:30PM	PELS Digital Media Committee	Room 101C
1:30PM – 3:00PM	PELS TC 12: Special Session on Energy Access and Power Electronics	Room 101D
2:00PM – 3:30PM	PELS Open Access Journal	Room 101E

PELS Meetings (continued)

2:30PM – 4:00PM	**PELS VP of Global Intersociety Relations /Education Committee**	*Room 101C*
3:00PM – 4:00PM	**PEDG Steering Committee Meeting**	*Room 101D*
3:30PM – 5:00PM	**PELS Industry Committee Meeting**	*Room 101E*
4:00PM – 5:30PM	**TTE Editorial Board/Steering Com. Mtg**	*Room 101C*
4:00PM – 5:30PM	**PELS TC 5: Sustainable Energy Technical Committee**	*Room 101D*
5:00PM – 6:30PM	**Power Electronics Magazine Advisory Board**	*Room 101E*

Wednesday, November 1

8:00AM – 9:00AM	**PELS Leadership Lessons – *Breakfast sponsored by WiE***	*Room 101AB*
9:00AM – 10:00AM	**PELS Publicity Committee Meeting**	*Room 101D*
9:30AM – 11:30AM	**WIE Committee Meeting**	*Room 101AB*
9:00AM – 11:00AM	**PELS VP of Products Committee Meeting**	*Room 101C*
9:00AM – 10:30AM	**PELS TC 9: Wireless Power Transfer Systems**	*Room 101E*
10:30AM – 12:00PM	**PELS Nominations Committee** (Members Only)	*Room 101E*
11:00AM – 12:00PM	**EiC Brainstorming Session** (Invite Only)	*Room 101C*
12:00PM – 1:30PM	**PELS Publications Luncheon and Awards**	*Room 101AB*
1:30PM – 2:30PM	**PELS TC 4: Electrical Transportation Systems**	*Room 101C*
1:30PM – 3:00PM	**IEEE Transactions on Power Electronics Editorial Board Meeting**	*Room 101AB*
1:00PM – 5:00PM	**PELS VP of Conferences Committee Meeting**	*Room 101D*
1:00PM – 5:00PM	**Digital Media/Education Recording Room**	*Room 101E*
3:30PM – 5:00PM	**PELS Mentorship Committee Meeting**	*Room 101C*

Thursday, November 2

8:00AM – 9:30AM	**PELS & CPSS Meeting**	*Room 101C*
8:00AM – 5:00PM	**Digital Media/Education Recording Room**	*Room 101E*
9:00AM – 11:00AM	**PELS VP Industry & Standards Committee**	*Room 101D*
10:30AM – 12:00PM	**Strategic Planning Committee**	*Room 101C*
12:00PM – 2:00PM	**PELS & IAS Awards Luncheon**	*Karl F. Dean Ballroom*
2:00PM – 5:00PM	**VP of Technical Ops Com. Mtg**	*Room 101C*

Friday, November 3

8:00AM – 8:30AM	**PELS AdCom Breakfast**	*Room 106ABC*
8:30AM – 3:30PM	**PELS AdCom Meeting**	*Room 106ABC*
12:00PM – 1:00PM	**PELS AdCom Lunch**	*Room 106ABC*

SPECIAL **EVENTS**

ECCE Welcome Reception

Sunday, October 29 | 6:00PM – 8:00PM

Location: Karl F. Dean Grand Ballroom

The conference will host a Sunday Welcome welcoming colleagues from both ECCE and IAS. The Presidents of IAS and PELS will greet attendees at the event. You will also have a chance to thank and mingle with our corporate partners, and meet and greet our colleagues who have become IEEE Fellows this year.

Newcomer's Orientation

Sunday, October 29 | 8:00PM – 8:30PM

Location: Room 204

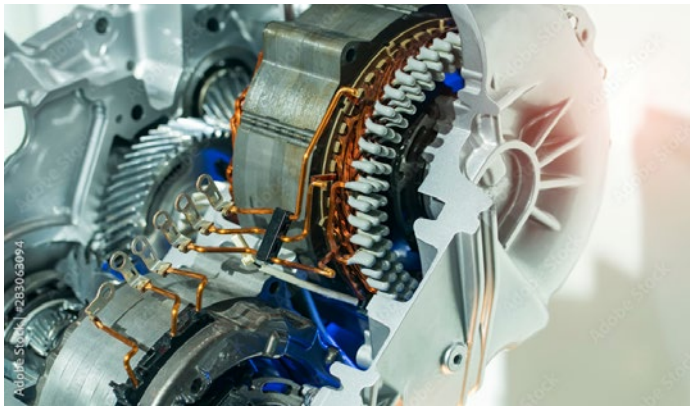
The Newcomer's Orientation is designed for first time attendees and will cover everything you need to know about the conference, schedules, program offerings, behind-the-curtain tricks and tidbits to help you navigate the conference.

ECCE High School Student Outreach: Wind Energy Generator Design

Monday, October 30 | 8:30AM – 1:30PM

Location: Back of Exhibit Hall B

The IEEE Energy Conversion Congress and Expo is pleased to announce its inaugural high school outreach event! The IEEE ECCE is partnering with Engineering for US All (e4usa) to offer this event meant to demystify and democratize engineering. We will expose students to the exciting field of energy conversion through an onsite wind turbine engineering design challenge featuring customized kits designed by KidWind, where the students can wind their own generators and study different magnetic materials. The high school teachers and their students will engage with graduate students through student demonstrations and lunchtime conversations. ECCE would like to extend a huge thank you to Student Demo volunteers who have given their time to engage with and mentor these high school students. The design challenge portion of this event will take place between 9:00AM - 10:45AM. This event is open to all registered conference attendees to watch.



Expo Hall Opening Reception

Monday, October 30 | 5:00PM – 7:30PM

Location: Expo Hall B

Join us for the opening of the ECCE 2023 Exhibit Hall! Enjoy a drink and tastes of hors d'oeuvres from around the world as you mingle with industry partners and friends and explore the latest advances in products and services to meet the needs of current and future challenges facing the energy conversion industry.

Luminaries Special Sessions

Tuesday, October 31 | 5:00PM – 7:10PM

Location: 207 (Tom Jahns Special Session)
209 (Fred Lee Special Session)

Join us for an exclusive series of special sessions dedicated to honoring the contributions of two esteemed scholars in the field of power electronics:

- **Professor Fred C. Lee**, Founder of the Center for Power Electronics Systems (CPES) at Virginia Tech.
- **Professor Thomas M. Jahns**, previous Director of the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) at the University of Wisconsin-Madison.

This unique opportunity offers a chance to learn from their experiences, celebrate their remarkable achievements, and engage in discussions about future trends in this dynamic domain. The sessions will open with a light networking reception to be followed by the opportunity to enjoy the special session.

Networking Dinner

Wednesday, November 1 | 6:00PM – 8:00PM

Location: Karl F. Dean Ballroom

This unique night brings together members from both ECCE and IAS to enjoy a night of networking. Since this years' conference takes place in Music City, get ready to enjoy a taste of local 'Nash' music and food as well as games.

PELS & IAS Awards Luncheon

Thursday, November 2 | 12:20PM – 2:00PM

Location: Karl F. Dean Grand Ballroom

We will gather to celebrate the great achievement of some of our colleagues at our traditional PELS & IAS Award Luncheon event.

Closing Reception

Thursday, November 2 | 5:40PM – 7:00PM

Location: 4th Floor Prefunction Space

Join us for drinks and dessert in the 4th Floor prefunction space following the FREE 90-minute tutorials.

WOMEN IN ENGINEERING (WIE) Events

WIE Keynote Panel and Luncheon

Monday, October 30 | 11:15AM – 12:45PM

Location: Room 207 – Please pre-register

The ECCE WIE Committee will host a panel discussion during lunchtime with the theme ***"Career Development Ceiling? Breaking Through and Guidance!"*** During the luncheon event, we will invite ECCE plenary speakers to share their experiences and challenges in career development within the field of power electronics and related industries. They will also address the issues related to women's career development, and explore industry trends. Join us to explore career development planning and the future of the power electronics industry together!

PELS Leadership Lessons – *Breakfast sponsored by WIE*

Wednesday, November 1 |

8:00AM – 9:00AM

Location: 101AB

PELS WIE will host a breakfast panel session on the topic ***"Leadership Lessons: How to Create Impact Before Reaching Senior Leadership"***. Panelists will share their stories about their career experiences and triumphs and shed light on the challenges they faced and the strategies they used to navigate through them successfully. Join us to exchange ideas, shape the conversation and gain valuable insights to pave your own path to achievement.

Tour Options

TOUR SIGN UP Pre-registration and pre-payment for tours are required. To sign up for a tour, visit the ECCE Registration Desk located on the 2nd floor.

ECCE is thrilled to introduce two captivating local tours showcasing Nashville's rich musical culture and vitality! Tour 2 offers a tailored experience for audio enthusiasts at the renowned RCA Studio B. Get ready to witness audio signals on oscilloscopes and explore other fascinating audio equipment.

TOUR 1 Cost: $60

Part 1: Country Music Hall of Fame Tour

Tuesday, October 31 | 11:15AM – 1:00PM

For over half a century the Country Music Hall of Fame and Museum has been home to a growing collection of over 2.5 million artifacts, including one-of-a-kind recordings, films, instruments, and more. Visitors of all ages will discover the connections between country music's past and artists of today in the interactive gallery space. Witness everything from Hank William's cherished Martin guitar to Elvis Presley's custom Cadillac, to outfits and instruments from all your favorite artists! The museum is completely self-guided, and guests typically spend about 1.5 – 2 hours viewing the exhibits. Please meet at the Country Hall of Fame Museum a few minutes before the tour starts to check in for your self-guided tour.

Part 2: Ryman Auditorium Guided Tour

Tuesday, October 31 | 2:00PM – 3:00PM

A National Historic Landmark, Ryman Auditorium was built by Captain Thomas G. Ryman in 1892 as the Union Gospel Tabernacle. A 13-time winner of the prestigious Pollstar Theatre of the Year award, the historic venue is well-known as the Mother Church of Country Music and is the most famous former home of the Grand Ole Opry (1943-1974). This tour arranged by ECCE will take attendees behind the scenes at the Ryman and explore the inner workings of this historic music venue. The Ryman is walking distance from MCC (.2 miles). Please meet at the 2nd Floor Registration area 15 minutes prior to the tour start time and an ECCE representative will walk the group over and check the tour group in.

TOUR 2 Cost: $60

Part 1: Historic RCA Studio B Tour

Tuesday, October 31 | 10:00AM – 11:00AM

Built in 1957, RCA Studio B became known as the birthplace for the "Nashville Sound," a style characterized by background vocals and strings that helped establish Nashville as an international recording center, located on Nashville's Music Row.

Located on renowned Music Row, Historic RCA Studio B is one of the most famous studios in the world. Over 35,000 songs were recorded here by artists such as Dolly Parton, Elvis Presley, Roy Orbison, and even more recently, Martina McBride and Carrie Underwood. Hear the stories behind the legendary recordings and view some of the original instruments used in producing over 1,000 hit records on this private guided tour. This tour will also explore sound in the context of some of the important songs that were recorded at the studio as well as information about the advent of multitrack recording and the sound properties of the studio spaces.

ECCE has arranged bus transportation from MCC to Studio B. Please meet outside the UPS store on Level 2 near the 6th Avenue entrance. Buses will be loading in the bus loading area on 6th avenue (across from parking garage entrances to MCC). Bus departs at **9:30AM**.

Part 2: Country Music Hall of Fame Tour

Tuesday, October 31 | 11:15AM – 1:00PM

For over half a century the Country Music Hall of Fame and Museum has been home to a growing collection of over 2.5 million artifacts, including one-of-a-kind recordings, films, instruments, and more. Visitors of all ages will discover the connections between country music's past and artists of today in the interactive gallery space. Witness everything from Hank William's cherished Martin guitar to Elvis Presley's custom Cadillac, to outfits and instruments from all your favorite artists! The museum is completely self-guided, and guests typically spend about 1.5 – 2 hours viewing the exhibits. Please meet at the Country Hall of Fame Museum, a few minutes before the tour starts to check in for your self-guided tour.

PRESENTER INFORMATION

Oral Presenters

SPEAKER READY ROOM

Sunday through Thursday

Location: Room 206B

All oral presenters must check in at the Speaker Ready Room at least four (4) hours prior to their scheduled session. Even if you have submitted your presentation in advance and have no changes, you must check and confirm that the presentation is correct.

Speaker Ready Room Hours:

Sunday, October 29 . . . . . 7:30AM – 3:30PM
Monday, October 30 . . . . . 7:30AM – 3:30PM
Tuesday, October 31 . . . . . 7:30AM – 10:30AM
Wednesday, November 1 . . . . . 7:30AM – 5:00PM
Thursday, November 2 . . . . . 7:30AM – 12:00PM

You may also edit your presentation during speaker ready room hours. If you have edits to your presentation, you will need to re-upload your presentation by 4:00PM the day prior for speakers presenting before 12:00PM or by 12:00PM for speakers presenting after 1:00PM. Please note, if you have edits to your presentation after the cutoff time, you will need to bring them with you on a flash drive directly to the session room. AV personnel will upload all presentations onto the laptop in your scheduled session room.

ORAL PRESENTERS' ORIENTATION

On the day of a presentation a Speakers' Breakfast will be held for oral presenters, session chairs and special session presenters 7:00AM – 8:00AM Monday through Thursday in room 207 on Level 2. Poster presentations do not attend the breakfast.

Oral presenters should meet with their respective session chairs to review the format and timing of their session and alert conference management of any changes. Oral Presenters should attend the orientation each day that they are scheduled to provide an oral presentation (or chair a session); you may only attend on days on which you are scheduled to speak.

Poster Presenters

POSTER PRESENTATION SCHEDULE

Monday, October 30 and Tuesday, October 31

Location: Exhibit Hall B

POSTER SESSION I
Monday, October 30 . . . . . 5:30PM – 7:10PM

POSTER SESSION II
Tuesday, October 31 . . . . . 10:30AM – 12:10PM

POSTER SESSION III
Tuesday, October 31 . . . . . 2:30PM – 4:10PM

Location: Level 4 Prefunction Area

POSTER SESSION IV
Thursday, November 2 . . . . . 2:00PM – 3:40PM

Posters will be on display on Monday and Tuesday in Exhibit Hall B. Thursday Poster Sessions will be held on Level 4 outside the Grand Ballroom. Poster presenters should be available for questions at their display boards during their scheduled poster presentation time. If you are unsure which session your poster should be presented, please review the complete Technical Session schedule. Poster Presenters will have access to Exhibit Hall B as well as Level 4 at Music City Center to set up and tear down their posters at the times listed below.

POSTER SESSION I

Monday, October 30

Setup . . . . . 5:00PM – 5:30PM
Poster Presenters' Orientation . . . . . 5:15PM – 5:30PM
Poster Session . . . . . 5:30PM – 7:10PM
Breakdown . . . . . 7:10PM – 7:40PM

Presenters for Poster Session I must have their posters set-up no later than 5:30PM. Any posters that remain on the poster boards at 7:40PM, and do not belong in Poster Session II will be removed and kept at the Registration Desk.

POSTER SESSION II

Tuesday, October 31

Setup . . . . . 10:00AM – 10:30AM
Poster Presenters' Orientation . . . . . 10:15AM – 10:30AM
Poster Session . . . . . 10:30AM – 12:10PM
Breakdown . . . . . 12:10PM – 12:40PM

Presenters for Poster Session II must have their posters set-up no later than 10:30AM. Any posters that remain on the poster boards at 12:40PM and do not belong in Poster Session III will be removed and kept in the Speaker Ready Room.

POSTER SESSION III

Tuesday, October 31

Setup . . . . . 2:00PM – 2:30PM
Poster Presenters' Orientation . . . . . 2:15PM – 2:30PM
Poster Session . . . . . 2:30PM – 4:10PM
Breakdown . . . . . 4:10PM – 4:40PM

Presenters for Poster Session III must have their posters set-up no later than 2:30PM. Any posters that remain on the poster boards at 4:40PM will be removed and kept in the Staff office (206A).

POSTER SESSION IV

Thursday, November 2

Setup . . . . . 1:30PM – 2:00PM
Poster Presenters' Orientation . . . . . 1:45PM – 2:00PM
Poster Session . . . . . 2:00PM – 3:40PM
Breakdown . . . . . 3:40PM – 4:10PM

Presenters for Poster Session IV must have their posters set-up no later than 2:00PM. Any posters that remain on the poster boards at 4:10PM will be removed and kept in the Staff office (206A). All uncollected posters will be discarded at the end of the conference.

PLENARY SESSION
KEYNOTE SPEAKERS

7:30AM – 8:30AM | Welcome Coffee & Snacks

Karl F. Dean Ballroom

Keynote Session Moderator

Giovanna Oriti
Naval Postgraduate School, USA
ECCE2021 General Chair

Monday, October 30 8:30AM – 11:15AM

General Chair/PELS President Welcome

Brad Lehman
Northeastern University, USA
ECCE 2023 General Chair

IAS President Welcome

Andy Knight
University of Calgary, Canada
IAS 2023 General Chair

9:00AM | Silicon Carbide Technology Development: Unlocking Efficiency and Sustainability in Clean Energy

Elif Balkas
Chief Technology Officer
Wolfspeed

As Chief Technology Officer, Dr. Balkas focuses on pioneering breakthrough semiconductor technology for Wolfspeed's Power and RF commercial applications. She joined Wolfspeed in 2006 and has more than 20 years of experience in various leadership positions within the wide bandgap (WBG) materials field in the technology industry. Prior to Wolfspeed, Dr. Balkas served as a scientist at Intrinsic Semiconductor where she was responsible for GaN and Silicon Carbide epitaxy product development with a focus on high-quality, efficient and effective processes.

Dr. Balkas co-founded the Women's Initiative at Wolfspeed, has served as the leader of the Professional Development Focus, and continues to serve on the Women's Initiative Steering Committee. She has a Ph.D. in materials science from North Carolina State University and has completed several executive education programs at The Wharton School focusing on product management and strategy, scaling a business, and leadership development.

ABSTRACT

Silicon carbide (SiC) has revolutionized power electronics with its wider bandgap, higher thermal conductivity and capability to handle higher voltages and temperatures. This keynote will highlight the outstanding thermal and chemical performance of SiC and how it's a perfect fit for challenging environments. SiC power devices deliver reduced power losses, higher efficiency and faster switching that propels compact, lightweight and efficient solutions for electric vehicles, renewable energy and high-voltage systems. Additionally, SiC's contributions to solar inverters, wind turbines and energy storage systems ensure higher efficiency and reliability in clean energy technologies. Furthermore, this keynote will address SiC's significant role in advancing sustainability as the world embraces cleaner power solutions. The presentation will conclude by highlighting the ongoing research that is addressing key challenges such as manufacturing costs, wafer size, material defects, and interface quality, unlocking SiC's immense potential for innovation and sustainable applications across a wide variety of industries. Overall, this keynote aims to inspire and showcase how SiC is transforming power electronics to shape a greener, more sustainable future in clean energy.

9:15AM | Enabling Innovations of Electrification of Aviation

Riona Armesmith
Chief Technology Officer
magniX

Riona Armesmith is Chief Technology Officer of magniX, the company powering the electric aviation revolution with electric propulsion solutions. As a skilled engineer in the mobility space, Riona brings an in-depth understanding and passion for the industry to magniX.

Riona has extensive experience in the aerospace industry with years of progressive leadership roles and an electronic and electrical engineering background, with expertise in electrical machine design. Prior to magniX, Riona had a long tenure with Rolls-Royce, a global leader in aerospace propulsion systems. At Rolls-Royce, Riona served in various leadership roles, most recently as Head of Programmes, Aviation Futures. Under Riona's leadership, magniX is working to advance its electrical propulsion systems toward certification and production at scale.

ABSTRACT

Aerospace is widely reported as one of the most challenging industries to decarbonize. However, challenging does not mean impossible, and the era of electric aircraft is here with upwards of 200 aircraft electrification projects in development globally. This keynote will explore the technical innovations required to achieve the electrification of Aviation covering everything from components to systems, data, and infrastructure.

9:30AM | Accelerating Technologies to Enable the Grid of the Future

Susan Hubbard
Deputy Laboratory Director
S&T – Oak Ridge National Laboratory

Dr. Susan Hubbard is the Deputy Laboratory Director for Science and Technology at Oak Ridge National Laboratory (ORNL) and the Executive Vice President for Science and Technology at UT-Battelle. She oversees one of the nation's most extensive portfolios of research and development, spanning physical and materials sciences, energy sciences and technologies, computing and computational sciences, neutron sciences, biological and environmental sciences, isotope science and technologies, and global security. She also oversees the transfer of ORNL technologies into the marketplace, and works closely with key partners to advance regional innovation, including on topics such as advanced mobility and decarbonization.

Hubbard has over a decade of scientific leadership in a national laboratory setting, most recently as an Associate Laboratory Director of the Earth and Environmental Sciences Directorate at Lawrence Berkeley Laboratory. Susan received her PhD in engineering from University of California at Berkeley, and prior to joining Berkeley Laboratory she was geologist at the US Geological Survey and a geophysicist in industry.

Among other awards, Dr. Susan Hubbard has been recognized as a member of the National Academy of Engineering and as a Fellow of the American Academy of Arts and Sciences, American Geophysical Union, and the Geological Society of America. She has and has an extensive record of National and professional service on scientific advisory boards, editorial boards, and committees.

ABSTRACT

The U.S. electric grid, initiated over 140 years ago, has fueled our nation's economic growth. Several drivers now underpin an urgent need to develop a 21st century grid that is resilient, secure, intelligent, and automated – a grid that can support to diverse energy sources and end users and withstand increasing extreme events and cyber-physical attacks. This presentation describes several technologies that are being developed to enhance our situational understanding of, response to, and control of a future grid through taking advantage of DOE National Laboratory capabilities, facilities, and partnerships. Progress in advancing specific elements important for realizing our future grid will be presented, including standardized and modular power electronics and controls for each stage of power delivery, and rapid sensing and analysis tools to enable grid security. I will then discuss the use of physical testbeds, such as the ORNL GRID-C facility and a Chattanooga-based microgrid, for scaling up and integrating components. Finally, the presentation will describe the use of DOE's high-performance computers - including the world's first exascale computer - for computationally exploring aspects important for large-scale grid planning, such as energy system interdependencies, optimal grid expansion and resource placement, and rapid response strategies to extreme events.

9:45AM | The Electrification and Digitization of the New Energy Landscape

Annette Clayton
Chief Executive Officer
Schneider Electric North America

Annette Clayton serves as the chief executive officer for Schneider Electric North America, responsible for the region's business strategy, and developing and fostering new growth business models in the areas of sustainability, decarbonization and renewables to further the mission towards an all-electric world. During her 11+ year tenure with the company, Clayton was also responsible for the P&L of the North America operating region and served as the Group's Chief Supply Chain Officer. She is a member of the company's Executive Committee.

Prior to Schneider Electric, Clayton served as the vice president, Global Operations, Dell, where she led the transformation of its global supply chain and fulfillment operation among other executive roles in Quality, Customer Satisfaction, and Real Estate. From 1983 to 2006 Clayton worked at General Motors in senior management roles, including the president of Saturn Corporation.

Clayton sits on the boards of the National Electrical Manufacturers Association and served as its chair in 2021 and 2022, and the National Association of Manufacturers. She provides oversight on Schneider Electric's financially backed boards of AlphaStruxure, Uplight, and Qmerit. She is also a board of director with Duke Energy and NXP Semiconductors. Clayton is a founding member of the Zero100 Advisory Board and is a Champion for the JourneyToLead organization where she contributes to accelerating the diversity and trajectory of women in leadership.

Clayton graduated from Wright State University with a bachelor's degree in general engineering and obtained a master's degree in engineering management from the University of Dayton. She has also completed the London Business School executive development program.

ABSTRACT

Today, the electric grid is mission critical for the rapid adoption of renewable energy and electric vehicles. While the grid is considered by many as the greatest engineering achievement of the 20th century, it was not designed to manage the evolving requirements of the 21st century. And with the increase in microgrids and other distributed energy resources in commercial and industrial buildings, homes, EV fleets, and batteries and bi-directional charging, they are all emerging as part of the new energy landscape and the drive to a more digital and sustainable future.

This presentation will explore how the advances in IoT technology--as more assets are being connected, monitored, and controlled by software--are accelerating the pace of change to support America's power grid as a system that works in cooperation between the demand and supply sides of the energy equation.

10:00AM – 11:15AM | Keynote Panel Session and Q&A

LUMINARIES **SPECIAL SESSIONS**

Join us for an exclusive series of special sessions dedicated to honoring the contributions of two esteemed scholars in the field of power electronics:

- **Professor Fred C. Lee**
  Founder of the Center for Power Electronics Systems (CPES) at Virginia Tech
- **Professor Thomas M. Jahns**
  Previous Director of the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) at the University of Wisconsin-Madison

Tuesday, October 31

5:00PM – 5:30PM | Light Refreshments
5:30PM – 7:10PM | Special Sessions

PROFESSOR THOMAS M. JAHNS SPECIAL SESSION

Room 207

This first-of-its-kind special session will celebrate the lifetime professional achievements of Prof. Jahns during the past 50 years. Prof. Jahns is known worldwide for his pioneering contributions to electric machines and power electronics, particularly in the field of high-performance permanent magnet machines and drives. These contributions span a wide range of ground-breaking technologies, beginning with the fault-tolerant modular motor drives that he developed during his Ph.D. studies and continuing today with his latest advances in state-of-the-art integrated motor drives using wide-bandgap switches in current-source inverter topologies for emerging automotive and aerospace applications. Prof. Jahns is a Life Fellow of IEEE and a US National Academy of Engineering (NAE) member. He is the recipient of the 2005 IEEE Nikola Tesla Technical Field Award and the 2022 IEEE Medal in Power Engineering. Invited speakers will share their perspectives about Prof. Jahns' technical contributions as well as special memories and anecdotes drawn from their personal relationships with Prof. Jahns. Attendees will be given an opportunity to share their thoughts and memories, and Prof. Jahns will share a few of his own. All ECCE attendees are invited to participate in this celebratory event designed to combine the serious with the light-hearted.

This unique opportunity offers a chance to learn from their experiences, celebrate their remarkable achievements, and engage in discussions about future trends in this dynamic domain. The sessions will open with a light networking reception to be followed by the opportunity to enjoy the special session.

PROFESSOR FRED C. LEE SPECIAL SESSION
Celebrating Fred C. Lee, VPEC (40 years) & CPES (25 years)

Room 209

Dr. Fred Lee is a distinguished figure in the realm of power electronics, renowned for his groundbreaking research and visionary leadership in high-frequency power conversion, magnetics, EMI, distributed power systems, renewable energy, power quality, high-density packaging, and modeling and control. Dr. Lee is a past President of the IEEE Power Electronics Society, a University Distinguished Professor Emeritus, and Founder and Director Emeritus of CPES, a preeminent academic center in power electronics research at Virginia Tech.

As VPEC and CPES Director, Dr. Lee has created one of the most successful and influential programs in power electronics worldwide that encompasses research, technology development, educational outreach, industry collaboration, and technology transfer. CPES focuses its research on meeting industry needs and allows the industry to profit from the Center's research and outputs. To date, more than 240 companies worldwide have benefited from the CPES industry partnership program that Dr. Lee created.

Throughout his career, Dr. Lee has supervised to completion of 90 Ph.D. and 94 Master's students. He mentored engineers who became prominent educators, researchers, entrepreneurs, and industry leaders. He holds 107 U.S. patents, authored 338 journal articles, and coauthored over 794 technical papers. His contributions earned accolades like the prestigious Ernst Blickle Award (2004), the IEEE Medal in Power Engineering (2015), and the CPSS Power Supply Technology Outstanding Achievement Award (2017). Dr. Lee is a member of the U.S. National Academy of Engineering and a Life Fellow of IEEE. According to the Microsoft H index, Dr. Lee is rated among the top three best-cited authors for over 2.5 million engineering authors in the world.

We invite you to join us in celebrating Dr. Lee's extraordinary journey, an opportunity not only to honor his remarkable achievements but also to gain insights from him regarding his "secret magics" and valuable advice for the younger generation of power electronics engineers.

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Monday, October 30 12:50PM – 2:30PM

SS1 | Grid-Interactive Power Converters –Technological Advancements and Opportunities

Room 205B

Chair/Organizers:

Gab-Su Seo, *National Renewable Energy Laboratory, (NREL), USA*

Behrooz Mirafzal, *Kansas State University, USA*

Historically the growth of electric power systems has been driven by large-scale generators and transmission systems due to economies of scale. However, new challenges arise as the proportion of power generation from nontraditional sources like wind and solar continues to increase. These renewable resources can vary significantly in size, from small residential rooftop solar and battery systems to large utility wind and solar power plants in the gigawatt range, and are integrated into both distribution and transmission systems. Many of these new resources are called inverter-based resources (IBRs) and are connected through inverters rather than electromechanical machines. In large power systems, there will be a mix of electromechanical and inverter-based resources, creating a hybrid power system. Advanced grid-support control and grid-forming (GFM) inverters will be essential, despite limited experience and understanding in this area, to improve resiliency and maintain stability in such hybrid systems. Historically the growth of electric power systems has been driven by large-scale generators and transmission systems due to economies of scale. Thus, electricity access to remote rural communities was hindered because grid expansion with large-scale technologies was cost-prohibitive. However, with technological advances in power electronics, renewable energy technologies, and energy system technologies, deploying such resources in a distributed manner has become economically feasible. Of specific interest is the deployment of IBRs in the form of microgrids. Networked microgrids provide new opportunities to address the adverse impacts of extreme climate events on the power grid. To bring these new opportunities to fruition, new perspectives are needed for designing and implementing IBRs. This Special Session will cover various topics related to managing grid-supportive IBR controls, energy storage systems, networked microgrids, black start and restoration of microgrids, the role of grid-forming and grid-following inverters, and ancillary services to the grid provided by inverters.

Session Panelists/Speakers

Gab-Su Seo, *National Renewable Energy Laboratory (NREL), USA*

Behrooz Mirafzal, *Kansas State University, USA*

Jingbo Liu, *Eaton, USA*

Aswad Adib, *Oak Ridge National Laboratory (ORNL), USA*

Wenzong Wang, *Electric Power Research Institute (EPRI), USA*

SS2 | Unlocking the Potential of HVDC Technology for Future Grids

Room 205C

Chair/Organizers:

Frans Dijkhuizen, *Hitachi Energy Research, USA*

Xiongfei Wang, *KTH Royal Institute of Technology, Sweden*

The High-Voltage Direct-Current (HVDC) technology is increasingly adopted for large-scale integration of remote renewable power plants,reinforcement of transmission systems with increased controllability and enhanced stability, and highly efficient interconnections between power grids. Hybrid AC/DC transmission systems will be the backbone of future power grids. Grid-forming capabilities are being imposed on HVDC links to secure a stable power transmission grid. Multi-terminal HVDC transmision systems and meshed HVDC grids are emerging to maximize the benefits of HVDC technology for promoting sustainable power systems. The panel will bring together experts from academia, industry, and government to share their knowledge and insights on the potential of HVDC technology for future grids. The challenges and opportunities for exploiting HVDC technology will be discussed.

Session Panelists/Speakers

JefferyDennis, *Grid Deployment Office (GDO), USA*

Jürgen Hafner, *Hitachi Energy, Sweden*

Rajib Datta, *GE Research, USA*

Ram Adapa, *Electric Power Research Institute (EPRI), USA*

Monday, October 30 3:00PM – 4:40PM

SS3 | Introduction to Futuristic Grid Architectures: Solid State Power Substation (SSPS)

Room 209B

Chair/Organizers:

Radha Sree Krishna Moorthy, *Oak Ridge National Laboratory (ORNL), USA*

With the growing deployment of distributed generation, or power electronic interfaced renewable energy and storage technologies, the nature and behavior of the grid is changing. Synchronous machine-driven asset contributions to the generation mix are shrinking, leading to concerns regarding grid stability. Furthermore, the scale of smaller distributed PE resources needed for managing the electrical network could dwarf the existing system leading to more complex optimization problems and communication interconnections. This special session will introduces the concept of a hierarchal system of controllers that spans the grid edge or the customer end to distribution scale substations or solid-state power substation (SSPS). This concept focuses on minimizing the number of interfaces and optimization considerations in the grid by clustering resources into nodes and hubs and are build with fundamental building blocks termed as smart universal power electronics regulators (SUPERs).

Session Panelists/Speakers

Michael Starke, *Oak Ridge National Laboratory (ORNL), USA*

Radha Sree Krishna Moorthy, *Oak Ridge National Laboratory (ORNL), USA*

Rolando Burgos, *Virginia Polytechnic Institute and State University (VTECH), USA*

Babak Parkhideh, *University of North Carolina, Charlotte (UNCC), USA*

SS4 | Intelligence and Digitalization in Sustainable Energy Systems

Room 209C

Chair/Organizers:

Yongheng Yang, *Zhejiang University, China*
Juan Carlos Balda, *University of Arkansas, USA*
Ke Ma, *Shanghai Jiao Tong University, China*
Gab-Su Seo, *National Renewable Energy Laboratory (NREL), USA*

The integration of power electronics in sustainable energy systems (SES) has presented several challenges, e.g., reliability, high-performance simulation, and cybersecurity. Digitalization and artificial intelligence (AI) are being increasingly used to overcome these challenges. For instance, digital twins and AI technologies can be used for system optimization, predictive maintenance, and to analyze data to optimize SES performance. As such, advanced simulation and hardware-in-loop systems are also being used to further optimize SES design and performance. However, a large amount of data may be exposed to cyber attackers. Thus, cybersecurity is of concern in such systems, and robust measures must be in place to protect against cyber-attacks towards the wide-scale adoption of power electronics-based SES. Nevertheless, the integration of digitalization and AI has the potential to transform the energy sector by improving reliability, efficiency, and system optimization. Addressing the challenges and opportunities presented by this rapidly evolving field is essential to achieving the goal of creating more reliable, efficient, and cost-effective SES. In this context, this special session invites industrial experts as well as research institute professionals to discuss emerging topics: ► Simulation of power electronics systems; ► Digital twins and AI in SES applications; ► HiL and power HiL for SES; ► Cyber-security in digital SES.

Session Panelists/Speakers

Jost Allmeling, Plexim GmbH, Switzerland
Fei Gao, *University of Technology of Belfort-Montbeliard (UTBM), France*
Dong Li, *RTDS Technologies Inc., Canada*
Hyungjin Choi, *Sandia National Laboratories, USA*

Tuesday, October 31 8:30AM – 10:10AM

SS9 | Smart Inverter Security and Resilience by Design: Industry Best Practices, Standard and Security Certification, and Research

Room 205C

Chair/Organizers:

Taesic Kim, *Texas A&M University-Kingsville, USA*
Subham Sahoo, *Aalborg University (AAU), Denmark*
Sudip K. Mazumder, *Laboratory for Energy and Switching-Electronics Systems (LESES), University of Illinois Chicago (UIC), USA*

With high penetration of distributed energy resources (DER), power systems are increasingly transforming into distributed power grids which provide grid automation, decarbonization, and de- centralization of critical assets. Smart inverters are key power-electronic devices that connect renewable energy and energy storage equipment to power grids. DER include several intelligent grid functions such as fault ride-through, grid-voltage support, and reactive-power compensation typically with real-time remote access, data exchange, and seamless over-the-air firmware updates in a cyber-physical environment. However, cybersecurity concerns arise due to extensive information exchange among DER and multiple stakeholders (e.g., utilities, aggregators, vendors, operators, and owners). Therefore, smart inverters account for a growing attack surface for the power grid. This special session will present a comprehensive overview of smart inverter security and resilience by design to bridge the gap between cybersecurity and power electronics communities. The topics of their contents include: *Smart Inverter Cybersecurity Best Practices: Introducing cybersecurity best practices from leading smart inverter vendors. Security Standards and Certification programs for smart inverters:* Introducing DER and smart inverter security standard and certification programs including IEEE 1547.3 (Guide for Cybersecurity of Distributed Energy Resources Interconnected with Electric Power Systems), EnergiCERT, UL Cybersecurity Certification Standard for Distributed Energy and Inverter-Based Resources, and SunSpec DER Device Cybersecurity Certification Programs. Research on cyber-resilient smart inverters: Overview of the state-of-the-art technologie for cyber- resilient smart inverter against the advanced/future threat actors from academia and national labs.

Session Panelists/Speakers

Flemming Johansen, *Schneider Electric, USA*
Victor Lory, *DEIF A/S, Denmark*
Danish Saleem, *National Renewable Energy Laboratory (NREL), USA*
Taesic Kim, *Texas A&M University-Kingsville, USA*
Sudip K. Mazumder, *University of Illinois Chicago, USA*
Subham Sahoo, *Aalborg University, Denmark*

SS10 | Advancements in Wide Band Gap Technolgies

Room 204

Chair/Organizers:

Victor Veliadis, *North Carolina State University (NCSU), USA*

Advancements in SiC (Silicon Carbide) MOSFETs and GaN (Gallium Nitride) power devices represent pivotal developments in the field of power electronics. SiC MOSFETs and GaN HEMTs offer superior performance characteristics, including lower conduction losses and faster switching speeds, making them ideal for high-frequency and high-power applications. The session delves into discussions with leading industry players such as Microchip, GaN Systems, and Onsemi, aiming to highlight SiC and GaN challenges and potential solutions, as well as their performance advantages. By sharing insights, the session seeks to overcome barriers that may be encountered while harnessing the full potential of these cutting-edge technologies, ultimately driving advancements and innovation in the field of power electronics.

Session Panelists/Speakers

Michael Rogers, *Mitsubishi Electric US Inc., USA*
Mrinal Das, *Onsemi, USA*
Kevin Speer, *Microchip Technology, USA*
Mahdi Jedari, *GaN Systems, USA*
Yang Jiao, *GaN Systems, USA*
Mohammad Bozorgi, *GaN Systems, USA*
Lei Kou, *GaN Systems, USA*
Lucas Lu, *GaN Systems Inc.*
Victor Veliadis, *North Carolina State University (NCSU), USA*
Ali Rahimi, *GaN Systems, USA*

Wednesday, November 1 8:30AM – 10:10AM

SS11 | Specific Electrification Challenges and Potential Solutions for Various Transportation Industries

Room 205B
Chair/Organizer:
Akm Arafat, *Drive System Design, USA*

Globally, there is a huge growth in demand and regulations for the decarbonization of transportation sectors. To meet this objective, efforts to electrify on- and off-highway vehicles and aircraft have been greatly expedited. While the mission is the same, the paths to get there are different. Each transportation industry is facing its own unique challenges and approaching solutions in a variety of ways with design, size, power density requirements, efficiency capabilities and functional safety elements being key focus areas. In this session, transportation industry experts and national lab experts will address cutting-edge technologies connected to advanced electric machines, power electronics and controls in the various modes of transportation. The experts will also focus on potential design approaches to attain desired product attributes (e.g., high power density, efficiency, and robustness), which will highlight the key differences in challenges and suitable solutions for various applications.

Session Panelists/Speakers
Arshan Khan, *CNH, USA*
Shajjad Chowdhury, *Oak Ridge, USA*
Sheikh Rabbi, *Duxion Motors, Canada*
Mohamed Badawy, *Scalvy Inc. and SJSU, USA*

SS12 | Wide-Bandgap Technologies: Reliability, Developments and Next Challenges

Room 209C
Chair/Organizers:
Maurizio Di Paolo Emilio, *Power Electronics News, Aspencore, USA*

The wide-bandgap market has experienced expansion and rising industrial acceptance. As technology advances, businesses are creating a wide range of products that offer advantages in a number of applications for the industrial, automotive and consumer industries, among others. Wide-bandgap semiconductors have improved the performance of power systems while allowing for component cost reduction. Failure rates in the parts-per-billion level are necessary to compete in markets with stricter standards. Reliability tests need to be passed to get this result. The primary reliability issues with wide-bandgap semiconductors like SiC and GaN, as well as the corresponding quality standards in several mission-critical applications, will be covered in this panel discussion. Our industry experts will also discuss the challenges that engineers are now encountering, as well as the remaining obstacles to widespread adoption and, subsequently, to provide enhanced performance and lower prices that will benefit the industry as a whole. Aspects including material quality, thermal management, high-power operation, circuit design, qualification testing and long-term performance will be covered by each panelist in detail.

Session Panelists/Speakers
Doug Bailey, *Power Integrations, USA*
Mrinal K. Das, *Onsemi Advanced Power Division, USA*
Peter Di Maso, *Cambridge GaN Devices, USA*
Jon Siegers, *Wolfspeed, USA*
Cem Basceri, *QROMIS, USA*

SS23 | High-Performance Electric Motors and Power Electronics for On- and Off-Road Electric Vehicles

Room 205C
Chair/Organizer:
Bulent Sarlioglu, *University of Wisconsin-Madison, USA*
Ozge Taskin, *Safran Group, UK*

This special session aims to discuss the newest electric machine and power electronics trends for both on- and off-road vehicles. The electrification of on- and off-road transport is adopting a significant level of innovation using novel architectures, better materials, and advanced manufacturing techniques for electric machines and power electronics. The main trends are listed as reliability, reduction in volume, weight, and cost while increasing the efficiency and performance of the electric motor. Climate change is becoming one of the major concerns in the world, and decarbonizing our energy system is a significant part of responding to this. Electric vehicles are currently one of the best solutions to help decarbonize transport and electricity supply and have a critical role in clean transportation. Nowadays, a range of high-performance but cost-effective advanced electric motors and power electronic converters for on and off-highway vehicles are in high demand. This special session will focus on introducing novel approaches to high-performance electric motors and power electronics used in both on and off-road applications. Motor topology advancements using advanced materials, robust design methods, design optimization, advanced power electronics design, winding design approach, and modular and scalable design approaches will be discussed. Key industry, academic and government experts will be the panelists to discuss how they overcome the market demands and share their expertise to achieve these targets.

Session Panelists/Speakers
Burak Ozpineci, *Oak Ridge National Laboratory (ORNL), University of Tennessee, USA*
Bo Zhang, *Tesla, USA*
Selin Yaman, *John Deere Intelligent Solutions Group, USA*
Tatiana Minav, *Tampere University, Finland & University of Agder, Norway*
Martin Bauer, *WAFIOS AG, Reutlingen, Germany*

SS14 | The Role of Power Hardware-in-the-Loop Simulation in the Successful Rollout of New Power Electronics Solutions

Part 1: 8:30AM - 10:10AM
COFFEE BREAK
Part 2: 10:40AM - 12:20PM

Room 205A
Chair/Organizers:
Pavel Purgat, *EGSTON Power Electronics GmbH, Austria*
Daniel Skibicki, *EGSTON Power Electronics GmbH, Austria*
Srdjan Srdic, *EGSTON Power Electronics GmbH, Austria*

The ever-increasing penetration of renewables into power systems and the ongoing transportation electrification calls for more advanced validation and testing of the developed subsystems even before they are fully developed. Power Hardware in the Loop (PHIL) simulation is gaining popularity as an effective tool for validating and testing new energy conversion solutions in both academia and industry. To explore the diverse applications and advantages of PHIL, a panel discussion will be held featuring leading experts from both academia and industry. The panellists will examine the role of PHIL in improving the resiliency and power quality of current power distribution systems, as well as the

potential of PHIL in the development of future smart grids and microgrids. With the increasing complexity and use of power electronics in power distribution systems, PHIL testing can provide valuable insights into the behaviour and performance of these new systems under both normal and abnormal operating conditions. The panellists will discuss the use of PHIL testing in identifying potential failures or weaknesses in power distribution systems and in developing strategies for improving their reliability and stability. The panellists will also discuss the applications of PHIL in transportation electrification, including electric vehicle (EV) charging and the integration of energy storage in power distribution systems. The panellists will share their experiences and insights on how PHIL testing can be used to evaluate the integration of EV chargers and energy storage interfacing converters in the power grid, and their influence on grid power quality. The discussion will also cover the importance of testing the charging equipment in relevant (close-to-reality) environments, which is crucial for its successful mass rollout. Throughout the discussion, the panellists will highlight the advantages of PHIL testing over traditional simulation and testing approaches, such as high fidelity, concurrent testing, repeatability, and versatility. They will also discuss the challenges associated with PHIL testing, such as the need for precise mathematical models and the importance of high-speed communication and real-time computation. The panel will highlight the need for standardization and summarize the ongoing standardization in IEEE WG P2004. The panel discussion will provide a unique opportunity to learn from leading experts in the field of power electronics and power systems and gain insights into the diverse applications and advantages of PHIL testing. The discussion will be of interest to researchers, engineers, and industry professionals involved in the design and development of power electronics systems, as well as those interested in the applications of PHIL testing in transportation electrification, energy storage, power distribution, and smart grid technologies.

Session Panelists/Speakers

Srdjan Srdic, Egston Power Electronics, Austria
Troy Beechner, *RCT Systems, Inc., USA*
Giovanni de Carne, *Karlsruhe Institute of Technology (KIT), Germany*
Enrico Santi, *University of South Carolina, USA*
John Buczek, *GE Power Conversion USA*
Alexander Uzochukwu, *GE Power Conversion USA*
A. Mamianja Rakotozafy, *GE Power Conversion USA*

Wednesday, November 1 10:40AM – 12:20PM

SS15 | Battery Tech vs. Charging Infrastructure: Driving Towards a Sustainable e-mobility Future

Room 209C
Chair/Organizers:
Sheldon Williamson, *Smart Transportation Electrification and Energy Research (STEER) Group, Ontario Tech University, Canada*
Ashish Kumar, *Our Next Energy (ONE), USA*
Akash Samanta, *Ontario Tech University, Canada*

The transition to sustainable e-mobility is a complex process that requires the development of both battery technology and charging infrastructure. A significant development in these two major domains is extremely essential to alleviate some of the major bottlenecks towards transiting to sustainable e-mobility. While battery technology plays a crucial role in determining the range, cost, and performance of electric vehicles (EVs), charging infrastructure is essential for enabling long-distance travel and reducing range anxiety. Advancements in battery technology have already made electric vehicles more viable as a transportation option. Lithium-ion batteries (LIB), for instance, have become smaller, lighter, and more powerful, allowing for longer driving ranges and faster acceleration. However, the internal characteristics of LIB are highly nonlinear and extremely sensitive to the operating and environmental parameters. Therefore, an intelligent safety framework and smart battery management systems (BMS) are extremely essential to ensure safe, reliable, and longer battery life. Furthermore, it is noticed that the frequent incident of fire in electric vehicles (EVs) is primarily due to ineffective BMS, especially poor thermal management control. New battery chemistries, such as solid-state batteries, could potentially offer even greater improvements in performance and safety. Therefore, recent advances in battery technology, BMS, and thermal management of batteries will be explained in significant detail along with the current issues, challenges and future research scopes. Recent advancements such as the application of artificial intelligence, machine learning, digital-twin, internet of things, cloud computing, and wireless BMS will also be covered. Another, import aspects of achieving sustainable e-mobility is the charging infrastructure development. Without adequate charging infrastructure, EVs may still face significant limitations even after adding more capacity and high-tech batteries. Adding more batteries will increase the range but also increase the weight and cost of the vehicle. Moreover, the replacement cost of the vehicle will also be more, resulting in a higher total ownership cost of EVs. EV drivers need access to a network of charging stations that can support long-distance travel and charging times that are comparable to refuelling times for gasoline vehicles. Failing to do that, EVs will never attract more users and the future of EVs will be questionable. This requires the deployment of high-speed and an adequate number of charging stations. Therefore, recent developments, issues and challenges of EV charging including wireless charging, DC fast charging along with the potential options to improve charging infrastructure development will be comprehensively discussed. To achieve a sustainable e-mobility future, it is necessary to continue to invest in both battery technology and charging infrastructure. While at the same time, the development of widespread, fast, and affordable charging infrastructure will enable the wide adoption of EVs.

Session Panelists/Speakers

Burak Ozpineci, *Oak Ridge National Laboratory (ORNL), USA*
Uday Deshpande, *D&V Electronics, Canada*
Sahar Sam, *Intellectulogy, Canada*
Samuel Haberl, *Our Next Energy, USA*

SS8 | Future of EM Design-Manufacturing Advancements

Room 102A
Chair/Organizers:
Peter Wung, *University of Dayton & Marquette University*
Keith Klontz

Electric machine design and manufacturing has been an essential part of the. electric power and energy area since the very beginning of electrical engineering. The art and science of electric machine design developed as both congruently, as the design required artistry of synthesis because the early attempts at design were constrained by the dearth of fundamental scientific concepts at that time. Initial forays into electric machine design were accomplished without the benefit of having enough scientific theory to answer the fundamental questions of why and how. The designers applied the artistry of synthesis: try, build, fail, try again, fail again, but failing better each time. The process was repeated until the result becomes acceptable as science that came from analysis progressed while

incorporating experimental results into theory to answer the how and why. Machine designs have evolved along with the technological developments that were occurring in parallel. It is an unceasing loop which iterates between synthesis and analysis and the loosening of constraints to meet the application driven specifications and conversely, the loosening of the constraints which drives the evolution of the specifications. In weaving constraints into the process of electric machine design, a conceptual feedback loop can be created to fit the constraints-based narrative. Figure 1 is a conceptual design loop for electric machine design to help visualize the loop. At this moment in history, we are benefitting from the confluence of accelerated advancements in technologies as described, which has accelerated the pace of electric machine development and design. Concomitant with accelerated advancements, we are challenged by the realities of Climate Change and global warming, which creates demands, both in the sense of urgency that we must adapt in order to change the trajectory, but also in driving future new application developments, which would in turn drive the entire constraints-based feedback loop. It is critical at this point in history that the experienced and neophyte practitioners of the art of electric machine design need to congregate and collaborate to determine the status of our latest advancements in the developing technologies we have available to us, to think about the potentials of these technologies in the advancement blocks. And also reflect and reexamine the constraints in ambitiously seeking ways to overcome them.

Session Panelists/Speakers

Ramon Guitart, *Infinitum*
Sumeet Singh

SS13 | Transient and Dynamic Modeling and Control of Large-Scale, Resilient Distribution Systems with High Penetration of Inverter-based Distributed Energy Resources and Loads

Part 1: 10:40AM – 12:20PM
COFFEE BREAK
Part 2: 2:00PM – 3:40PM

Room 205C
Chair/Organizers:
Wei Du, *Pacific Northwest National Laboratory (PNNL), USA*
Xiaonan Lu, *Purdue University, USA*

The distribution system is experiencing a significant change with the massive increase of grid-following and grid-forming, inverter-based distributed energy resources (DERs) and loads in recent years. This brings challenges to the modeling and simulation of such complex, large-scale distribution systems with potentially thousands of inverter-based DERs and loads. The special sessions gather domain experts from national labs, universities, inverter manufacturers, utilities and government agencies to discuss the challenges and potential solutions of modeling the transient and dynamic behaviors of large-scale, resilient distribution systems with high penetration of inverter-based DERs and loads. First, the physics-based and data-driven approaches such as white-, black-, and gray-box modeling that aim to address the challenges of inverter modeling under different situations will be presented. Second, an integrated electromagnetic transient and three-phase phasor co-simulation platform that aims to simulate large-scale distribution systems with potentially thousands of inverter- based DERs and loads will be introduced. Third, real-world transient and dynamic events of distribution feeders with high penetration of inverter-based DERs captured by high-resolution micro-phasor- measurement-units (μPMUs) and power quality meters will be shared and discussed. Finally, panel discussions and interactions with the audience will also be included in this special session.

Session Panelists/Speakers

Yi Yang, *the U.S. Department of Energy Solar Energy Technologies Office (SETO), USA*
Wei Du, *Pacific Northwest National Laboratory (PNNL), USA*
Roshan Sharma, *ComEd, USA*
Hanchao Liu, *GE Research, USA*
Zhe Chen, *GE Research, USA*
Yaosuo (Sonny) Xue, *Oak Ridge National Laboratory (ORNL), USA*
Francis K. Tuffner, *Pacific Northwest National Laboratory (PNNL), USA*
Xiaonan Lu, *Purdue University, USA*

SS19 | Bidirectional Switches are Coming. Are You Ready?

Part 1: 10:40AM – 12:20PM
LUNCH
Part 2: 2:00PM – 3:40PM

Room 201A
Chair/Organizers:
Thomas Jahns, *University of Wisconsin – Madison, USA*
Jin Wang, *The Ohio State University, USA*

Power semiconductor devices that can block voltage and control current flow in both polarities have been an unfulfilled dream of power electronics engineers for the past 60 years. MOS-gated silicon power semiconductor technology faced challenges that made it difficult to apply in commercially-viable monolithic bidirectional (BD) switches, but the prospects today look much more promising with wide- bandgap (WBG) power semiconductors. In fact, WBG-based BD switch technology has advanced to the point that some power semiconductor manufacturers have begun offering sample BD switch devices to interested customers, raising hopes for the beginning of commercial production in the non-too-distant future. If this vision of production BD switches sounds appealing, then this special session is for you! Not convinced yet? Here are two reasons to take this emerging trend seriously. First, there are numerous mass-volume power applications where it is necessary to control the flow of bidirectional power, including electric vehicle charging, distributed and grid-tied power systems using regenerated energy and/or energy storage components, and solid-state circuit breaker protection. In addition, the world is full of opportunities for integrated motor drives that combine the motor and power electronics in the same housing. Some of the most promising power converter topologies for these applications such as matrix converters, current-source inverters, Vienna rectifiers, and T-cell converters would benefit greatly from the availability of WBG-based BD switches. The second reason for taking this trend seriously is that silicon carbide (SiC) and gallium nitride (GaN) bidirectional power switches are poised to enable these applications with their compelling advantages of high efficiency, high blocking voltage capability, and lower weight/volume system implementations. In particular, monolithic switches allow for bidirectional symmetric conduction and voltage blocking with a chip area close to that of a similarly rated unidirectional switch, making them ideally suited to fuel a revolution in power electronics technology. Today, in the absence of commercially-available BD switches, back-to-back (anti-series) connection schemes of unidirectional power devices are typically used, resulting in a 4X penalty in chip area and high cost that make them uncompetitive. In contrast, a variety of monolithic SiC and GaN switch bidirectional concepts are being actively pursued including dual-gate bidirectional GaN switches, and back-to-back connected SiC MOSFETs and JFETs. This session will be broken into two major sections, and each section will consist of presentations by experts in this field followed by a facilitated panel discussion that will encourage participants to pose questions to the presenters. The first of these two sections will focus on the semiconductor technology of SiC and GaN bidirectional switches including their operating

principles, promising monolithic bidirectional devices reported to date, current development status, and commercialization issues. The second section will focus on key applications and power converter topologies that will benefit from the availability of BD switches, including both static power converters for grid-tied applications and future motor drives in transportation and industrial/commercial applications. Please come to learn and participate in a lively discussion about the future of this promising BD switch technology!

Session Panelists/Speakers

Victor Veliadis, *PowerAmerica, North Carolina State University (NCSU), USA*
Isik Kizilyalli, *ARPA-E, US Dept. of Energy), USA*
Mohamed Imam, *GaN Concept Eng. Design Ctr, Infineon Tech. Americas), USA*
Rakesh Lal, *Transphorm, Inc.), USA*
Subhashish Bhattacharya, *North Carolina State University (NCSU)), USA*
Johann Kolar, ETH Zurich, *Power Electronics System Laboratory, Switzerland*
Bulent Sarlioglu Professor, *Univ. of Wisconsin – Madison, WEMPEC), USA*
Thomas Jahns Em., *Univ. of Wisconsin – Madison, WEMPEC), USA*
Jin Wang Professor, *The Ohio State University, CHPPE), USA*

Wednesday, November 1 2:00PM – 3:40PM

SS17 | Transmission Expansion Planning Models for Offshore Wind Energy in the U.S.

Room 202A
Chair/Organizers:
Johan Enslin, *Clemson University*
James McCalley, *Iowa State University*
Eric Hines, *Tufts University*
Per-Anders Lof
Barbara Garnick

Amid rising concerns regarding the dearth of fossil fuels and global climate change, different nations across the globe have set forth vigorous targets for renewable integration and corresponding power network development/upgradation. One of the most significant renewable resources is offshore wind (OSW) power which bears the capability to resolve the above discuss challenges if developed properly. This session is dedicated to planned offshore grid development in the U.S. Atlantic Coast to integrate existing/future OSW wind power projects into the onshore grid. In the first section of this special session, the developed transmission expansion planning (TEP) models that support the exploration of topologies for a future integrated onshore/offshore electricity grid will be discussed. The TEP models are based on state-of-the-art reduced bus models of the Eastern Interconnect (EIC) that facilitate rapid scenario power flow, reliability, and production-cost assessments. Based on these TEP models, developed topologies that integrate the full capacity of existing BOEM lease and call areas will be presented. The subsequent section of the special session will present a modular multi-terminal HVDC (MTDC) network for large-scale integration of OSW power. It will present the associated challenges and provide a way forward for the realization of the planned offshore grid. This session could provide an initial guideline for electric utilities, regulators, and government departments to accrue maximum benefit from the enormous OSW resource in the U.S. The associated market structure, environmental impact, and equity related to OSW power development in the U.S. will be discussed in the last section of this special session followed by an open discussion with participants.

Session Panelists/Speakers

Johan Enslin, *Clemson University, USA*
Moazzam Nazir, *Clemson University, USA*

SS18 | Future of Electric Machines Design Materials Advancement

Room 102A
Chair/Organizer:
Peter Wung, *University of Dayton & Marquette University, USA*
Ayman EL-Refaie, *Marquette University, UK*
Barrie Mecrow, *New Castle University, UK*

Electric machine design and manufacturing has been an essential part of the. electric power and energy area since the very beginning of electrical engineering. The art and science of electric machine design developed as both congruently, as the design required artistry of synthesis because the early attempts at design were constrained by the dearth of fundamental scientific concepts at that time. Initial forays into electric machine design were accomplished without the benefit of having enough scientific theory to answer the fundamental questions of why and how. The designers applied the artistry of synthesis: try, build, fail, try again, fail again, but failing better each time. The process was repeated until the result becomes acceptable as science that came from analysis progressed while incorporating experimental results into theory to answer the how and why. Machine designs have evolved along with the technological developments that were occurring in parallel. It is an unceasing loop which iterates between synthesis and analysis and the loosening of constraints to meet the application driven specifications and conversely, the loosening of the constraints which drives the evolution of the specifications. In weaving constraints into the process of electric machine design, a conceptual feedback loop can be created to fit the constraints-based narrative. Figure 1 is a conceptual design loop for electric machine design to help visualize the loop. At this moment in history, we are benefitting from the confluence of accelerated advancements in technologies as described, which has accelerated the pace of electric machine development and design. Concomitant with accelerated advancements, we are challenged by the realities of Climate Change and global warming, which creates demands, both in the sense of urgency that we must adapt in order to change the trajectory, but also in driving future new application developments, which would in turn drive the entire constraints-based feedback loop. It is critical at this point in history that the experienced and neophyte practitioners of the art of electric machine design need to congregate and collaborate to determine the status of our latest advancements in the developing technologies we have available to us, to think about the potentials of these technologies in the advancement blocks. And also reflect and reexamine the constraints in ambitiously seeking ways to overcome them.

Session Panelists/Speakers

Frank Johnson, *Niron Magnetics, Inc., USA*
Nick Simpson, *University of Bristol, UK*
Sastry Pamidi, *FAMU-FSU College of Engineering, USA*
Ayman El-Refaie, Marquette University, USA

SS22 | Challenges and Opportunities for Aviation Electrification and ARPA-E Aviation-class Synergistically Cooled Electric-Motors with Integrated Drives program (ASCEND)

Part 1: 2:00PM - 3:40PM
COFFEE BREAK
Part 2: 4:10PM - 5:50PM

Room 209B
Chair/Organizers:
Bulent Sarlioglu, *University of Wisconsin-Madison*
Jin Wang, *The Ohio State University*
Peter de Bock, *ARPA-E, Department of Energy, USA*

Although the electrification of aircraft is advancing rapidly, developing aircraft propulsion using motors and power electronics is challenging due to technological limitations and safety considerations, especially since 2-10 MW of power is required for regional aircraft. Also, many other technological developments are needed, such as protection, controls, partial discharge mitigation, etc. Nevertheless, these challenges present opportunities for research and development to push the technology further with the ultimate goal of achieving all-electric or hybrid propulsion. This special session is divided into two parts. The first section will focus on the challenges and opportunities for the electrification of aviation. Several complex subjects need to be addressed, including partial discharge, fault tolerance, voltage levels, reliability, protection, and control. and cooling for electric motors and power electronics. This special session will discuss all-electric and hybrid architectures, as well as novel technologies for electric machines and power electronics. The panelists for this session will include key industry, academic, and government experts who will share their expertise and discuss how they are addressing market demands to achieve the target of electrifying aircraft. Topics covered will include high-power wide bandgap devices, electromagnetic interference, partial discharge at high altitudes, high-grade magnets and steel for electric machines, and multi-inverter/multi-phase combinations. The second section will feature presentations from the program director and principal or co- principal investigators for DOE ARPA-e's ASCEND project, which aims to achieve transformational improvements in integrated powertrain (motor + power electronics + thermal management) power density for electrified aviation systems with a target of >12kW/kg. This project has been supporting transformational technologies to reach these targets that include power electronics/ motor integration, material advances, advanced insulation systems, novel cooling methods, and advanced magnetics. Teams will update on the status of these technologies and their timeline towards prototype demonstration.

Session Panelists/Speakers
Philip Abolmoali, *US Air Force Research Laboratory, USA*
Gokcin Cinar, *University of Michigan, USA*
Alan Mantooth, *University of Arkansas, USA*
Thomas Jahns, *Grainger, USA*
Sara Roggia, *magniX, USA*
Amy Jankovsky, *Marquette University, USA*
Ayman El-Refaie, *Marquette University, USA*
Jagadeesh Tangudu, *Raytheon Technologies Research Center, USA*
Ayman EL-Refaie, *Marquette University, USA*
Parag Kshirsagar, *Raytheon Technologies Research Center, USA*
Hamid Toliyat, *Texas A&M University, USA*
Mathew Gardner, *University of Texas at Dallas, USA*
Mike Tomsic, *Hyper Tech Research Inc., USA*
Mohammed Arif Salam, *Honeywell, USA*
Colin Tschida, *Wright Electric, USA*
Yogendra Joshi, *Georgia Tech University, USA*

Wednesday, November 1 4:10PM – 5:50PM

SS20 | Powering the Blue Economy: An Emerging Time for Wave, Hydro, and Current Energy

Room 208A
Chair/Organizers:
Yue Cao, *Oregon State University*
Ted Brekken, *Pacific Marine Energy Center*
Brian Johnson, *University of Texas – Austin*
Eduardo Cotilla-Sanchez, Oregon State University

The US/Canada Pacific Northwest (including Oregon, Washington, Alaska, and British Columbia), among other global coastal and riverine regions (e.g., Tennessee River), has access to abundant renewable energy embedded in ocean and river. The energy, known in a wave form (vertical motion) or a current form (horizontal motion) or a hydrodam form (potential energy), still has limited power generation capacity to local grids due to several challenges, especially at the core of mechanical to electrical energy conversion. In 2019, the US Department of Energy (DOE) launched the Powering the Blue Economy initiative to explore the billions of dollars worth of such hydro energy potential alongside the coastline and riverine communities. This decade marks a new era for research and development to bring the highest efficiency, highest reliability, and lowest cost for such blue energy usage, enabling a wide range of adoption. In this session, four industry and one government panelists and four academia organizers will present and discuss the technology needs, innovations, and demonstrations of converter-level design, interdisciplinary control co-design, and system integration to the microgrid/grid connection. The panel organizers and panelists especially represent recently funded projects by the DOE ARPA-E SHARKS program, and three DOE Water Power Technology Office's Wave and HydroWIRES programs.

Session Panelists/Speakers
Paul Jacobson, *Water and Ecosystems, EPRI*
Landon Mackey, *C-Power*
Alexandre Paris, *ORPC Canada*
Ben McGilton, *National Renewable Energy Lab (NREL)*

SS21 | Ultra Wide Band Gap (UWBG) Semiconductors: Status and Potentialities for Power Electronics

Room 202C
Chair/Organizers
Jean-Luc Schanen, *Univ Grenoble Alpes, France*

In order to meet the increasing demand for power converters, the use of ultra-wide bandgap semiconductors such as diamond, aluminum nitride or gallium oxide (Ga2O3) emerged as a potential path for development. Among these materials, this session proposes an overview diamond and Ga2O3 power devices, with and academic and industrial perspective. the goal is to present the potential advantages and bottlenecks of these future materials. Even if these new materials are not fully ready for industrial use, sample and commercial devices are available, and should be stimulating the audience for new applications. Last but not least, the 3 first spekers (confirmed) never attended ECCE, and that's one of the reason they are interested in participating: they would like to meet actuale users of devices. And for ECCE, this makes 3 registrations of unsusual attendees.

Session Panelists/Speakers
Toshiharu MAKINO, *Advanced Power Electronics Research Center, Japan*
Manpuneet Kaur Benipal, *Advent Diamond, USA*
David EON, *Univ. Grenoble Alpes, France*
Yuhao Zhang, *Virginia Tech, USA*

Thursday, November 2 8:30AM – 10:10AM

SS5 | Future of Electric Machines Design-Computational Advancements

Room 205C
Chair/Organizers:
Peter Wung, *University of Dayton & Marquette University, USA*
Greg Heins, *Regal Rexnord Corporation, Asia Pacific & Monash University, Australia*
Mircea Popescu, *Ansys, Sheffield, U.K.*

Electric machine design and manufacturing has been an essential part of the. electric power and energy area since the very beginning of electrical engineering. The art and science of electric machine design developed as both congruently, as the design required artistry of synthesis because the early attempts at design were constrained by the dearth of fundamental scientific concepts at that time. Initial forays into electric machine design were accomplished without the benefit of having enough scientific theory to answer the fundamental questions of why and how. The designers applied the artistry of synthesis: try, build, fail, try again, fail again, but failing better each time. The process was repeated until the result becomes acceptable as science that came from analysis progressed while incorporating experimental results into theory to answer the how and why. Machine designs have evolved along with the technological developments that were occurring in parallel. It is an unceasing loop which iterates between synthesis and analysis and the loosening of constraints to meet the application driven specifications and conversely, the loosening of the constraints which drives the evolution of the specifications. In weaving constraints into the process of electric machine design, a conceptual feedback loop can be created to fit the constraints-based narrative. Figure 1 is a conceptual design loop for electric machine design to help visualize the loop. At this moment in history, we are benefitting from the confluence of accelerated advancements in technologies as described, which has accelerated the pace of electric machine development and design. Concomitant with accelerated advancements, we are challenged by the realities of Climate Change and global warming, which creates demands, both in the sense of urgency that we must adapt in order to change the trajectory, but also in driving future new application developments, which would in turn drive the entire constraints-based feedback loop. It is critical at this point in history that the experienced and neophyte practitioners of the art of electric machine design need to congregate and collaborate to determine the status of our latest advancements in the developing technologies we have available to us, to think about the potentials of these technologies in the advancement blocks. And also reflect and reexamine the constraints in ambitiously seeking ways to overcome them.

Session Panelists/Speakers

Gianmario Pellegrino, *Politecnico di Torino, Italy*
Ian P. Brown, *Illinois Institute of Technology, USA*
Keld Folsach Rasmussen, *Grundfos, Denmark*
Alireza Fatemi, *GM, USA*
Joel Van Sickel, *Mathworks, USA*
Philippe Wendling, *Altair, USA*

SS6 | Design Automation for Power Electronics – from Device to Systems Design, Verification and Certification

Part 1: 8:30AM – 10:10AM
COFFEE BREAK
Part 2: 10:40AM – 12:20PM

Room 209C
Chair/Organizer:
Kevin Hermanns, *PE-Systems GmbH*
Wilmar Martinez, *KU Leuven*

The power electronics industry is facing major challenges today. Large areas of daily life are to be electrified, while at the same time the demands on the technical performance of the components and systems to be developed are increasing. This is accompanied by new materials and shorter development cycles. In order to master these challenges, new ways are needed to control the growing complexity. First and foremost, this can be achieved by automating individual steps and later entire development cycles. The session tries to give an overview of the different aspects of automation in development. In particular, the question will be answered, what is possible today and where are solutions missing? The session covers aspects from the design of individual components (semiconductor modules and magnetic devices) to the design of complete conversion systems. In addition, new design goals such as security by design of power electronic converters will be addressed and discussed. Along the development cycles, methods for design synthesis are covered as well as methods for verification and certification. The session will also address the treatment of data sets generated during development and discuss their use for novel design methods (e.g. machine learning algorithms).

Session Panelists/Speakers

Kevin Hermanns, P*E-Systems GmbH*
Wilmar Martinez, *KU Leuven*
Jean-Luc Schanen, *Université Grenoble Alpes*
Peter Wilson, *University of Bath*
Dirk Müller, *Underwriters Laboratory*
Subham Sahoo, *University Aalborg*
Andreas Rosskopf, *Fraunhofer IISB*
Nitesh Satheesh, *Microchip*
Timothé Delaforge

SS16 | Emerging Applications of Inductive Power Transfer Technology

Room 202B
Chair/Organizers:
Grant A. Covic, *University of Auckland, New Zealand*
Zhichao Luo, *South China University of Technology, China*
Fei Lu, *Drexel University, USA*
Ming Liu, *Shanghai Jiao Tong University, China*

As one of the most epoch-making techniques, inductive power transfer (IPT) has been promoted for various applications, especially for the electric-driven devices. Since the IPT technique possesses the advantages of reliability, automation, safety, low maintenance, convenience, and electrical isolation, more and more academic researchers and industries are getting involved in this emerging area. So far, the IPT technology has been used in implanted medical devices, portable electronic devices, electric vehicles, and AGV etc. However, there are still some factors hindering the IPT technology from being widely industrialized and

commercialized. For example, cost and power density are two key elements for the IPT system to be industrialized. Compared to the conventional conductive charging system, several auxiliary units are needed in the IPT system such as the foreign object detection unit, and parking alignment assistant unit, etc. This will also increase the complexity of the IPT system. As the wide band gap (WBG) devices (silicon carbide and gallium nitride) become more prevalent due to their reduced loss, higher voltage rating and operation temperature, the IPT system is allowed to operate at higher switching frequencies with a more compact system structure. Artificial intelligence such as machine learning, meta-heuristic method, etc., is also a powerful way to design and optimize the IPT system. These cutting-edge technologies allow us to explore more possibilities for IPT in our future life. Therefore, this special section aims to offer a timely opportunity for academic researchers and industrial engineers to present, discuss, and exchange ideas about how to make our future life 'wirelessly freer'. Typically, our panelists from world-leading IPT technology companies will talk about the future roadmap of the IPT technology in the next 5-10 years, the critical points for IPT technology industrialization, the next generation IPT technology, and the emerging applications for IPT, etc. This special section is not a technical seminar. Everyone with different professional background is welcome to join and discuss with our panelists if you are interested in the previous, modern and future IPT technology.

Session Panelists/Speakers

Paul Mitcheson, *Bumblebee Power Ltd., UK*
Aaron Stein, *Resonant Link Ltd., VT*
Tony Han, *eLeapPower Ltd., Canada*
Morris Kesler, *Witricity Ltd., USA*

SS24 | Finger on the Pulse: Sustainable & Robust Data Centers

Part 1: 8:30AM – 10:10AM
COFFEE BREAK
Part 2 - 10:40AM – 12:20PM

Room 205A
Chair/Organizer:
Brian Zahnstecher, *PowerRox*
Frede Blaabjerg, *Aalborg University*

Data centers have played supporting and increasingly-critical roles in the advancement of every facet of society and technology over the past few decades. From a power consumption perspective, data centers are the fastest growing segment of global power. From an energy footprint perspective, data center footprints are not only very large, but directly control/interface with a much larger global energy footprint (i.e. – communication networks, industrial controls/drives, etc.) and should therefore be designed and assessed with energy efficiency and sustainability in mind from Day 1. This special session will put a focus on the key concepts, metrics, and drivers necessary to enable proper analyses of the data center from design of constituents to the impacts of the application space to understanding of the sustainability challenges and opportunities. Complementary drivers, such as energy storage, are explored from traditional and newer perspectives to advance the understanding of their critical linkage to data center functionality. A variety of topics and speakers, invited from a swath of global leaders of industrial and academic contributors, have been methodically chosen and organized to present a handful of focused topics to provide broad understanding of the modern and forward- facing issues along with actionable solutions and frameworks driving constant improvement to industrial energy footprints in the spirit of perpetual optimization of data center utilization.

Session Panelists/Speakers

Brian Zahnstecher, *PowerRox, USA*
Michael Sagar, *EnerSys, USA*
Harry Soin, *Advanced Energy, USA*
Frede Blaabjerg, *Aalborg University, Denmark*
Victor Veliadis, *PowerAmerica / NC State University, USA*
Bhushan Joshi, *Ericsson, USA*
Ryan Egly, *Schneider Electric, USA*

Thursday, November 2 10:40AM – 12:20PM

SS7 | All-DC Wind Generation Systems: High-Voltage Wind Turbine Conversion, MVDC Collector and HVDC Transmission Grid Technologies

Room 205B
Chair/Organizers:
Omid Beik, *SMIEEE Colorado School of Mines, USA*
Johan H. Enslin, *Clemson University, USA*

This special session will discuss all-DC schemes for wind generation systems. The all-DC gird includes: (i) A wind turbine conversion system that is amenable to higher voltages and adaptable for connection to DC collector grids. (ii) A medium voltage DC collector (DC) collector grid. (iii) A high voltage DC (HVDC) transmission grid. The MVDC is stepped-up to HVDC on the offshore substation using modular multilevel converters (MMC)-based DC-DC converters. Alternatively, high-voltage solid state transformers (SSTs) may be used. The wind farm is connected to the AC grid using voltage source converter (VSC)-based MMCs. The power electronics switches that are building blocks of VSCs are not yet commercially available at higher-voltage and high-current. Therefore, for such applications the VSCs will need to be multilevel and modular by connecting switches in series and parallel. This makes them bulky and costly and hence unsuitable for the confined space within the wind turbine. Therefore, the output of back-to-back VSCs and the wind turbine is rated at low-voltage AC levels and a tower transformer is used to step this voltage up to medium voltage AC levels. In this special session futuristic high-voltage wind turbine conversion system will be presented that eliminates the VSCs in wind turbines, and facilitates the connection of wind turbines to a MVDC collector grid. Discussions will also include the viability of the all-DC systems for future wind farms; the past, present and industry trends moving away from LCC and towards VSC HVDC systems; role of utilities in growing HVDC systems; and modeling and integration of DC systems.

Session Panelists/Speakers

Omid Beik, SMIEEE, *North Dakota State University (NDSU), USA*
Johan H. Enslin, *Clemson University, USA*
Ying Jiang Hafner, *Hitachi Energy, USA*
Dushan Boroyevich, *Virginia Tech, USA*


INTELLIGENT ACTUATION SYSTEMS
PROPULSION
MOTORS
NON-AUTOMOTIVE
SOFTWARE
ELECTRONICS
SENSORS
CHASSIS
CONTROLLING FUTURE MOTION
HL Mechatronics
Innovator Today
Pioneer Tomorrow
HL

NOTES

Wednesday, November 1 — 4:10PM – 5:50PM

SPECIAL SESSION: PELS/IAS Journal Prize Paper Presentation Session 1

Room 201A
Session 1 Chairs:
Yaow-Ming Chen and Xiongfei Wang

TPEL FIRST PLACE

7.2 kV Three-Port SiC Single-Stage Current-Source Solid-State Transformer With 90 kV Lightning Protection

Liran Zheng, Xiangyu Han, Chunmeng Xu, Rajendra Prasad Kandula, Lukas Graber, Maryam Saeedifard, Deepak Divan

TPEL FIRST PLACE

A Family of Hybrid IPT Couplers with High Tolerance to Pad Misalignment

Wei Zhao; Xiaohui Qu; Jing Lian; Chi K. Tse

TPEL FIRST PLACE

Precise Luminous Flux and Color Control of Dimmable Red-Green-Blue Light-Emitting Diode Systems

Cheuk Ping Germaine Wong; Albert Ting Leung Lee; Kerui Li; Siew-Chong Tan; S. Y. Hui

TPEL FIRST PLACE

Vertical Stacked LEGO-PoL CPU Voltage Regulator

Jaeil Baek; Youssef Elasser; Kaladhar Radhakrishnan; Houle Gan; Jonathan P. Douglas; Harish K. Krishnamurthy; Xin Li; Shuai Jiang; Charles R. Sullivan; Minjie Chen

TPEL FIRST PLACE

Title: Data-Driven Continuous-Set Predictive Current Control | for Synchronous Motor Drives

Paolo Gherardo Carlet; Andrea Favato; Saverio Bolognani; Florian Dörfler

Thursday, November 2 — 10:40AM – 12:20PM

SPECIAL SESSION: PELS/IAS Journal Prize Paper Presentation Session 2

Room 208A
Session 2 Chairs:
Ryan Li and Leon Tolbert

TPEL LETTER

Electronic MOV-Based Voltage Clamping Circuit for DC Solid-State Circuit Breaker Applications

Lakshmi Ravi, Di Zhang, Dehao Qin, Zheyu Zhang, Yuntao Xu, Dong Dong

TPEL LETTER

A Machine-Learning-Based Fault Diagnosis Method With Adaptive Secondary Sampling for Multiphase Drive Systems

Zicheng Liu, Lanlan Fang; Dong Jiang; Ronghai Qu

JESTPE FIRST PLACE

High-Performance Multi-MHz Capacitive Wireless Power Transfer System for EV Charging Utilizing Interleaved-Foil Coupled Inductors

Brandon Regensburger; Sreyam Sinha; Ashish Kumar; Sounak Maji; Khurram K. Afridi

TTE FIRST PLACE

DAB Converter for EV Onboard Chargers Using Bare-Die SiC MOSFETs and Leakage-Integrated Planar Transformer

Yongwan Park; Shiladri Chakraborty; Alireza Khaligh

TUTORIALS

SUNDAY, OCTOBER 29 8:30AM – 11:50AM

T1 | Grid Forming Power Converters. Concepts, Implementation and Analysis

ROOM 202A

Organizers:

Pedro Rodriguez – *Luxembourg Institute of Science and Technology*
Xiongfei Wang – *KTH Royal Institute of Technology*
Rolando Burgos – *Virginia Tech*
Heng Wu – *Aalborg University*

As the penetration of renewable energy sources driven by grid-connected power converters monotonously increases, unusual interactions between innovative and legacy generation systems become more concerning since they threaten the system's stability and reliability. These undesirable interactions are mainly due to the fact that power converters and conventional electromechanical generators currently work under different physical and control principles and rules. This gives rise to some incompatibilities in terms of dynamic response and physical limits, which has become evident once the share of power converters connected to the grid has become relevant enough. In order to address this issue, the hierarchical control of power converters in electrical grids should be revised, and the modelling and analysis methods should be adapted to the new requirements from systems operators. In this tutorial, we will review the role of grid-connected power converters, paying special attention to the most critical aspects when they work as grid-following converters, i.e., injecting current into a given voltage source provided by the grid, and as grid-forming converters, i.e., energizing an electrical grid 'from scratch' and regulating its operation when heterogeneous generators and loads are connected. We will see how grid forming-converters might be understood as an electronic implementation of the well-known synchronous generators, but well also evidence that not all the features and operation principles of the electromechanical machine invented in the IXX century are of interest to conform the electrical power systems of the future. In this tutorial we will present the operation principle and controllers of grid-forming converters, will analyze their performance and will make an overview of the most relevant implementation approaches reported in the literature. Moreover, we will present in detail a preferred implementation, assessing the services provided to the grid (inertia emulation, power oscillations damping, voltage/frequency regulation, power quality improvement, island operation, black-start, ...) under different operation conditions and applications. Finally, we will present some analysis techniques to evaluate the impact of grid-forming converters on the grid performance, paying special attention to dynamic analysis and stability, and providing rules and guidelines for tuning grid-forming controllers.

T2 | Shallow Neural Networks and Deep Learning Applications in Power Electronics and Electrical Drives

ROOM 202B

Organizers:

Giansalvo Cirrincione – *University of Picardie*
Jules Verne and Rahul R Kumar – *University of the South Pacific*

This tutorial aims to provide an overview of the application of shallow and deep neural based approaches in the field of power electronics and electrical drives. Power electronics and electrical drives have traditionally relied on conventional control methods, however, with advancements in machine learning, shallow and deep neural based strategies have shown great potential to improve the performance and efficiency of these systems. Shallow neural architectures are often preferred for power electronics and electrical drives due to their simplicity and real-time processing capabilities. On the other hand, Deep learning techniques provide a more sophisticated approach to modeling and controlling these systems as well as explainability, which can lead to better performance and accuracy. In this tutorial, we will discuss the recent advances and applications of shallow and deep neural-based approaches in various domains within power electronics and electrical drives. Additionally, we will highlight some of the challenges and opportunities for further research in this field.

T3 | GaN FETs and GaN Integrated Circuits for DCDC and Motor Drives Applications

ROOM 202C

Organizers:

Marco Palma and Michael de Rooij– *Efficient Power Conversion Corporation (EPC)*

Gallium nitride (GaN) power semiconductors have seen increased adoption in many powerelectronic applications. Recently GaN devices have made inroads into compact and efficient DCDC converters and BLDC motor drives with surprising benefits that include ultra-low audible emissions, small size, high DC to mechanical efficiency, reduced component count, and improved precision control when compared to MOSFET-based inverters. The goal of this tutorial is to provide engineers with the tools and understanding needed to fully utilize the potential of GaN FETs and emerging GaN integrated circuits and be able to implement them in advanced DCDC converters and in BLDC motor drive applications. The seminar comprises four main sections; 1) An introduction to the important distinguishing characteristics of GaN FETs, 2) The fundamentals of designing with GaN FETs and ICs, 3) GaN-based DCDC and motor drive application examples demonstrating the techniques presented in section II, and 4) an update to the state-of-the-art GaN integration. Section I opens with a brief progression of GaN FETs characteristics over the last decade and how those characteristics have yielded performance improvements over MOSFETs. Methods to quantify those benefits for quick comparison based on device characteristics and target application operating modes will also be given. This includes an introduction to the next generation of GaN FETs (the 6th) and integrated circuits and how these new devices are reshaping the design of power electronic converters. This section will also show a comparison between EPC GaN devices and other GaN devices in the market. The results of the latest reliability tests on GaN FETs will also be covered, showing the exceptional reliability GaN devices offer. Section II goes into detail on how to design converters and inverters using GaN devices starting at the schematic with a focus on gate drivers and bootstrap supplies techniques. Various thirdparty GaN FET compatible gate drivers will be presented, including new techniques for highvoltage devices. It will cover how to quantify reverse recovery's damaging impact on MOSFETbased converters and how GaN devices offer a significant performance advantage. The next part in section II covers layout techniques and guidelines for PCB design to maximize electrical performance, reliability, and manufacturability that largely impact QFN and Chip Scale Package (CSP) devices. Examples of what can go wrong, from the PCB design through assembly, and procedures to follow to prevent

them will be given. The ability to add additional cooling is paramount to high power density solutions, and this section will conclude with details on a simple yet very effective approach to adding heatsink solutions for GaN devices. The GaN power bench tools that properly dimension the converter devices and simulate the thermal behavior will be presented live. Section III explores application examples that have significantly benefitted from GaN FETs and ICs. DCDC converters will be covered, including multi-phase converters for high current loads and multi-level converters for minimizing the thickness of converter solutions. Multi-level converters will cover 100 V and 200 V GaN devices and include advanced techniques to address low voltage drop bootstrap multi-level shifting gate drivers. The expansion of GaN FETbased applications to motor drives and how GaN integration can significantly increase power density, reduce weight, and improve overall performance. The difference between 20 kHz and 100 kHz operation will be demonstrated, as well as the effect of dead time. These parameters affect audible emissions, mechanical efficiency, torque ripple, and DC filter requirements that will be supported by specific measurements that will be presented. Section IV concludes with a look at the progression of GaN integration and what lies ahead for the future. A look into the latest releases reveals half bridges complete with level shifting gate drivers and synchronous bootstrap power supply minimizing external component count, reducing board area, and increasing operating frequency capability for many applications. The tutorial closes by opening the floor to questions and discussion.

T4 | SiC Unleashed: Are SiC technology High Performances Reliable Enough for Your Application?

ROOM 204

Organizers:

Xuning Zhang, Cesare Bocchiola and Zhiyu Shen – *Microchip Technology Inc.*

Silicon Carbide (SiC) devices improves the power density of various converters by shrinking the size of passive components and improving the power conversion efficiency; by the way, only proper SiC devices design can guarantee the level of reliability required by most professional, industrial, or hi-rel. applications. This seminar presents an in-depth summary of SiC devices and their applications, to help converter designers at different levels to get the full benefits and face the challenges found when using SiC devices; proper design guidelines are also needed to extract the maximum benefit from using SiC devices. The presentation will begin with an introduction to SiC technology status. A summary of internal device structure and principle of operation will be discussed to understand the potential benefits achievable with a reliable design of devices built on SiC technology. Detailed static and dynamic characteristics, thermal performance and device ruggedness will be discussed with related datasheet parameters to also assess the superior performance of SiC devices over Si. Optimal implementation of SiC MOSFETs will be discussed in detail. This section starts with gate driving design, such as, driving voltage selection, driving circuit design and advanced driving concepts. Then, the power stage design and layout are introduced, including loss estimation, parasitic control, etc. Finally, converter level optimization aspects are covered, such as thermal management and EMI noise control. This section will provide converter designers with design guidelines to implement SiC devices appropriately and ensure their maximum benefits. Design examples in real applications such as EV charger and DC Solid State Circuit Breaker applications will be presented with real hardware and test results to verify the benefit of using SiC device in system size/ weight/ cost reduction compared with Si devices.

T5 | Aviation Class Propulsion Solution: Additively Manufactured Motor Coils, Integrated with Modular Motor Drive & Advanced Cooling

ROOM 205A

Organizers:

Nathan Weise, Ayman EL-Refaie, Armin Ebrahimian, Seyed Iman Hosseini Sabzevari, A. Khan Waqar, Sina Vahid, Ali Al-Qarni, Salar Koushan and Chowdhury Towhid – *Marquette University*

Transportation electrification has been the center of many research projects in both academia and industry over the past decade. There has been a special focus on aerospace electrification over the past few years. As the core of hybrid/electric propulsion systems, electric machines, and their drive systems have been at the center of these research efforts. Considering the power density and efficiency requirements for aerospace electrification, conventional machine/drive systems might be not feasible for such an application. To that end, the concept of integration of the machine, drive system, and cooling system has been investigated. Such a concept is known as Integrated Modular Motor Drive (IMMD) in which the machine, drive and cooling system are integrated and considered as a single structure. On the drive side, the possibility of achieving high power density and efficiency is increased by the emergence of wide band gap devices (WBGDs). Their intrinsic benefits like, low on-state resistance and fast turn-on/off speed contribute to lower conduction and switching losses which in turn lead to higher efficiency. Furthermore, their ability to function at higher junction temperature relative to their Silicon (Si) counterparts, reduce the cooling system requirements. Optimal design, including board layout, and component selection, is of high importance while using the WBGD, due to the effect of parasitics on the overall performance. On the machine side, the focus is typically on increasing the machine's electric and magnetic loading as well as the mechanical tip speed. This can be achieved via novel machine topologies, advanced materials, advanced manufacturing as well as integrated systems with shared advanced cooling

In this tutorial, the design considerations and requirements for integrated modular motor drives, as a solution for aviation electrification, are presented. The challenges of designing and characterizing additively manufactured motor coils and paralleling GaN switches are presented and test results are shown. The advanced cooling system design for both motor and drive systems is described. Finally, the overall integrated system is demonstrated and some test results are presented.

T6 | Integrated Motor Drives, State of the Art, Challenges, and Emerging Technologies

ROOM 205B

Organizers:

Lee Empringham and Liliana de Lillo – *University of Nottingham*
'Daisy' Xu Deng – *Newcastle University*
Thomas Jahns – *University of Wisconsin*
Daniel Kernan – *ITT Industries corp*
Barrie Mecrow, *Newcastle University*

The energy savings that can be achieved by driving electrical motors at the desired speed rather than maximum speed using variable frequency converter technologies is clear and accepted within industry. There can be however a general reluctance to retrofit VFD's due to increased infrastructure and installation costs. The integration of power electronic converters into electrical motors to create variable speed integrated motor drives offer many benefits over traditional separated VSD's in

terms of installation costs, environmental requirements and raw material costs. There is also a cross sector move towards integration of motors and converters in order to reduce weight and raw material usage, for example in the automotive sector. This tutorial will introduce the concept of the integrated motor drive and summarize the challenges involved with their design and manufacture. Specific contributions will be provided by several world leading experts in areas of integrated drive topologies and distributed control, wide bandgap semiconductors and implications for their use in IMD's, systems based thermal management solutions and emerging technologies. Integrated motor drives from an industrial point of view will be highlighted together with a discussion of the constraints and commercial factors that are involved in addition to real-world examples of industrial deployment.

T7 | Advances in Wireless Power Technology for Electric Vehicles and Smart Devices

ROOM 205C
Organizer:
Chun Rim – *GIST*

Recent advances in wireless power transfer (WPT) technologies offer consumers and industries with more convenient, efficient, and intelligent charging of electric vehicles (EVs) and smart devices (SDs) such as smart phones, drones, robots, and IoTs. WPT has been adopted to get free from frequent plug in and out of charging by hand. Heavy and bulky batteries alone cannot solve the energy hungry problem of all mobile things, which should be eventually recharged. In this tutorial, fundamental principles of WPT including inductive power transfer (IPT) are briefly introduced first, and major WPT theories such as coupled coil model, gyrator circuit model, magnetic mirror model, and general unified dynamic phasor model are explained. Advances in WPT for EVs are extensively explained, which are classified into stationary charging electric vehicles (SCEVs) and roadway powered electric vehicles (RPEVs). SCEVs are getting more attraction due to their convenience and safety. Furthermore, due to rapid increase in the market shares of EVs and renewable energies, the interoperability of EVs and grids became of great importance. EVs are no longer simple energy consumers but energy providers to the grids. WPT is a promising solution to connect EVs with grids automatically whenever parked. This is a potential contribution of SCEVs as a flexible means of interoperable power systems. The coil design, large tolerance charging, compensation circuit, and foreign object detection (FOD) issues are addressed in detail. Recent progress in worldwide technology development is summarized as well. RPEVs are free from serious battery problems such as large, heavy, and expensive battery packs and long charging time because they get power directly from a road while moving. The power transfer capacity, efficiency, lateral tolerance, electromagnetic field (EMF), air-gap, size, weight, and cost of the WPTSs have been improved by virtues of innovative semiconductor switches, better coil designs, roadway construction techniques, and higher operating frequency. Recent advances in WPT for RPEVs are introduced. Advances in WPT for SDs are explained, which are quite different from each other depending on operational environments. Smartphones are the most successful applications of WPT, which are now evolving to get more freedom of charge in space. Due to distributed and numerous nature of IoTs, WPT for widespread area is quite challenging. Various drones and robots of different power level and endurance time require fast enough charging speed with freedom of position. Recent technology developments are explained. Future of WPT issues are addressed, which includes interoperable wireless EVs, longer distance IPT, 3D wireless chargers, and synthesized magnetic field focusing (SMF).

T8 | Electromagnetic Compatibility of Switched-Mode Power Supplies

ROOM 209A
Organizer:
Guenter Keller – *Deggendorf Institute of Technology*

The tutorial "Electromagnetic Compatibility of Switched-Mode Power Supplies" is subdivided into several sections. Starting with a brief overview of legal regulations, like CE mark and Declaration of Conformity, a selection of emission and immunity standards are presented. This includes the description of test set-ups, for example for measuring conducted emissions using conventional or STFFT based test receivers and their detector circuits, as well as test parameters, like frequency ranges, based on European and International standards. Than four coupling mechanisms (impedance, capacitive, magnetic and radiated) are discussed, based on components and PCB structures. Subsequently basic countermeasures are proposed and evaluated according meaningful applicability to switched-mode power supplies. The section signals and characteristics explains common-mode and differential-mode interferences as well as the Fourier Transform in detail with a number of waveforms, like rectangular, triangular and trapezoidal waveforms, which are typically for switched-mode power supplies. In particular switching transients are discussed against the background of wide band gap devices like GaN transistors. One large section discusses the origin of electromagnetic interferences referring to the previous sections. This section addresses some widely used circuits, their operating modes, like continuous conduction mode, discontinuous conduction mode and boundary conduction mode, and also parasitics of passive components, using high frequency equivalent circuits of capacitors, inductors and transformers, and active components, like junction capacitances and terminal inductances. A large number of examples is presented in form of results of measurements, simulations or calculations. The second half of the presentation deals with EMC design of switched-mode power supplies, also evaluating efficiency and control issues. This section is subdivided into a number of subsections. Firstly the power factor correction is briefly presented. A large subsection addresses EMC filters, which is subdivided into pre filters and post filters. The filter structure is discussed according common-mode and differential-mode attenuation and source and load impedance. Problem solving approaches of the gap between measurements according standards and filter effectiveness are presented. Additionally an outlook to active EMI filters is given. Also design aspects of magnetic components are discussed. Followed by suitable components, which presents for example the impact of start of winding of a magnetic component, suitable circuits with soft-switching principles are compared to hard-switching circuits. After that shielding basics are presented, in particular the impact of holes for cooling purposes on electromagnetic shielding effectiveness. Finally PCB layout structures are evaluated and recommendations are presented. These investigations also address grounding, one of the most discussed topics in PCB design among engineers, as well as component placing and component selection, e. g. based on integrated circuit pin out and return current paths. Most aspects are explained by measured, simulated or calculated examples. Many examples are discussed against the background of electromagnetic compatibility as well as their impact on efficiency, lifetime and costs of the power supply. The tutorial contains on the one hand practical examples and uses on the other hand the basic physics of Maxwell for a principle understanding. Many principles can be transferred to other electronic circuits.

T9 | HVDC Transmission Systems and DC Grids: Developments and Challenges

ROOM 209B
Organizer:
Khaled Ahmed – *University of Strathclyde*

As large renewable power plants tend to be located far from consumption centers, integration of the power collected from these power plants represent a major challenge. For example, the electrical outputs of these renewable power plants could be DC or AC voltage with magnitude and frequency which are incompatible with that of the AC grids. Therefore, power electronic interfacing is needed to decouple the AC grids from the power plants, control active and power exchange with AC grid, and assist renewable power plants to ride-through different AC and DC network faults. The commercially available state-of-the- arts high voltage direct current (HVDC) link technologies are based on voltage source converters. However, most of the presently operational HVDC transmission systems are based on the thyristor line commutated current source converter technology that offers low semiconductor power loss and high power density, thanks to the robustness and high current capability of the thyristor in a single wafer capsules. On the other hand, thyristors inject significant low frequency harmonics into AC side, which must be eliminated by large passive filtering, and cannot decouple the control of reactive power from the active or DC power to be injected into the AC network. The use of large passive components leading to large footprint systems. Self-commutated voltage source converter HVDC transmission systems were developed to address the shortcomings associated with the line commutated current source converter based HVDC transmission systems. The tutorial aims to clarify the advantages and disadvantages of different HVDC technologies, i.e., LCC and VSC from the broader context of large power evacuation, HVAC grid support and renewable power generation and integration. The tutorial will cover integration of large renewable energy plants, including operation, control and interactions with AC grids. Also, interactions of current source converter (CSC) and voltage source converter (VSC) based HVDC with AC systems through controls and harmonics will be analyzed. AC and DC faults analysis for different HVDC technologies will be discussed. Finally, DC grids will be reviewed and discussed including the theoretical concepts, technology, control, faults, DC/DC embedded, and protection with particular emphasis on practical implementation aspects and on reported operational issues. For ease of illustration, the tutorial will be supported with simulations performed in MATLAB/SIMULINK.

SUNDAY, OCTOBER 29 8:30AM – 10:00AM

T10 | Gallium Nitride: Device Technologies and Applications

ROOM 209B
Organizer:
Davide Bisi – *Transphorm Inc.*

Thanks to its superior switching performance, Gallium nitride is penetrating several power conversion markets, including mobile device chargers, power supplies, data centers, renewable energies, and automotive. In this tutorial, we'll review the key elements to understand GaN technologies and their applications. We will discuss the key parameters of power devices, including on-state resistance, breakdown voltage, parasitic capacitances, and their impact on conversion losses. We will review GaN material properties and appreciate where GaN is superior to silicon and silicon carbide. We'll dive into GaN transistors and discuss strategies to achieve normally-off operations, high current rating and high voltage rating (up to 1200V!). We will analyze switching transients and frequency response, discussing good practices to drive your GaN device fast and reliably. You will learn about industrial and automotive qualification standards, lifetime tests, transient reliability and short-circuit capability. The tutorial will end with a review of main GaN applications, including circuit topologies and design recommendations to make the most out of highly efficient, highly reliable GaN devices.

SUNDAY, OCTOBER 29 10:20AM – 11:50AM

T11 | Z-Source DC Solid-State Circuit Breakers

ROOM 202A
Organizers:
Fang Peng and Jinyeong Moon– *FAMU-FSU*
Keith Corzine – *University of California Santa Cruz*

The utilization of DC interconnection in power systems is becoming increasingly prevalent for various reasons, such as the potential for significant savings in power conversion stages and the ease of interconnecting inherently DC-natured components, such as solar panels, fuel cells, and batteries. DC power systems have become the norm for ship propulsion systems, building electrification, aircraft power systems, electric vehicles, and many other applications. While the power conversion components in these systems are well-known and well-defined, considerable research is still being conducted into the circuit breakers. The primary challenge in breaking a DC circuit is that there is no zero crossing in the current, thus creating a sustained arc that can potentially damage the switch or cause a fire. One solution is to use an oversized AC breaker for the DC application. Other solutions involve hybrid breakers (with a main-path mechanical contactor and auxiliary solid-state components). Another option is the fully solid-state circuit breaker (SSCB). Although the on-state loss is usually higher than that of a mechanical contactor, the SSCB has the advantages of a very rapid response and more controllability. Within the SSCB category, there are a number of variations. The basic design switches off the main-path current and transfers the energy to a metal-oxide varistor (MOV). Other variations involve power converter elements acting as breakers. This version of the SSCB has the benefit of highly controllable behavior. The Z-source circuit breaker is a unique type of SSCB based on the fundamental Z-source LC circuits. Its fundamental operating principle is that a rapid fault at the breaker terminal with an increasing current will result in a decrease in the current of the main path semiconductor. If this semiconductor is a silicon-controlled rectifier (SCR), the device will be automatically shut off when the Z-source circuit forces the device current to reach zero. Consequently, the Z-source breaker is different from other SSCBs in that it automatically deactivates the current path in response to a fault without requiring detection circuitry and technique. Additionally, the Z-source breaker has the benefit of a rapid turn-off due to its solidstate operation, which is usually in the microsecond range. Yet another advantage is the independent operation of multiple breakers in a DC microgrid. Whether the Z-source breakers are connected in a shunt configuration or series (downstream), only the breaker nearest the fault will be disengaged. This tutorial will first review the fundamental Z-source circuits introduced approximately 15 years ago. This includes the coupled inductor Z-source circuits and utilization of the circuits in the Z-source inverter. Subsequently, the fundamental Z-source breaker idea will be described, followed by a number of variations on the Z-source breaker, including bi-directional topologies. Finally, incorporating the Z-source breaker within DC-DC power converters will be presented. Select examples of Z-source breakers will be utilized throughout the tutorial to illustrate various practical concepts, with simulations of these examples being made available to the tutorial participants.

SUNDAY, OCTOBER 29 1:00PM – 2:30PM

T21 | Wide Bandgap Device based Power Electronics for Aerospace Applications

ROOM 201A

Organizer:

Jin Wang – *The Ohio State University*

Aerospace applications are not new but potentially the final frontiers for power electronics research and developments. On the aviation side, because of the need for fuel saving and greenhouse gas reduction, more electric aircraft (MEA), unmanned aerial vehicles (UAV), electric vertical take-off and landing (e-VTOL) aircraft, and future hybrid and turbo electric propulsion call for a new generation of power converters, motor drives, and solid-state circuit breakers with unprecedented power density, efficiency, and reliability. On the space side, lunar, Mars and deep space expeditions, will need light-weight and highly efficient power electronics systems to work reliably at places that no man has gone before, where space radiation and extreme operation conditions present more challenges to power devices and circuits. Wide bandgap (WBG) power devices, such as Silicon Carbide (SiC) Junction Barrier Schottky (JBS) diodes and power MOSFETs and Gallium Nitride (GaN) high electron mobility transistors (HEMTs) and Gate Injection Transistors (GITs), are regarded as natural candidates for aerospace applications. With great efforts from device manufacturers and system integrators, these devices are either already or close to being implemented in different power converters, actuator drives and circuit breakers for aerospace applications. The main remaining challenges for WBG devices and their circuits for aviation applications include radiation hardness, extreme operation temperature, high altitude, high voltage, high dv/dt, and high di/dt operation induced issues such as lower partial discharge inception voltage and higher EMI noises. The tutorial will start with an introduction of state-of- the art of power electronics devices and circuits for aerospace applications, then dive into detailed discussions on the above mentioned challenges. Design examples for both electric propulsion and lunar surface power distribution will be introduced in detail. The tutorial caters to professionals at the intermediate level. Audience members should be aware of basic power electronics devices and circuits and be interested in more recent developments. By the end of this tutorial, attendees will: learn about the historical development of electrical machines and their theories, and the ubiquity of magnetic field modulation phenomena; understand the general airgap field modulation theory framework for design, analysis, and innovation of electrical machines; be able to apply the general airgap magnetic field modulation theory in qualitative analysis and quantitative calculation of machine performance and inventing emerging machine topologies to meet various application needs.

SUNDAY, OCTOBER 29 1:00PM – 4:20PM

T12 | Model Predictive Control: From Theory to Industrial Applications

ROOM 202B

Organizers:

Tobias Geyer – *ABB Switzerland Ltd.*

Petros Karamanakos – *Tampere University*

Conventional control methods fail to operate the power electronic systems in an optimal manner, causing the underutilization of the existing hardware. An attractive control alternative is model predictive control (MPC) due to its numerous advantages, such as explicit inclusion of design criteria and restrictions, design versatility, and inherent robustness. Thanks to these features, MPC can bring significant benefits by improving performance metrics (e.g., current distortion, power losses, settling time), and/or reducing the hardware requirements (or, equivalently, by fully utilizing the existing hardware). Motivated by the above, the objective of this tutorial is to show MPC-based approaches that improve the performance of power electronic systems. To this aim, different algorithms will be discussed and analyzed, while design guidelines that maximize the performance benefits of MPC will be provided. Moreover, to clearly demonstrate the tangible improvements that MPC brings, it will be shown how MPC paved its way in industry by increasing the rated power of high-power converters, lowering their cost, and guaranteeing their safe operation in the presence of adverse operating conditions. Finally, a critical assessment of the existing MPC methods will be provided, and the tutorial will close with an outlook for MPC in power electronics and possible future research directions. Overall, the tutorial aims at providing a balanced mix of theory and application-related material with a particular focus on the application of MPC in industry. Special care is taken to ensure that the presented material is intuitively accessible to the power electronics practitioner. This is achieved by augmenting the mathematical formulations by illustrations and simple examples. By the end of the tutorial, the attendees will be able to: • have a good understating of MPC for power electronics, • understand what design options exist that maximize the system performance, • appreciate the benefits MPC brings to industry, and • design MPC-based controllers that outperform conventional control techniques and push the system performance to its physical limits.

T13 | Power Electronics Intensive Power Systems: Dynamic Modeling and Control, Hardware Testing, and Standardization

ROOM 202C

Organizers:

Xiaonan Lu – *Purdue University*

Wei Du – *Pacific Northwest National*

Mariko Shirazi – *University of Alaska*

Jing Wang – *National Renewable Energy*

Christopher Rowe – *Enphase Energy*

There are tremendous research efforts and industry practices for enhancing grid resilience and stability with increasing penetration of inverter-based resources, with special emphasis on grid- forming and grid-following inverters, localized and network-interconnected microgrids, and advanced substation modeling and control, among others. The challenges are identified in multiple sections throughout the electric power systems, ranging from grid-edge end users to large-scale distribution systems and bulk power grids. It is noteworthy that resilient and stable power electronics intensive power systems are urgently needed to modernize electric power grids with a high penetration level of inverter-based resources (IBRs) for guaranteed operational continuity. Conventional grid-interactive power electronic inverters mainly focus on satisfying the design constraints on control and hardware implementation of individual inverter units and the operating requirements at the single point of interconnection (POI). However, given the increasing penetration level of IBRs in modern power grids, converter systems should also be taken into account to meet the grid needs in a wider area. All the emerging criteria call for a paradigm shift into a power-electronics-intensive power system in the areas of dynamic modeling and control, advanced hardware testing, as well as industrial standardization. In this tutorial, the diversified and multi-disciplinary instructor team from academia and government national laboratories will introduce the latest research advances and industry practices on grid-interactive power electronic inverters, highlighting dynamic modeling and control, large-scale hardware-in-the-loop validation, full-scale hardware testing in both normal and fault conditions, and also the legacy and emerging industrial standardization. The topics will range from

fundamental concepts covering the necessary background knowledge to advanced applications and field deployment. Further, a hierarchy of topics covering individual inverters (grid-forming and grid-following), inverter clusters (hybrid AC and DC microgrids), 1 MW full-scale hardware test-bed (NREL 1 MW grid-forming test facility), and very-large-scale power systems with high penetration of inverters (Western Electricity Coordinating Council [WECC] network) will be introduced with the complementary capabilities of the instructor team. The tutorial serves to share the latest research progress and industry practice of grid-interactive power electronics and covers a broad audience group, including universities, inverter vendors, utilities, and government national laboratories. It is noteworthy that the tutorial will be designed as an interactive session for boosting audience interest and participation. Particularly, the interactive tutorial session will be implemented by inviting the audience to access the interactive tools and video tours during the tutorial to dive into the demo with real-world scenarios and applications.

T14 | Artificial Neural Networks for Power Electronics – A Hands-On Approach

ROOM 204

Organizers:

Joao Pinto, Burak Ozpineci and Marcio Kimpara – *Oak Ridge National Laboratory*

Power electronics systems consist of power electronic switching devices, linear circuit elements, digital circuits, microprocessors, electromagnetic devices, DSPs, filters, controllers, sensors, etc., and the advanced development of these systems and their applications include many areas of knowledge such as solid-state physics, circuit theory, power systems, systems and control theory, simulation and computing, signal processing, electronics, electric machines, electromagnetics, among others. The problems faced during such development may include (Optimum) Converter design, Control, Modulation, Energy management, System Integration, Parameter estimation, System Identification, Diagnostics, Prognostics, Fault tolerance operation, etc. Many of these problems are ill-posed and contain uncertainties, and using standard first-principle mathematical modeling can be impossible, time-consuming, and/or lack precision. Therefore, for them, lately, data-driven modeling is becoming more and more needed. Among many data-driven techniques, Artificial Neural Network (ANN) is one of the best options. However, many power electronics researchers that start applying this technique to solve their power electronics problems can make mistakes in at least one of the steps of the ANN development process and therefore struggle to successfully implement them. The fundamental phases of the ANN developments process are: i) formulating the problem, ii) identifying the type of problem, iii) selecting the best architecture to solve the problem, iv) generating/collecting the data; v) choosing the ANN development platform, vi) designing the ANN; vii) defining the stop criteria; viii) choosing the training algorithm, ix) splitting the data into training, testing, and validation datasets; x) training, testing, and validating the ANN; xi) implementing the ANN (software or hardware); xii) deploying the implemented ANN. Therefore, training in the whole process, with a good understanding of each phase, is crucial to increase the successful use of such a powerful technique. This tutorial will provide a background in the ANN principles and a practical and detailed description of all phases for using this technique. Then, a discussion of the most common power type of problems in power electronics will be provided. In the sequence, three power electronics problems will be described and the use of ANN to solve them will be addressed in a hands-on approach, i.e., each attendee will design, train, test, validate, software implement, and deploy them during the tutorial, acquiring the knowledge to develop research in ANN applications aimed at power electronics.

T15 | Design for Reliability: The Origin of Aging and Degradation in Advanced Power Modules and Emerging State of Health (SOH) Estimation Techniques

ROOM 205A

Organizers:

Douglas DeVoto and Faisal Khan – *National Renewable Energy Laboratory*

Faisal Khan, *NREL*

Designing modern power modules and power converters involves optimizing for a variety of performance metrics including switching efficiency, power density, maximum operating temperature, junction-to- coolant thermal resistance, lifetime, and cost. Many of these targets directly conflict with each other and require a multi-objective optimization strategy. While balancing electrical and thermal requirements is well understood, this tutorial will focus on strategies to introduce reliability optimization earlier in the design process and the failure modes in modern power converters. Common failure locations (e.g., wire bonds, solder interface) and mechanisms within traditional automotive power electronics package designs and reliability concerns associated with packaging at higher temperatures and higher heat fluxes will be discussed. Novel materials, manufacturing methods, and packaging solutions will be presented that increase overall power module package reliability. Modeling procedures will demonstrate optimization strategies for thermomechanical performance and validation methods to accelerated test profiles and operation profiles will be reviewed. The selection of an acceleration profile to highlight a real- word failure mechanism will be explored through several case studies. Key nondestructive and destructive evaluation techniques will be reviewed for their effectiveness, procedure difficulty, time, and cost. Not all components in a power converter circuit are equally impacted by aging, and there exist module or component level precursor and diagnostics, which are mostly electrical characterization. This tutorial will reveal the origin of aging and corresponding degradation in electrical and thermal performance associated with power modules and other circuit components. In addition to offline measurements, several emerging online state of health (SOH) estimation techniques applicable to active devices such as MOSFETs and IGBTS, and passive components will be discussed. The origin of degradation in a live circuit as well as how to determine the remaining life of a power converter using the concept of dynamic safe operating area (DSOA) will be presented. These offline and online techniques will finally be linked to build more robust power modules and converters.

T16 | Cryogenic Power Electronics Design for Electrified Aircraft Propulsion

ROOM 205B

Organizers:

Fei (Fred) Wang, Cheng Ruirui and Dam Shimul – *The University of Tennessee*

Zhang Zheyu – *Clemson University*

Cryogenic power electronics offer numerous game-changing benefits, including 1) improved performance of power semiconductor devices, such as silicon (Si)- and gallium nitride (GaN)based, offering decreased specific on-state resistance and increased switching speed; 2) faster switching frequency operation at cryogenic temperature, greatly reducing the need for passive (e.g. EMI filtering); thereby reducing filter weight; 3) less cooling requirement at extremely low ambient temperatures, and 4) light and/or efficient busbar designs due to the low resistivity of conductors at cryogenic temperature. This seminar will provide several key perspectives for the cryogenic power electronics design from the component up to the

converter level. First, the characteristics of critical components, including power semiconductors and magnetics, at cryogenic temperature are introduced. Second, special considerations, trade, and design studies of cryogenic power stage and filter are discussed. Then, two examples of a 40 kW Si-based and a 1 MW SiC-based cryogenically cooled inverter system for electric aircraft propulsion are illustrated, with cooling design, safety considerations, and the protection scheme highlighted. Upon completion, seminar attendees will have a firm grasp on the cryogenic power electronics design and be provided with a range of possible options in order to better utilize the cryogenic cooling system in power converters.

T17 | Reliability Requirements and Qualification of Automotive Power Semiconductors

ROOM 205C

Organizers:

Layi Alatise and Jose Ortiz-Gonzalez – *University of Warwick*

Don Gajewski – *Wolfspeed*

Wide bandgap devices are increasingly penetrating the automotive market and are becoming prime candidates for implementation in automotive applications, whether in traction inverters or battery chargers. The mission profile of the traction inverter is a particularly aggressive one since the electrothermal stresses on the power devices vary significantly in amplitude and frequency as the motor drive goes through various stages of the drive cycle including acceleration, deceleration, stalling etc. Historically, the traction converter has been implemented using silicon devices where the performance and reliability is well known and understood. Application of WBG devices like SiC MOSFETs and GaN power devices in automotive applications requires understanding of the reliability and qualification procedures especially according to the automotive standard. SiC and GaN power devices have varying internal physics and modes of operation with vastly varying robustness and reliability performance compared to silicon devices. Given the sensitive nature of the application, these devices must pass stringent automotive reliability tests and guidelines defined by the Automotive Electronics Council (AEC), the Joint Electron Device Engineering Council (JEDEC-JC70) and the European Center of power electronics (AQG). This tutorial aims to introduce the subjects related to (i) WBG device physics and operation: This includes details of how these WBG devices differ from traditional silicon IGBTs and MOSFETs (ii) WBG device reliability and robustness: This includes details on what aspects of these WBG technologies make them more or less robust than traditional silicon devices. (iii) Application specific reliability requirements: This includes details of how to translate the mission profile of the application into stresses on the power devices. This is essential given the fact the devices used in electric chargers will be subject to very different electrothermal and thermo-mechanical stresses compared to devices in the traction converter or the load servicing dc/dc converter. (iv) Test methodologies and specifications: This includes details of the circuits and systems used to implement these tests. Discussions will include the differences between standard end-of-line production tests, screening tests and qualification tests.Due to the nature of these WBG devices, some of these testing methodologies have to be adapted to the peculiarity of WBG device physics.

The testing circuits, equipment and facilities required to implement these tests will be discussed. At the end of the tutorial, it is intended that all attendees will become conversant with the reliability and robustness requirements of power devices used in automotive applications. The tutorial is a joint lecture delivered by power device experts from Academia (University of Warwick) and industry (Wolfspeed).

T18 | Advanced Data-driven and Digital-twin Enabled Power-electronics-intensive Battery Management Systems and Fast Charging

ROOM 209A

Organizers:

Sheldon Williamson and Akash Samanta– *Ontario Tech University*

Uday Deshpande – *D&V Electronics*

As electrified transport systems proliferate, Lithium-ion batteries (LIBs) are increasingly becoming the critical element in the immediate and long-term technical and commercial success of these programs. Understanding battery technology and its role in applications are becoming crucial. While there have been many articles published on battery elements and systems, this tutorial approaches the problem from a technical as well as from a user mindset. Primarily, range anxiety and reliability aspects are a bottleneck for the wide adoption of EVs. The internal characteristics of LIBs are highly nonlinear and extremely sensitive to operating and environmental parameters. Therefore, an intelligent safety framework and smart battery management systems (BMS) are extremely essential to ensure safe, reliable, and longer battery life. Furthermore, it is noticed that the frequent incident of fire in electric vehicles (EVs) is primarily due to ineffective BMS, especially poor thermal management control. The reliable operation of BMS requires detailed information on the voltage, current, temperature, and aging profile of each cell. Moreover, important battery states like the state of charge, health, and remaining useful life cannot be directly measured with physical sensors. Therefore, intelligent state estimation techniques such as artificial intelligence (AI), machine learning (ML), and deep learning (DL)- based techniques will be discussed in this short course. Now, as high-resolution data is the backbone of any data-driven technique and collecting and processing high-resolution data needs the IoT for accessing advanced platforms such as cloud computing and data storage. All these aspects will be discussed with examples in this tutorial. Furthermore, the application of microcomputers and new-gen computing platforms, such as edge-computing and fog-computing will also be discussed. Recently, with the introduction of fast charging, the issues of range anxiety and long charging times have been somewhat minimized. However, there has been a high risk of thermal runaway and other safety issues due to this. To ensure effective BMS operation, superfast data acquisition, processing, and control based on accurate battery state are of utmost importance. Here, a recently patented digital-twin-based battery safety framework powered by DL will be introduced. In addition, fast charging and active cell balancing have a significant negative impact on battery health, thus some of our recent developments such as constant temperature constant voltage (CTCV) charging and modular multilevel converter (MMC) based cell balancing and protection techniques aside from the application of reconfigurable battery pack and its application in fast charging and EV battery management will also be covered in this tutorial. The application of data-driven techniques and electromagnetic impedance spectroscopy will be discussed for battery diagnosis, remaining useful life prediction, and remaining useful capacity prediction. A special emphasis will be given to the state estimation of unknown old batteries and second-life LIBs. Furthermore, insights on health-conscious BMS and ways to extend battery useful life will be discussed based on our recent research and development. The application of higher-order cell electrical and thermal modeling in battery emulator development will also be covered in sufficient detail. Finally, recent R&D issues, challenges, and case studies of existing BMS methods and thermal management systems will be explained.

Cancelled

T19 | Smart Transformer: Achieving High Power Flexibility in Future Electrical Grids

ROOM 209B

Organizers:

Giovanni De Carne and Felix Wald, *Karlsruhe Institute of Technology*

Marco Liserre and Marius Langwasser, *Kiel University*

The electrical grid is moving toward a 100% integration of power electronics-based resources for generation (e.g., renewables), loads (e.g., electric vehicles), and storage (e.g., batteries). This allows a better usage of green energy and a faster independence from fuel-based energy resources. This transformation to an electronic grid, however, requires faster actuators than classical electromechanical ones.

The Smart Transformer plays a central role in this transformation, being able to re-dispatch and optimally manage the energy flow within the distribution grid. As a power electronics-based transformer, it not only transforms the voltage level from MV to LV grids, but it allows a dynamic interaction with the connected grid, as it will be shown in this tutorial for different scenarios. In order to exploit its capability, the Smart Transformer requires combining power system aspects and power electronics constraints, resulting in new requirements and challenges.

This tutorial introduces the Smart Transformer concept and takes into account power system considerations as well as power electronics knowledge. Main topics that will be addressed in this tutorial will regard the scenarios and business cases, where the Smart Transformer plays a key role (e.g., electric vehicle charging stations, harbor and airport infrastructures), Smart Transformer architectures and topologies, basic controller designs and innovative concepts for increasing the power flexibility in distribution grids, and standards for the grid integration.

The Project will summarize the results of ten years work of German and international experience. Contributions from IEEE PES Task Force, IEEE Standard working group P3105 and CIGRE WG B4.91 will be included, in order to provide to participants the latest news in terms of standardization and grid integrations of smart transformers.

T20 | General Airgap Field Modulation Theory for Electrical Machines and Its Applications in Automotive and Aerospace Industries

ROOM 209C

Organizers:

Ming Cheng – *Southeast University*

Peng Han – *Ansys, Inc.*

Le Sun – *Nanjing University of Science and Technology*

Sa Zhu – *Hohai University*

Electrical machines are devices that convert mechanical energy into electrical energy or vice versa. They were invented in the 1800s and have a history of nearly 200 years. Other inventions of similar ages, such as the Watt steam engine, telegraph, incandescent light bulb, etc., have been outdated by emerging technologies. By contrast, the electrical machine shows great tenacity and vitality, becoming a living fossil of the Industrial Revolution. Demand for high-performance electrical machines is increasing day by day with the rapid development of our social economy. Application areas of electrical machines have extended from conventional industrial drive to aerospace, transportation, numerical control machine tools, robots, and other high-tech fields, ranging from deep below the surface of the earth to deep space, from the furthest depths of the ocean to the surfaces of land and sea. This tutorial will provide a comprehensive overview of airgap magnetic field modulation phenomena widely observed in electrical machines, and the general airgap field modulation theory that has been developed systematically to understand and research them. It will be shown by several examples that the developed theory not only serves to unify analysis of disparate electrical machines, from conventional DC machines, induction machines, and synchronous machines to unconventional flux-switching permanent magnet (PM) machines, vernier machines, brushless doubly-fed machines, etc., but also paves the way towards the creation of new electrical machine topologies. Starting from overviews of key concepts in electrical machine engineering and in-depth specialized analysis of the novel theory itself, this short course works through applications of the developed theory before proceeding to both qualitative analysis of the theory's operating principles and quantitative analysis of its parameters. The stator-PM variable reluctance resolver for compact and high-speed motor applications and the dual-rotor power-split machine for hybrid electric vehicles invented by the principle of magnetic field modulation are included as two representative examples. By the end of this tutorial, attendees will: • Learn about the historical development of electrical machines and their theories, and the ubiquity of magnetic field modulation phenomena; • Understand the general airgap field modulation theory framework for design, analysis, and innovation of electrical machines; • Be able to apply the general airgap magnetic field modulation theory in qualitative analysis and quantitative calculation of machine performance and inventing emerging machine topologies to meet various application needs.

SUNDAY, OCTOBER 29 2:50PM – 4:20PM

T22 | Understanding of Observed Switching Waveform or High-Speed SiC Devices: From Application Perspectives with Analytical Insights

ROOM 201B

Organizers:

Xu She – *Lunar Energy*

Zheyu Zhang – *Clemson University*

SiC power devices promise the revolution of next-generation power electronics and have been adopted in many applications, such as electric vehicles, photovoltaics, and energy storage systems. High-speed switching is one of the key features, enabling SiC-based power electronics to be highly efficient and ultra-dense. Therefore, high-fidelity switching data based on switching testing become an essential step for high-precision device datasheets by SiC device manufacturers, product design optimization by SiC converter OEMs, and SiC-based R&D activities by researchers and graduate students. It is observed, including presenters' experiences, the measured SiC switching waveforms are extremely non-ideal and highly sensitive to the test circuit design, measurement system, and even the operator. With the given SiC part under the same operating condition, switching waveform discrepancies under two different setups is quite normal but confusing. Usually, "noise" and "parasitics" are two common terms to be blamed for the explanation of the observed waveforms with limited insights into what's truly happened during the switching test. In reality, the dynamics (overshoot, undershoot, high-frequency ringing, low-frequency oscillation, spurious spike) in a switching waveform is typically a combining effect because of circuit parasitics, load high-frequency characteristics, measurement setup, probing, etc. Without holistic considerations, misleading and confusion are highly possible. With this, the proposed tutorial focuses on the understanding of observed switching waveform for high-speed SiC devices. Three impact factors will be targeted: parasitics, load, and measurement. We will first overview parasitics in the switching loop considering the physical implementation in the actual circuit (e.g., device lead, PCB traces, interconnection, etc.), then holistically discuss its impact on the switching waveform based on

the equivalent circuit with the detailed device model. Second, we will perform a comparative analysis with two loads: 1) an optimally designed inductor with minimized capacitive parasitics and 2) an actual induction motor with the power cable. Starting from the load modeling considering the high-frequency characteristics, its impact on switching behavior will be quantified based on the circuit simulation. Third, we will focus on the measurement, including grounding loop effects due to probing and the probe location-induced measurement error.

As a basic format, for each part, we will present illustrations of the representative SiC switching waveforms in industry products and laboratory engineering prototypes by leveraging the presenters' extensive work from both industry and R&D laboratories. Then we will attempt to understand the observed waveforms through device modeling and circuit analysis. Finally, we will demonstrate the theoretical analysis using simulation to visualize the non-ideal waveform and enhance the understanding. In the meantime, the interactive instructor-audience approaches will be introduced during the simulation demonstration.

Free Closing Tutorials

THURSDAY, NOVEMBER 2 4:00PM – 5:30PM

T23 | Advancements in Digital Design and Manufacture of Electric Propulsion Motors

ROOM 209AB

Organizers:

Phil Mellor, Nick Simpson and Josh Hoole – *University of Bristol*

Mircea Popescu and Melanie Michon – *Ansys*

Electric propulsion is widely seen one of the main solutions to improve energy efficiency and reduce CO2 emissions in transportation. Whether hybrid or full electric future propulsion systems will undoubtedly require power electronic driven electrical machines. Industry-led technology road maps across automotive, aerospace, heavy goods transport etc. sectors recognise the importance of electrification and have set demanding targets on future electrical machine power to weight, efficiency and cost, alongside considerations of security of material supply chain and local manufacturing capabilities. Further there is a growing skills shortage in experienced engineers with a knowledge of electrical systems, stifling opportunities for growth and innovation. There is a strong interest to reduce the volume and cost of active materials in propulsion motor technologies beyond their current state-of-art. Potential solutions include increased motor speeds and higher pole numbers and/or typologies such as reluctance and induction machines with reduced dependence on rare-earth materials. In high performance, weight critical applications such as aircraft the limitations of conventional electrical machine construction, comprising laminated iron and organic polymer insulated magnet wire coils, is becoming a major barrier to future performance improvement. Reliability and longevity are also emergent considerations, particularly in understanding the impact of the adoption of new designs, materials and manufacture where there is not an established knowledge base or experience. As there can be significantly different usage and performance requirements across e-mobility applications adopting a common standard of motor design is unlikely to yield the optimum in terms of overall system energy efficiency and cost. Design software needs to become increasingly sophisticated to cater for the new technological development and in providing a valuable experience for potentially no

n-specialist users. These considerations will be discussed and compared. In particular the tutorial will explore the prospects of advancements in new materials and net shaped manufacture alongside computational intelligence in addressing the challenges of an increasingly digital design environment. Automotive and aerospace case studies covering a range of new developments will be outlined, to include:

- How cutting-edge sensitivity analysis and multi-objective optimisation techniques can be applied in the design of an electric propulsion motor. The accessibility of a high performance or cloud computing infrastructure is capable of delivering a truly revolutionary design workflow, allowing multiple candidate solutions to be evaluated in terms of electromagnetic, thermal and mechanical behaviour across the full operating envelope.
- The potential of metal additive manufacture in reducing loss in high frequency windings and in providing integrated thermal management. The design chain of computational efficient modelling of 3D winding structures, 3D printing process, conductor post treatment and insulation will be explained.
- Developmental trends of composites with directional thermal, mechanical and electromagnetic properties suitable for electrical machines. How X-ray tomography, common in the composite inspection, can be used to assess manufacturing variability and degradation in electrical machine windings.

T24 | New Advances and Trends on Model Predictive Control for Power Electronics and Electrical Drives

ROOM 209AB

Organizers:

Marco Rivera and Patrick Wheeler – *University of Nottingham*

In the last decades, the application of fast modern microcontrollers have been continuously growing, allowing the development and implementation of new and more intelligent control strategies as an alternative to conventional techniques for power converters. Model Predictive Control is one of these powerful and attractive alternatives that has received a lot of attention in recent years. The use of predictive control offers several interesting advantages: it is an intuitive control approach, it does not need linear controllers and modulators, and it is possible to easily include nonlinearities and restrictions in the control law. It is expected that the advantages of predictive control will lead to industrial applications in the very near future. In this tutorial new advances and trends in the application of model predictive control for power electronics and electrical drives will be presented.

TECHNICAL PROGRAM SCHEDULE
ORAL SESSIONS

Monday, October 30 12:50PM – 2:30PM

Oral Session 1 | Photovoltaic Systems

Room 201B
Chairs: Li Ding, Ehsan Jamshidpour

12:50PM | A Five-Level Low-Cost Modular Voltage Stepped-Up Converter for Photovoltaic Systems [#116]
Jiani Luo, Zaixin Song, Wei Han and Dianxun Xiao
HKUST(GZ), China; The Hong Kong Polytechnic University, Hong Kong

1:10PM | An Integrated Bidirectional Tri-port Microconverter for Hybrid Solar Plants [#696]
Satish Belkhode, Joseph Benzaquen and Deepak Divan
Georgia Institute of Technology, United States

1:30PM | Reduced Sensor Control Approach for Active Power Decoupling Circuit in PV Microinverter Application [#603]
Yidi Shen, Daniel Zakzewski, Arafat Hasnain, Rakesh Resalayyan and Alireza Khaligh
University of Maryland, United States

1:50PM | Broadband Electrochemical Impedance Spectroscopy of Photovoltaic Cells Based on Converter Switching Ripple Control [#45]
Awingot Richard Akparibo and Paul Barendse
1. University of Cape Town, 2. Ashesi University, Ghana; University of Cape Town, South Africa

2:10PM | AI-Based Black-Box Modeling Algorithm for System Identification in Three-Phase Single-Stage PV Inverter Systems [#1225]
Yuxi Men, Junhui Zhang, Xiaonan Lu and Tianqi Hong
Purdue University, United States; University of Georgia, United States

Oral Session 2 | Renewable Energy Grid Integration I

Room 208B
Chairs: Yue Cao, Robert S. Balog

12:50PM | High Voltage Selective Global Flexible Power Point Tracking for Photovoltaic Systems [#1410]
Anusha Kumaresan, Hossein Dehghani Tafti, Glen G. Farivar, Neha Beniwal, Naga Brahmendra Yadav Gorla, Josep Pou and Kai Strunz
Nanyang Technological University, Singapore; University of Western Australia, Australia; University of Melbourne, Australia, Australia; IIT Palakkad, India; Technical University of Berlin, Germany

1:10PM | A Power Ramp Rate Control Strategy with Reduced Energy Storage Utilization for Grid-Connected Photovoltaic Systems [#164]
Wai Yan Hein, Neha Beniwal, Glen G Farivar and Josep Pou
Nanyang Technological University, Singapore; General Electric Global Research, United States; The University of Melbourne, Australia

1:30PM | A Variable Linear Coefficient Battery Cost Function Control for Revenue Maximization of a Grid Tied-Solar-BES Power Generation System [#442]
Subhadip Chakraborty, Gaurav Modi, Bhim Singh and B.K. Panigrahi
EE Dept., Indian Institute of Technology Delhi, India

1:50PM | Hybrid Simulation of a Wave Energy Converter Power Take Off for Flicker and Power Quality Studies [#1322]
Michael Boller, Fabio Carapellese, Ted Brekken and Eduardo Cotilla-Sanchez
Oregon State University, United States; Politecnico di Torino, Italy

Oral Session 3 | Enhanced Control of Grid-Forming Converters

Room 201A
Chairs: Gab-Su Seo, Heng Wu

12:50PM | Comparative Analysis on DC-Link Voltage Synchronization Controllers for Dual-Port Grid-Forming Voltage-Source Converters [#888]
Shuo Zhang, Wei Qiao, Liyan Qu and Jun Wang
University of Nebraska-Lincoln, United States

1:10PM | A Method for Synthesizing Virtual Impedance using a Disturbance Observer in Virtual Synchronous Generator [#349]
Geon Heo and Yongsoon Park
Gwangju Institute of Science and Technology, Korea (South)

1:30PM | Overcurrent Suppression by Power Feedback Control Manipulating Angular Frequency for VSG Inverter [#693]
Yushi Miura, Kushida Hideto and Higuchi Kenya
Nagaoka University of Technology, Japan

1:50PM | Enhancing Stability of dVOC Controlled Grid-Forming Inverters Under Large Grid Transients - A Power Angle Based Approach [#1541]
Arnab Acharya and Raja Ayyanar
Arizona State University, United States

2:10PM | On the Passivity and Stability of Grid-Forming Voltage-Source and Current-Source Inverters [#625]
Pranjal Gajare, Joseph Benzaquen and Deepak Divan
Georgia Institute of Technology, United States

Oral Session 4 | DC-DC Converters I

Room 202A
Chairs: Manikanta Pallantla, Yingyi Yan

12:50PM | Decentralized Control of a Modular Multi-Port Cascaded Boost Converter (M2CBC) for Electric Vehicle Battery Swapping Station [#556]
Suman Mandal, Swamy Jakkula, Satish Belkhode, Anshuman Shukla and Suryanarayana Doolla
Indian Institute of Technology Bombay, India; Georgia Institute of Technology, United States

1:10PM | An Expandable Non-Isolated Multiport dc-dc Converter with High Switching Frequency Operation [#925]
Zahra Saadatizadeh and Alan Mantooth
University of Arkansas, United States

1:30PM | Analysis of a Transformerless High Step-Down DC-DC Converter [#204]
Truong Phan Nhat, Dung Nguyen Anh, Liu Yu-Chen and Chiu Huang-jen
NTUST, Taiwan; Lucid Motors, United States; NTUT, Taiwan

1:50PM | Analysis and Evaluation of Integrated Dual Input Converter with Power Processing and Sharing Capability [#239]
Kausik Biswas, Shreeva Pattnaik, Olive Ray and Chandrasekhar Narayan Bhende
Indian Institute of Technology Bhubaneswar, India

2:10PM | Analysis and Design of High-Efficiency Modular Multilevel Resonant DC-DC Converter [#1646, Post Journal]
Dong Cao
University of Dayton, United States

Oral Session 5 | DC-DC Isolated I

Room 202B
Chairs: Dong Cao, Jinia Roy

12:50PM | Single-Stage 48 V/1.8 V Coupled-Transformer Voltage Regulator (CTVR) [#878]
Xin Lou, Feiyang Zhu, Zheqing Li, Qiang Li and Fred C. Lee
CPES, Virginia Tech, United States

1:10PM | Design and Implementation of a 12 kW Scalable Electronic-Embedded Transformer (EET)-based DC Transformer (DCX) with Trapezoidal Current [#1358]
Yuliang Cao and Dong Dong
Virginia Tech, United States

1:30PM | Design of the Dual Active Bridge Converter to Minimize RMS Current in Supercapacitor Interface Applications [#632]
Arkadeb Sengupta, Thiago Pereira and Marco Liserre
Kiel University, Germany

1:50PM | Mode Analysis, Transformer Saturation, and Fault Diagnosis Technique for an Open-Circuit Fault in a Three-Phase DAB Converter [#1655, Post Journal]
Sagar Rastogi, Brij Singh, Subhashish Bhattacharya and Suyash Sushilkumar Shah
North Carolina State University, United States; John Deere, United States

Oral Session 6 | Power Converter Modeling

Room 202C
Chairs: Ruiyang Qin, Lei Gu

12:50PM | Modelling and Identification of the Common and Differential Mode LCL Filter Parameters in Grid-Tied Voltage Source Inverters [#1462]
Seyed Salman Ahmadi and Brendan McGrath
RMIT University, Australia

1:10PM | Harmonic Transfer Function Modeling of LCC-S Inductive Power Transfer System [#477]
Cheng Gong, Zhaoyi Ding and Chi-Seng Lam
University of Macau, China

1:30PM | Accelerating Switching Model-based Simulation Through Parallel Computing [#767]
Yi Li, Zheyu Zhang, Shuangshuang Jin and Christopher Edrington
Clemson University, United States

1:50PM | On the Design of NARX-ANNs for the Black-Box Modeling of Power Electronic Converters [#447]
Andrea Zilio, Filippo Dalla Zuanna, Davide Biadene, Tommaso Caldognetto and Paolo Mattavelli
University of Padova, Italy

2:10PM | Three-Dimensional Semi-Finite Element Based Proximity Loss Calculation for Litz Wires in A High Frequency Transformer [#380]
Chaohui Liu, Xiao Chen, Yakun Zhang, Shuai Shi, Zhaohe Meng, Zhichao Li and Wei Su
NEVC Beijing, China; University of Sheffield, United Kingdom; BEIJING ELECTRIC VEHICLE CO.,LTD., China

Oral Session 7 | Control of Three-Phase Converters

Room 204
Chairs: Jessica Boles, Hongjie Wang

12:50PM | Negative Voltage Sequence Control for an Electric Arc Furnace Power Supply based on a Multilevel AC-AC Converter [#1103]
Andrea Volpini, Samuele Granata, Gianluca Postiglione and Pericle Zanchetta
University of Pavia, Italy; Nidec ASI, Italy

1:10PM | Dead-time Compensation Method for Bus-clamping Modulated Voltage Source Inverter [#880]
Reza Asrar Ghaderloo, Yidi Shen, Chanaka Singhabahu, Rakesh Resalayyan and Alireza Khaligh
University of Maryland, United States

1:30PM | DC Current Elimination for MPC for CHB-STATCOM Employing Current Transformer Sensors [#343]
Francesco Simonetti, Sobhan Mohamadian, Concettina Buccella and Carlo Cecati
University of L'Aquila, Italy; Politecnico di Bari, University of L'Aquila, Italy

1:50PM | A Single-Cell-Based Injection Method for Circulating Current Control in MMC [#605]
Davide D'Amato, Riccardo Leuzzi and Vito Giuseppe Monopoli
Politecnico di Bari, Italy

2:10PM | Data-Enabled Finite Control-Set Model Predictive Control of a Grid-Tied Inverter [#1024]
Wenjie Wu, Lin Qiu, Hui Li, Xing Liu, Chao Du and Youtong Fang
Zhejiang University, China; Florida State University, United States; Shaanxi University of Science & Technology, China

Oral Session 8 | Induction Machines

Room 208A
Chairs: Silvio Vaschetto, Md Sariful Islam

12:50PM | Equivalent Circuit Model Fitting for an IM Motor Using FEM Results for Multiple Voltage and Frequency Supplies [#315]
Farid Zidat, Sylvain Perez, Abdessamed Soualmi and Philippe Wendling
Altair Engineering, France; Altair Engineering, United States

1:10PM | Assessment of Skew Degree Scheme for High-Efficiency and Low-Vibration Induction Motors Based on Improved Analytic Hierarchy Process [#391]
Mingji Liu, Zhen He, Zixu Wang, Shuyang Xu, Xueshen Cui, Hassan H Eldeeb, Guorui Xu, Jinping Kang and Haisen Zhao
State Key Laboratory of Alternative Electrical Power, China; SLPT Global Pump Group of SLPT Automotive, United States

1:30PM | Deep Learning-Based Bearing Fault Classification Using Stray Magnetic Flux Signal [#875]
Ramin Rajabioun, Mojtaba Afshar and Bilal Akin
Van Yuzuncu Yil University, Turkey; University of Texas at Dallas, United States

1:50PM | Evaluating the Use of Terminal Currents and the Controller Signals in the Diagnosis of Eccentricity and Interturn Faults in a Micro-DFIG [#134]
Ester Hamatwi, Paul Barendse and Azeem Khan
University of Namibia, Namibia; University of Cape Town, South Africa

2:10PM | Automatic Classification of Eccentricities and Misalignments in SCIM Applying Persistence Spectrum and CNN to Stray-Flux Signals [#149]
Vicente Biot-Monterde, Angela Navarro-Navarro, Israel Zamudio-Ramirez, Jose Antonino-Daviu and Roque A. Osornio-Rios
Universitat Politecnica de Valencia, Spain; Universidad Autonoma de Queretaro, Mexico

Oral Session 9 | Electric Machines for Transportation

Room 209A
Chairs: Alireza Fatemi, Gerd Bramerdorfer

12:50PM | Comparison between a Series-Hybrid Variable-Flux Memory Motor and a Rare-earth Interior Permanent Magnet Synchronous Motor [#234]
Akrem Mohamed Aljehaimi, Bassam Samy Abdelmageed and Pragasen Pillay
Concordia University, Canada

1:10PM | Comparative Turn-off Safe Modes of Ferrite- and NdFeB-Interior PMSMs [#1216]
Paolo Ragazzo, Gaetano Dilevrano, Simone Ferrari and Gianmario Pellegrino
Politecnico di Torino, Italy

1:30PM | A High-speed Surface Permanent Magnet External Rotor Motor and Integrated Drive for Electric Vehicles [#1416]
Vandana Rallabandi, Mostak Mohammad, Himel Barua, Shajjad Chowdhury, Burak Ozpineci, Jonathan Wilkins, Lianshan Lin, Bidzina Kekelia and Emily Cousineau
Oak ridge national laboratory, United States; National Renewable Energy Laboratory, United States

1:50PM | Design and Controllability Trade-Off in Dual Three-phase Winding PMSMs [#1505]
Zhu Shaohong, Qayyum Naila, Ernest Emil, Paciura Krzysztof, Zou Tianjie and Gerada Chris
Cummins Inc., United Kingdom; University of Nottingham, United Kingdom

2:10PM | A Narrowband Independent-Speed Variable-Frequency Aviation Generator [#573]
Peng Peng, Sina Vahid, Ayman El-Refaie and Julia Zhang
General Motors Company, United States; Marquette University, United States; The Ohio State University, United States

Oral Session 10 | Diagnostics, Noise and Vibration in Electric Machines

Room 209B
Chairs: Hassan Eldeeb, Jose Antonino-Daviu

12:50PM | Common Mode Voltage based Stator Insulation Testing for Inverter fed Motors with High Resistance Grounding Systems [#284]
Muhammad Faizan Shaikh, Byambasuren Battulga, Sang Bin Lee and Carlos Platero
Korea University, Korea, Republic of; Polytechnic University of Madrid, Spain

1:10PM | Instantaneous Torque Estimation for Variable Flux Machines Considering Permanent Magnet Temperature Variation [#1483]
Maria Martinez, Daniel F. Alonso, Juan M. Guerrero and Fernando Briz
University of Oviedo, Spain

1:30PM | Evaluation of Noise Performances of Odd and Even Number of Slots per Pole Pair of 3-Phase Brushless Electric Machines [#990]
Md Sariful Islam, Mohammad Islam, Brycen Halfmann, Abraham Tesfamicael and Rhishav Mahaju
HL Mechatronics, United States

1:50PM | Industrial Steam Turbine Generator Predictive Maintenance Based on Measurement Availability [#1022]
Georgios Falekas, Athanasios Karlis and Jose Alfonso Antonino Daviu
Democritus University of Thrace, Greece; Universitat Politecnica de Valencia, Spain

2:10PM | Experimental Comparison of Acoustic Noise, Vibration, and Power Consumption in Ball-Bearing-Supported Motors and Single-Drive Bearingless Motor with Radial Passive Magnetic Bearings [#1679, Post Journal]
Theeraphong Srichiangsa, Surya Narayana Gunda and Akira Chiba
Kasetsart University, Thailand; Tokyo Institute of Technology, Japan

Oral Session 11 | Medium Voltage and High-Power Drives

Room 209C
Chairs: Nicola Bianchi, Mohammed Agamy

12:50PM | Comparison of a 10 kV SiC Current Switch with two 6.5 kV Series Connected Si SGCTs for Medium Voltage Current Source Inverter Applications [#1068]
Sneha Narasimhan, Subhashish Bhattacharya and Navid Zargari
North Carolina State University, United States; Rockwell Automation, United States

1:10PM | Loss-Constrained Optimized Pulse Patterns for Three-Level Converters with Robustness to Power Factor Variations [#236]
Isavella Koukoula, Petros Karamanakos and Tobias Geyer
Tampere University, Finland; ABB Systems Drives, Switzerland

1:30PM | DC-link Stability of Stacked Polyphase Bridges Supplying Induction Machine having Common-Duty-Ratio Control [#40]
Slavko Mocevic, Pavel Kadachigov, Eddy Aeloiza, Darren Tremelling and Lennart Harnefors
ABB - USCRC, United States; ABB, Finland; ABB, Sweden

1:50PM | A 6.5 kV SiC MOSFET based Inverter for Medium Voltage (2.3 kV) High-Speed Motor Drive Applications [#1439]
Raj Kumar Kokkonda, Sanket Parashar, Partha Pratim Das and Subhashish Bhattacharya
North Carolina State University, United States

2:10PM | A Hybrid Multilevel and Multi-Pulse Power Converters based Adjustable Speed Drive [#949]
Rohit Kumar and Bhim Singh
Indian Institute of Technology Delhi, India

Oral Session 12 | SiC Devices I - Modeling and New Concepts

Room 205A
Chairs: Amy Romero, Jose Ortiz Gonzalez

12:50PM | The Optimisation, Fabrication and Comparison of 10 kV-rated 4H-SiC IGBTs and MOSFETs [#634]
Arne Benjamin Renz, Tianxiang Dai, Marina Antoniou, Qinze Cao, Kyrylo Melnyk, Xinkai Tian, Vishal Ajit Shah, Katarzyna Stokeley, Andrew Newton, Oliver James Vavasour
University of Warwick, United Kingdom; Oxford Instruments Plasma Technology, United Kingdom

1:10PM | Robust and Area Efficient 4H-SiC 1.2 and 3.3 kV Floating Field Ring (FFR) and Trench-FFR Termination Designs and Analysis [#504]
Kyrylo Melnyk, Peter Michael Gammon, Arne Benjamin Renz, Qinze Cao, Neophytos Lophitis and Marina Antoniou
University of Warwick, United Kingdom; University of Nottingham, United Kingdom

Monday, October 30 3:00PM – 4:40PM

Oral Session 13 | Power Converters for Electric Vehicles

Room 201B
Chairs: Ali Khajehoddin, Feng Wang

3:00PM | A Three-phase MVAC to Mutiport LVDC Converter with High Frequency Isolation for Fast DC Charging Station for EVs [#807]
Harisyam P v, Saichand Kasicheyanula, Shashidhar Mathapati and Kaushik Basu
Indian Institute of Science, India; Delta Electronics, India, India

3:20PM | A Smart Three-Port Converter for Interconnecting Grid, EV, and Solar-PV for Enhancing System Performance [#1109]
Yash Nikhare, Jalaj Kumar and Suvendu Samanta
Department of Sustainable Energy engg IIT Kanpur, India; Department of Electrical Engineering, IIT Kanpur, India

3:40PM | Design and Implementation of a Multiport System for Solar EV Applications [#561]
Reza Rezaii, Mohammad Nilian, Md Safayatullah, Sumana Ghosh and Issa Batarseh
University of Central Florida, United States; Ford Motor Company, United States

4:00PM | Stepwise Transitions Control for Reconfigurable LLC resonant Converters with Multiple Modes [#367]
Yu Zuo, Xiaobin Shen, Xuewei Pan and Martinez Wilmar
KU Leuven, Belgium; Harbin Institute of Technology, Shenzhen, China

4:20PM | Fixed-frequency PWM LLC resonant converter with 8-type rectifier for wide input voltage applications [#365]
Yu Zuo, Xuewei Pan, Pervaiz Hassan, Tian Fanghao and Martinez Wilmar
KU Leuven, Belgium; Harbin Institute of Technology, Shenzhen, China

Oral Session 14 | Distributed Energy Integration

Room 204
Chairs: Dong Cao, Marius Langwasser

3:00PM | An Adaptive Virtual Impedance Control for Reactive Power Sharing in Microgrids [#458]
Junjie Xiao, Lu Wang, Zian Qin and Pavol Bauer
Electrical Sustainable Energy TU Delft, Netherlands

3:20PM | A Grid-Supporting Rectifier with Frequency and Voltage Regulation Capabilities [#1431]
Biqi Wang, Rolando Burgos and Bo Wen
Virginia Tech, United States

3:40PM | Distribution System Optimal Operation of Smart Homes with Battery and Equivalent HVAC Energy Storage for Virtual Power Plant Controls [#1445]
Steven Poore, Rosemary Alden, Evan Jones and Dan Ionel
SPARK Lab, University of Kentucky, United States

4:00PM | A 4.16kV/750kVA MV Power Conditioning System for Distribution System Applications [#1268]
Ahmed Rahouma, David Porras, Hui Cao, Yuxiang Chen, Juan Balda, Yue Zhao, Alan Mantooth and German Oggier
University of Arkansas, United States; Universidad Nacional de Rio Cuarto, Argentina

4:20PM | Utilizing Smart Inverter Virtual-Sensor Nodes for Enhanced Behind-the-Meter Visibility in high PV penetration distribution feeders [#1264]
Mehrnaz Madadi, Subhashish Bhattacharya, Richard Beddingfield and Paul Ohodnicki
North Carolina State University, United States; General Electric, United States; University of Pittsburgh, United States

Oral Session 15 | Renewable Energy Grid Integration II

Room 208B
Chair: Yonghao Gui, Heng Wu

3:00PM | Sensitivity-Based Stability Analysis for Voltage Controlled Converters [#1146]
Diego Perez-Estevez, Diego Rios-Castro and Jesus Doval-Gandoy
University of Vigo, Spain

3:20PM | A Benchmarking Tool for State-of-the-Art Microgrid Design Approaches [#1199]
Shweta Meena, Hualong Liu, Hao Tu, Srdjan Lukic and Wenyuan Tang
North Carolina State University, United States

3:40PM | A Decomposed Two-Port Network Impedance Modeling Method of Type-3 Wind Generation System with Grid-Forming Control [#602]
Liang Huang, Chao Wu, Dao Zhou, Frede Blaabjerg, Ion Boldea and Shan He
Aalborg University, Denmark; Shanghai Jiao Tong University, China; Politehnica University of Timisoara, Romania

4:20PM | Overview of HIL Co-simulation for Very Large Distribution Systems and Power Electronic Converters with a DC Fast Charging EV Benchmark Study on an IEEE Test Feeder [#1223]
Rosemary Alden, Donovin Lewis and Dan Ionel
SPARK Laboratory, ECE Department, University of Kentucky United States

Oral Session 16 | Power Converter Modeling, Analysis and Design

Room 205C
Chair: Harish S. Krishnamoorthy

3:00PM | Event-Driven Controller Hardware-In-The-Loop Simulation for Modular Multilevel Converters [#302]
Yangbin Zeng, Weicheng Liu, Jialin Zheng, Haoyu Wang, Han Xu, Di Mou, Zhengming Zhao, Hong Li and Zuoxing Wang
Tsinghua University, China; Columbia University in the City of New York, United States; Beijing Jiaotong University, China

3:20PM | Comparative Study of Nonlinear Black-Box Modeling for Power Electronics Converters [#531]
Liang Qiao, Yaosuo Xue, Yonghao Gui, Wei Du and Fei (Fred) Wang
The University of Tennessee, Knoxville, United States; Oak Ridge National Laboratory, United States; Pacific Northwest National Laboratory, United States

3:40PM | ANN-based Cooperative Frequency Restoration in a Network of Grid-forming and Grid-following Inverters [#610]
Silvanus Dsilva, Mohsen Hosseinzadehtaher, Alireza Zare, Mohammad B. Shadmand, Sertac Bayhan and Haitham Abu Rub
University of Illinois Chicago, United States; Hamad Bin Khalifa University, Qatar; Texas A and M University at Qatar, Qatar

4:00PM | Efficient and Robust Controller Design Automation for Power Converters [#216]
Wanrong Li, Sinan Li, Huawei Yuan, Jianguo Zhu, Yuhan Zhang and Fujian Li
the University of Sydney, Australia; Nanyang Technological University, Singapore

4:20PM | Multi-rate State-Variable-Interfaced Decoupling Simulation Strategy for Large-Scale Power Electronics Systems [#449]
Han Xu, Zhengming Zhao, Yangbin Zeng, Jialin Zheng, Bochen Shi, Weicheng Liu, Haoyu Wang and Wenhao Xie
Tsinghua University, China

Oral Session 17 | Power Converters and Motor Drives for Transporation Electrification

Room 202C
Chairs: Cong Li, Liran Zheng

3:00PM | Feed Forward compensation for the Reduction of Vibrations in Ship`s Generators [#146]
Joaquin Rojas Leon, Constanza Ahumada, Yeiner Arias Esquivel, Roberto Cardenas and Doris Saez
Universidad de Chile, Chile; Instituto Tecnologico de Costa Rica, Costa Rica

3:20PM | Novel Integrated On-Board Battery Charger for All-Electric Aircraft Based on Multiphase SPM Synchronous Machine [#1059]
Mohamed Y. Metwly and JiangBiao He
University of Kentucky, United States

3:40PM | Development of a DC Distribution Testbed for High-Power EV Charging [#631]
Md Shafquat Ullah Khan, Edward Watt, Alastair Thurlbeck, Emin Ucer, Rasel Mahmud, Mithat John Kisacikoglu and Andrew Meintz
National Renewable Energy Laboratory (NREL), United States

4:00PM | Stability Analysis of Vehicle-Grid Coupling System under Mixed Operation of Locomotives [#137]
Yi Liu, Yue Wang, Pengkun Li, Bole Feng and Hong Wu
Xi an Jiaotong University, China

4:20PM | A Converter Topology for Auxiliary Power System of an All Electric Aircraft [#943]
Alfonso Damiano, Giuseppe Bossi, Floris Andrea, Buccella Concettina, Simonetti Francesco and Cecati Carlo
University of Cagliari, Italy; University of Aquila, Italy

Oral Session 18 | DC-DC Converters II

Room 202A
Chairs: Manikanta Pallantla

3:00PM | Fully Soft-Switching Flying Capacitor Based Quasi-Resonant Buck Converter [#1226]
Kumar Joy Nag and Aleksandar Prodic
University of Toronto, Canada

3:20PM | Comparative Study of DC-DC Converter Supplying Pulsated Current for Solid Oxide Fuel Cell Application [#1415]
Mattia Iurich, Ahmed Saafan, Boran Fan, Dong Dong, Rolando Burgos, Casey Brown, Hossein Ghezel-Ayagh and Roberto Petrella
CPES Virginia Tech, United States; Fuel Cell Energy, United States; University of Udine, Italy

3:40PM | A Three-Phase Synergetically Controlled Buck-Boost Current DC-Link EV Charger [#1649, Post Journal]
Daifei Zhang, Jonas Huber and Johann Kolar
ETH Zurich, Switzerland

Oral Session 19 | DC-DC Isolated II

Room 202B
Chairs: Dong Cao, Bilal Akin

3:00PM | Flying Transformer Multi-Level Converter for Isolation and Seamless Control for 48V POL Applications [#831]
Jacob Lopez, Ratul Das and Hanh-Phuc Le
University of California San Diego, United States

3:20PM | A 3rd Gen 10-kV SiC MOSFET High-Frequency Power Conversion Block for MV Applications [#1214]
Roderick Gomez, Juan Balda and Yue Zhao
University of Arkansas, United States

3:40PM | High-Performance Bidirectional Impedance Control Network-based Resonant DC-DC Converter [#793]
Firehiwot Gurara and Khurram Afridi
Cornell University, United States

4:00PM | Towards Full Range Zero-Voltage Switching of DAB Converters: An Improved Multi-Mode Modulation at Light Loads Under Close-to-Unity Voltage Ratio [#1718, Post Journal]
Zhijing Ye, Chi Li, Jiye Liu and Zedong Zheng
Tsinghua University, China

4:20PM | A Scalable Electronic-Embedded Transformer (EET), a New Concept toward Ultra-high-frequency High-power Transformer in DC-DC Converters [#1657, Post Journal]
Yuliang Cao and Dong Dong
Virginia Tech, United States

Oral Session 20 | Multiphase AC-DC Converters

Room 205B
Chairs: Ali Khajehoddin, Dehong Xu

3:00PM | Single-Stage Quad-Active-Bridge Series-Resonant AC-DC Converter: Modulation for Active and Reactive Power [#1063]
Daniel Chavez, Damian Sal y Rosas and Julio Tafur
Universidad Nacional de Ingenieria, Peru; Pontificia Universidad Catolica del Peru, Peru

3:20PM | A Novel Single-Stage Bidirectional Isolated Three-Phase Resonant Mode AC-DC PFC Converter [#1367]
Mafu Zhang, Huanghaohe Zou, Chen Zibo, Ruiyang Yu and Alex Huang
UT austin, Semiconductor power electronic center, United States

3:40PM | Isolated Single-stage Three-phase AC/DC Converter using Bidirectional Switches [#1350]
Ramandeep Narwal, Isaac Wong, Subhashish Bhattacharya, B. Jayant Baliga and Douglas C. Hopkins
North Carolina State University, United States

4:00PM | Investigation of Input Current Distortion at Sector Transitions in Unfolding-based Grid-tied AC-DC converters. [#604]
Sanat Poddar, Mahmoud Mansour, Aditya Zade and Regan Zane
Utah State University, United States

4:20PM | Zero Voltage Switching AC-DC Converter Based on Zero State Modulation (ZSM) [#994]
Rajendra Prasad Kandula, Jonathan Harter, Misael Martinez Montejano and Christian Boone
Oak Ridge National Laboratory, United States

Oral Session 21 | Industrial Power Converters - Topology, Design, and Control | Session Featuring Prof. Po-Tai Cheng and Acknowledging his Contributions

Room 201A
Honorary Chair: Po-Tai Cheng
Chairs: Pericle Zanchetta, Xiaonan Lu

2:55PM | Recognition Session
Pericle Zanchetta, Xiaonan Lu
University of Nottingham, United Kingdom, Purdue University, USA

3:20PM | Design and Optimization Strategy to Size Resilient Stand-Alone Hybrid Microgrids in Various Climatic Conditions [#1647, Post Journal]
Norma Anglani and Giovanna Oriti
University of Pavia, Italy, Italy; Naval Postgraduate School, United States

3:40PM | Active and Reactive Power Sharing using Adaptive Virtual Impedance Control for Parallel-connected Inverters [#401]
Keisuke Kusaka, Koharu Kondo, Jun-ichi Itoh and Aya Murata
Nagaoka University of Technology, Japan; OMRON Corporation, Japan

4:00PM | Gradient-Based Predictive Pulse Pattern Control for Grid-Connected Converters with LCL Filters [#1036]
Petros Karamanakos, Mirza Abdul Waris Begh, Shirin Rahmanpour and Tobias Geyer
Tampere University, Finland; ABB Systems Drives, Switzerland

4:20PM | Fault-Tolerant Control Method using Tangential Weighting to Improve Torque per Ampere for Medium-Voltage Drives under Open Fault Condition [#420]
Taeyun Kim, Yongsug Suh and Hyeoncheol Park
Jeonbuk National University, Korea, Republic of

Oral Session 22 | Electrical Drives for Aerospace and Traction Applications

Room 209A
Chairs: Lei Hao, Zhe Zhang

3:00PM | Balanced Z-Source Inverter for Common-Mode Voltage Cancellation [#1422]
Pengkun Tian, Thomas Jahns and Bulent Sarlioglu
University of Wisconsin-Madison, United States

3:20PM | Bonded Nd-PM Claw-Pole Synchronous Motor Drive for Traction Applications: Benefits and Challenges [#706]
Dhruvi Dhairya Patel, Ion Boldea and Babak Fahimi
The University of Texas at Dallas, United States; Politechnica University of Timisoara, Romania

3:40PM | A Simplified Fixed Switching Frequency Model Predictive Control for an AFPM Motor Drive in a Distributed Electric Aircraft Propulsion System [#1282]
Farzad Y. Notash, Benjamin Luckett and JiangBiao He
University of Kentucky, United States

4:00PM | Multi-Physics Modeling of Power Electronic Converters with Liquid Immersion Cooling [#1420]
Reza Ilka, Yiju Wang, JiangBiao He, Ronak Ali, Aaron Swartz, David Chen, Ning Ren, Z. George Zhang, Gefei Wu and Roger England
University of Kentucky, United States; Valvoline Global Operations, United States

4:20PM | FPGA Based Open Loop Synchronized Sinusoidal Pulse Width Modulator for Aircraft Electric Propulsion Machine Drive [#126]
Vasile Horga, Athar Hanif, Marcel Ratoi, Andy Provenza and C.G. Cantemir
Technical University of Gheorghe Asachi Iasi, Romania; The Ohio State University, United States; NASA Glenn Research Center, United States

Oral Session 23 | SiC Devices II - Abnormal Conditions

Room 205A
Chairs: Amy Romero, Jose Ortiz Gonzalez

3:00PM | Analysis of SiC MOSFETs Short-circuit during Shoot-Through Event in Half Bridge Configuration [#1021]
Man Zhang, Helong Li, Zhiqing Yang, Shuang Zhao, Xiongfei Wang and Lijian Ding
Hefei University of Technology, China; Royal Institute of Technology, Sweden

3:20PM | Evaluation of Bipolar Degradation in SiC MOSFETs for Converter Design [#450]
Yifei Wu, Chengxi Li, Li Ran, Peter Gammon, Hao Feng, Yun Li, Chong Ng, Binbing Wu and Qinze Cao
The University of Warwick, United Kingdom; Chongqing University, China; CRRC Times Electric, China; Offshore Renewable Energy Catapult, United Kingdom

3:40PM | Partial Discharge Evaluation of a 3.3 kV SiC MOSFET Power Module at Flight-Altitude Pressures Under 60 Hz Ac Voltage [#1486]
Ke Wang, Yizhou Cong, Pengyu Fu, Jin Wang, Ashish Kumar, Kraig Olejniczak and Daniel Pelletier
Ohio State University, United States; Wolfspeed Inc., United States

4:00PM | Physics-based Compact Model of SiC MOSFET for Cryogenic Performance Prediction [#62]
Xu Lu, Yansong Lu, Hao Yin, Yijun Ding, Chong Zhu and Xi Zhang
Shanghai Jiaotong University, China

4:20PM | Investigation on Ruggedness Degradation of Planar-gate SiC MOSFETs after Total Ionizing Dose Radiation [#482]
Shiwei Liang, Ziyuan Wu, Lei Shu, Jun Wang, Haonan Chen, Gaoqiang Deng, Zhanwei Shen, Fan Fan and Chengjie Wang
Hunan University, China; Beijing Microelectronics Technology Institute, China; Institute of Semiconductors, CAS, China

Oral Session 24 | GaN and Other Semiconductor Devices

Room 208A
Chairs: Shu Yang, Srivatsa Raghunath

3:00PM | Is the GaN HEMT More Prone to Sustained Oscillations under Cryogenic Conditions [#1575]
Ziang Li, Yuqi Wei, Maksudul Hossain Md, Jinjun Liu and Alan Mantooth
Xi'an Jiaotong University, China; Intel, DuPont, Washington, USA, United States; University of Arkansas, United States

3:20PM | Optimal Dead Time Selection in GaN FET Switching Leg Via Thermal Analysis [#1549]
Vincenzo Barba, Fausto Stella, Salvatore Musumeci, Marco Palma and Radu Bojoi
Politecnico di Torino, Italy; Efficient Power Conversion Corporation (EPC), Italy

3:40PM | Novel Dynamic ON-Resistance Measurement Circuit Topology, Operation, and Performance for High Voltage GaN Power HEMTs [#1212]
Lee Gill, Luciano Andres Garcia Rodriguez, Jacob Mueller, Robert Kaplar and Alan Michaels
Sandia National Laboratories, United States; Virginia Tech, United States

4:00PM | Self-Reverse-Blocking (SRB) Control of Dual-Gate Monolithic Bidirectional GaN Switch with Quasi-Ohmic On-State Characteristic [#1661, Post Journal]
Neha Nain
ETH Zurich, Switzerland

4:20PM | Suppression Strategy for Oscillatory False Triggering Between Two paralleled GaN-HEMTs Based on Optimization of Parasitic Inductance [#1443]
Yoshida Ryoma, Ishihara Masataka, Umetani Kazuhiro and Hiraki Eiji
Okayama University, Japan

Tuesday, October 31 8:30AM – 10:10AM

Oral Session 25 | Photovoltaic Power Converters

Room 201B
Chairs: Ramanathan Thiagarajan, Carl Ho

8:30AM | Scalability of PV Systems with Seamless Operation Transition between I-V Droop Control and MPPT Control for DC Bus Signaling [#1028]
Yasushi Eto, Yuichi Noge, Masahito Shoyama and Tadatoshi Babasaki
Kyushu University, Japan; NTT Facilities, INC., Japan

8:50AM | Novel Common Mode Voltage Elimination Methods in Three-Phase Four-Wire Grid-Connected Inverters [#1639, Post Journal]
Giovanna Oriti and Alexander Julian
Naval Postgraduate School, United States; Independent Researcher, United States

9:10AM | Development of a Direct Medium Voltage Single Stage LLC Resonant Solar PV Inverter [#547]
Parthkumar Bhuvela and Adel Nasiri
University of South Carolina, United States

9:30AM | Fast MPPT for Residential PV Systems with Low DC-Link Capacitance and Differential Power Processing [#704]
Nicolas Aguero Meineri, Ignacio Santana and Ignacio Galiano Zurbriggen
University of Calgary, Canada

Oral Session 26 | Electronic Power Grid Systems

Room 208 B
Chairs: Frans Dijkhuizen, Fred Wang

8:30AM | Inductor Current Minimization and Dynamic Analysis of DC-DC Converter for Interconnection of CSI/VSC HVDC Networks [#1262]
Mohamed Mansour, Joseph Olorunfemi Ojo, Khaled Hany Ahmed and Ezekiel Olayiwola Arogunjo
Tennessee Tech University, United States; University of Strathclyde, United Kingdom

8:50AM | Modeling and Performance Enhancement of Grid Tied Tidal Energy System with Fractional Order Integral Based Incremental Conductance [#1076]
Deepi Singh, Austin Zhou, Abdul Muneeb, Abdul Basit Mirza and Fang Luo
Stony Brook University, United States

9:10AM | Fault handling method in an HVDC system with half-bridge MMCs and hybrid dc circuit breakers [#206]
Mitsuyoshi Enomoto, Kenichiro Sano, Yushi Koyama, Kei Sekiguchi, Takahiro Ishiguro and Daichi Suzuki
Tokyo Institute of Technology, Japan; Toshiba Infrastructure Systems & Solutions Corp., Japan; Toshiba Energy Systems & Solutions Corporation, Japan

9:30AM | Low-Voltage Ride-Through Method of the HVDC Transmission System for Feeding Islanded Offshore AC Loads [#452]
Nikola Krneta and Kenichiro Sano
Tokyo Institute of Technology, Japan

9:50AM | Emerging Computing Architectures: Simulation of Power Electronics in Power Grids [#996]
Suman Debnath, Phani R V Marthi, Jongchan Choi and Ryan Bennink
Oak Ridge National Laboratory, United States

Oral Session 27 | Microgrids and Active Distribution Networks

Room 201A
Chairs: Jonathan Kimball, Reza Kheirollahi

8:30AM | Suppression of Circulating Current between Parallel-Connected DC Converters in DC Microgrid [#425]
Adil Ayub Sheikh and Dong-Choon Lee
Yeungnam University, Korea, Republic of

8:50AM | Picogrid: An experimental Platform for Prosumer Microgrids [#630]
Maitreyee Marathe and Giri Venkataramanan
University of Wisconsin-Madison, United States

9:10AM | Event-Triggered Consensus Distributed Control Scheme for a Compromised Power Electronics-Dominated Grid [#82]
Ahmad Khan, Mohsen Hosseinzadehtaher and Mohammad B. Shadmand
University of Illinois Chicago, United States

9:30AM | The Use of Digital Twins in Inverter-based DERs to Improve Nanogrid Fault Recovery [#1434]
Andrew Eggebeen, Mark Vygoder, Giovanna Oriti, Jake Gudex, Julian Alexander and Robert Cuzner
University of Wisconsin - Milwaukee, United States; Naval Postgraduate School, United States; Consultant, United States

Oral Session 28 | Grid Stability and Power Quality

Room 202A
Chairs: Subhashish Bhattacharya, Tomi Roinila

8:30AM | Energy Consumption and Power Quality in Bitcoin Mining Facilities in Texas [#829]
Sama Almubarak, Hasan Ibrahim, Dev Singhania and Prasad Enjeti
Texas A&M University, United States

8:50AM | Modeling and Stability Analysis of Microgrid with High Proportion of Renewable Energy Generation [#312]
Yiran Yan, Xinbo Ruan, Zhiheng Lin, Yuhang Chen, Mingming Shi and Xian Zheng
NUAA, China; Electric Power Research Institute of Jiangsu, China

9:10AM | Pitfalls of Using Passivity Index to Guide Grid-connected Inverter Control Design in Low-frequency Region [#1138]
Feifan Chen, Liang Zhao, Lennart Harnefors, Mikko Routimo, Jarno Kukkola and Xiongfei Wang
KTH Royal Institute of Technology, Sweden; Aalborg University, Denmark; ABB Corporate Research, Sweden; ABB Oy Drives, Finland

9:30AM | On The Voltage Stability of The Power Electronics-Dominated Grid: Mathematical Derivation of The Stability Margin [#421]
Ahmad Khan, Mohammad B. Shadmand and Sudip K. Mazumder
University of Illinois Chicago, United States

9:50AM | Virtual Oscillator Control of Smart Transformer based Meshed Low Voltage Distribution Grid [#1189]
Sahil Gaurav and Chandan Kumar
Indian Institute of Technology Guwahati, India

Oral Session 29 | Single-Phase AC-DC Converters

Room 202B
Chairs: Nidhi Haryani, Daifei Zhang

8:30AM | A Variable Turn-Off Time Control Method for Light Load Efficiency Improvement in Totem Pole PFC [#833]
Kai Chen, Chuangchuang Lu, Weiyang Zhou and Ke Jin
Nanjing University of Aeronautics & Astronautics, China

8:50AM | Wide Operating Range Single-Stage Onboard Electric Vehicle Charger Using Impedance Control Network Architecture [#844]
Dheeraj Etta, Mausamjeet Khatua and Khurram K. Afridi
Cornell University, United States; Intel Labs, United States

9:10AM | A Soft-Switched CCM Bridgeless PFC Rectifier for 240-W USB-PD EPR Wall Adapter [#290]
Lei Wang, Huan Li and Sinan Li
The University of Sydney, Australia; the University of Sydney, Australia

9:30AM | Single-Stage Isolated Bidirectional Soft-Switched AC-DC Converter with Active Power Decoupling [#959]
Muhammad Zarkab Farooqi, Bhim Singh, Bijaya Panigrahi and Rohit Kumar
Indian Institute of Technology Delhi, India

9:50AM | A New Multi-Output Structure with CRM Boost PFC Converter [#883]
Xueshen Zhang, Keon-Woo Kim, Moon-young Kim, Jeong-Il Kang and Yeonho Jeong
University of Rhode Island, United States; Samsung Electronics, Korea (South)

Oral Session 30 | Converter Stability

Room 202C
Chairs: Vikram Roy Chowdhury, Lakshmi Ravi

8:30AM | Parameters Design of Stabilized Control Strategy for Smart Transformer-fed Grid [#166]
Jian Tang, Zhixiang Zou, Zhenlan Dou, Chunyan Zhang, Shuai Yuan and Xin Jin
Southeast University, China; State Grid Shanghai, China

8:50AM | Impact of the DC-DC Stage on Grid-Connection Stability in Solid-State Transformer [#948]
Samuele Granata, Giulia Tresca, Francesco Benzi and Pericle Zanchetta
University of Pavia, Italy

9:10AM | Small-Signal Stability Analysis of Droop-Controlled Point-to-Point Low-Frequency AC Transmission Lines [#692]
Rafael Castillo-Sierra, Giri Venkataramanan and Dionisio Ramirez
University of Wisconsin - Madison, United States; Universidad Politecnica de Madrid, Spain

9:30AM | Detection and Control of DC Bias Flux in Dual Active Bridge Medium Frequency Transformers [#681]
Mark Nations and Subhashish Bhattacharya
North Carolina State University, United States

Oral Session 31 | Axial Flux Machines

Room 208A
Chairs: Matthew C. Gardner, Giulio De Donato

8:30AM | Novel In-Core Cooling of Yokeless and Segmented Armature (YASA) Axial Flux Machines [#932]
Gokhan Cakal and Bulent Sarlioglu
University of Wisconsin-Madison, United States

8:50AM | The Superiority of Efficiency Considering Harmonic Current caused by PWM inverter in Axial-Flux PM Machine Using Ferrite PM for Traction applications: Compasiron to Radial-Flux PM Machines Using NdFeB PM [#446]
Ren Tsunata, Masatsugu Takemoto, Jun Imai, Tatsuya Saito and Tomoyuki Ueno
Okayama University, Japan; Sumitomo Electric Industries, Ltd., Japan

9:10AM | Design Optimization Considering a Detailed PCB Stator Layout for Coreless AFPM Machines with Minimal Eddy and Circulating Current Losses [#1290]
Yaser Chulaee, Greg Heins, Ben Robinson, Mark Thiele, Dean Patterson and Dan M. Ionel
University of Kentucky, United States; Regal Rexnord Corporation, Australia

9:30AM | Analysis and Design of a Low-Speed, Spoke-Type Coreless Axial-Flux Permanent-Magnet Motor [#455]
Federico Marcolini, Giulio De Donato, Fabio Giulii Capponi, Maurizio Incurvati, Schiestl Martin and Federico Caricchi
Sapienza-University of Rome, Italy; MCI Management Center Innsbruck, Austria; Infineon, Austria

9:50AM | Efficient Design and Material Strategies for High Power Density Axial Flux Permanent Magnet Motors [#1477]
Dorsa Talebi, Sri Vignesh Sankarraman, S Mehdi Seyedi, Sina Khalesidoost, Nick A Martin, Matthew C Gardner and Hamid A Toliyat
Texas A&M University, United States; University of Texas at Dallas, United States

Oral Session 32 | Modelling and Analysis of Electrical Machines I

Room 209A
Chairs: Prerit Pramod, Ali Safayet

8:30AM | A Study on Stator Winding Loss Distribution of Additively Manufactured Coils in Fractional Slot Concentrated Windings [#1376]
Salar Koushan and Ayman El-Refaie
Marquette University, United States

8:50AM | Computationally efficient driving cycle based design and optimisation for variable air gap axial flux machines [#665]
Gabriel Weissitsch, David Klink, Gerd Bramerdorfer and Greg Heins
Johannes Kepler University Linz, Austria; Monash University, Australia

9:10AM | Modelling Approach for Superconducting AC Windings: Case Study on Axial Flux PM Machines [#1163]
Ines Santos Perdigao Peixoto, Silvio Vaschetto, Joao Filipe Pereira Fernandes, Paulo Jose da Costa Branco, Alberto Tenconi and Andrea Cavagnino
Politecnico di Torino, Italy; University of Lisbon, Portugal

9:30AM | Multi-objective Optimizations of Copper and Aluminum Hairpin Windings: a Comparison [#324]
Gregorio Cutuli, Stefano Nuzzo, Tianjie Zou, Giovanni Franceschini, Chris Gerada and Davide Barater
University of Modena and Reggio Emilia, Italy; University of Nottingham, United Kingdom

9:50AM | Steady-State Torque Prediction of Inverter-Fed Induction Machine Based on Multi-Layer Perceptron Neural Network [#843]
Haiwei Cai and Xu Wang
Southeast University, China

Oral Session 33 | Materials, Losses, Thermal and Manufacturing Issues I

Room 209B
Chairs: Andrea Cavagnino, AK Arafat

8:30AM | An Accurate Experimental Approach for Deriving Equivalent Thermal Conductivity of Impregnated Electrical Windings [#567]
Zaynah Ahmad, Rafal Wrobel, Thomas C. Werner, Shafiq Odhano and Volker Pickert
Newcastle University, United Kingdom

8:50AM | Reduction of Circulating Current by Bundle Inversion in Electrical Machines with Distributed Winding [#862]
Takumi Kono, Junichi Asama and Hiroshi Shida
Shizuoka University, Japan; Innovative Motor Design Co., Ltd., Japan

9:10AM | Real Time Estimator of Winding Hotspot Temperature for PMSM Drives [#1185]
Paolo Pescetto, Gaetano Dilevrano, Gianmario Pellegrino and Aldo Boglietti
Politecnico di Torino, Italy

9:30AM | Design of Experiments Analysis of Manufacturing Variations on Performance of Halbach Array Slotless Motors [#906]
Ritvik Chattopadhyay, Md Sariful Islam and Iqbal Husain
North Carolina State University, United States; Halla Mechatronics, United States

9:50AM | Statistical Simulation of Conductor Lay in Random Windings via X-ray Computed Tomography of Electric Vehicle Stators [#230]
Joshua Hoole, Guillaume Remy, Nick Simpson, Mark Williams and Philip Mellor
University of Bristol, United Kingdom; WMG, University of Warwick, United Kingdom

Oral Session 34 | IM Drives

Room 209C
Chairs: Mahesh Swamy, Sneha Narasimhan

8:30AM | A Carrier-Based Overmodulation Strategy With Minimum Voltage Distortion for Symmetrical Nine-Phase Induction Motor Drives [#974]
Martin Medina-Sanchez, Alejandro Yepes, Oscar Lopez, Ayman Samy Abdel-Khalik and Jesus Doval-Gandoy
University of Vigo, Spain; Alexandria University, Egypt

8:50AM | Robust Nonlinear Control for High Performance Induction Motor Drives Based on Adaptive Disturbance Compensation [#337]
Angelo Accetta, Maurizio Cirrincione, Silvia Di Girolamo, Filippo D'Ippolito, Marcello Pucci and Antonino Sferlazza
INM - National Research Council of Italy (CNR), Italy; University of the South Pacific, Fiji; Department of Engineering, University of Palermo, Italy

9:10AM | Virtual Voltage Vectors Based Model Predictive Control for Symmetrical Six-Phase Induction Machines [#375]
Joao Serra, Fernando Bento and Antonio J. Marques Cardoso
CISE, University of Beira Interior, Portugal

9:30AM | Direct Torque Control of Five-Phase Induction Motor Drives With xy Current Regulation Under an Open-Phase Fault-Condition [#988]
Bheemaiah Chikondra, Omar Al Zaabi and Khalifa Al Hosani
Khalifa University, UAE, United Arab Emirates

9:50AM | Identifying Misalignments and Coupling Unbalances in Soft-Started Induction Motors Applying Persistence Spectrum and CNN to Stray-Flux Signals [#299]
Vicente Biot-Monterde, Angela Navarro-Navarro, Israel Zamudio-Ramirez, Jose Antonino-Daviu and Roque A. Osornio-Rios
Universitat Politecnica de Valencia, Spain; Universidad Autonoma de Queretaro, Mexico

Oral Session 35 | Gate Drivers

Room 205A
Chairs: Francesco Iannuzzo, Tanya Gachovska

8:30AM | A Digital Gate Driver IC with Active Gate Waveform Calibration Technique Achieving Switching Loss Reduction by 24% and DESAT Turn-off Arbitrary Waveform Memory for Overcurrent Protection Targeting 1200V SiC MOSFETs [#461]
Shusuke Kawai, Takeshi Ueno, Koutaro Miyazaki and Hiroaki Ishihara
Toshiba, Japan

8:50AM | Current-fed Active Voltage Source Gate Driver for SiC MOSFETs [#1384]
Parimey Patil, Rajat Shahane and Anshuman Shukla
IIT Bombay, India

9:10AM | One-Pulse Active Gate Control Method Capable of Reducing Both Surge Voltage and Switching Loss [#1018]
Daiki Yamaguchi, Shinji Sato, Atsushi Yao and Hiroshi Sato
AIST, Japan

9:30AM | A Robust Design Method of Desaturation Protection Circuit for Silicon Carbide Power MOSFETs [#1182]
Jiahong Liu and Huai Wang
Aalborg University, Denmark

9:50AM | An Integrated Driver with Bang-Bang Dead-Time Control and Charge Sharing Bootstrap Circuit for GaN Synchronous Buck Converter [#1643, Post Journal]
Ching-Jan Chen and Yen-Ming Chen
National Taiwan University, Taiwan

Oral Session 36 | Power Electronics and Electric Machines in Space Applications

Room 205B
Chairs: Hang Dai, Rakib Islam

8:30AM | Design and Development of Three-Phase High-Frequency AC Power Distribution Architecture for Space Application [#1203]
Sairakshith Keesara, Surjakanta Mazumder, Shamibrota Kishore Roy, Utsab Kundu, Pradeep K Peter, Enjeti Prasad and Kaushik Basu
Indian Institute of Science, Bengaluru, India; U R Rao Satellite Centre, Bengaluru, India; Texas A&M University, College Station, TX, United States

8:50AM | A 200 kHz/1.5 kW, Multi-winding Transformer for Lunar Surface Power Application [#440]
Zhining Zhang, Naeem Bharmal, Yujie Zhang, Junchong Fan, Yuzhou Yao, Robert Guenther, Pengyu Fu and Jin Wang
The Ohio State University, United States; GPEM LLC., United States

9:10AM | Development of a 120-V 10-kW GaN-based Flexible Dc Energy Router for Lunar Surface Microgrids [#1177]
Zhining Zhang, Nihanth Adina, Yuzhou Yao, Siddhant Shah, Junchong Fan, Man Xu, Pengyu Fu and Jin Wang
The Ohio State University, United States

9:30AM | Performance Analysis of Optimally Designed BLDC Motor Equipped with Different Winding Layouts for Robotic Arms [#1058]
Mohamed Y. Metwly, Landon Clark, Biyun Xie and JiangBiao He
University of Kentucky, United States

9:50AM | A Novel Hybrid DC Circuit Breaker with Reverse-Biased Voltage Source for MVDC [#800]
Yuchen He, Yuan Li and Fang zheng Peng
Florida State University, United States

Wednesday, November 1 8:30AM – 10:10AM

Oral Session 37 | Converter-Based Resources

Room 201B
Chairs: Reza Kheirollahi, Li Zhang

8:30AM | Mechanical Stresses due to Voltage Source Converters on a Wind Turbine Shaft [#1242]
Simon Pierre Betoka Onyama, Joseph Song-Manguelle, Pascal Lingom, Jean-Maurice Nyobe-Yome, Mamadou Lamine Doumbia and Thomas Alphonse Mbock Singock
University of Quebec at Trois-Rivieres, Canada; University of Douala, Cameroon, Cameroon; University of Quebec at Rouyn-Noranda, Canada

8:50AM | A Passive Damper Design Method of Three-Phase Asymmetric-LCL Power filter for Grid-Tied Voltage Source Inverter [#758]
Hailong Zhao, Weimin Wu, Orabi Mohamed, Koutroulis Eftychios, Henry Chung and Frede Blaabjerg
Shanghai Maritime University, China; Aswan University, Egypt; Technical University of Crete, Greece; CityU of Hongkong, Hong Kong; Aalborg University, Denmark

9:10AM | New Perspectives on Zero Emission Marine Transportation-Offshore Hybrid Energy Refueling System [#1141]
Xiangchen Zhu, Yanbo Wang and Zhe Chen
Aalborg University, Denmark

9:30AM | A New Capacitive Coupled Step-up DC-DC Converter [#257]
Ademir Toebe, Pedro Henrique Bulegon Lobler, Luciano Schuch and Cassiano Rech
Federal University of Santa Maria, Brazil

9:50PM | Quantitative Small-Signal Stability Analysis of Grid-Forming Inverters in Large-Scale Power Systems [#1227]
Lizhi Ding, Yuzhu Ouyang, Xiaonan Lu, Junjie Qin, Shuan Dong, Jin Tan and Andy Hoke
Purdue University, United States; National Renewable Energy Laboratory, United States

Oral Session 38 | Energy Storage and Harvesting

Room 208B
Chairs: Hengzhao Yang, Carl Ho

8:30AM | Development of a Converter-based Supercapacitor System Emulator for PV Applications [#264]
Paychuda Kritprajun, Elizabeth Sutton, Leon M. Tolbert, Yunting Liu, Jingxin Wang, Nattapat Praisuwanna and Maximiliano Ferrari
The University of Tennessee, Knoxville, United States; The Pennsylvania State University, United States; Oak Ridge National Laboratory, United States

8:50AM | Cycle-life of Lithium-ion Capacitors: Factors Influencing Aging [#242]
Pankaj Saha, Mahdi Soltani, Stig Munk-Nielsen and Daniel-Ioan Stroe
AAU Energy, Aalborg University, Denmark, Denmark; AAU Energy, Aalborg University, Denmark, Belgium

9:10AM | Dual-Mode Energy Harvesting with Perovskite-Polymer Composites [#474]
Minje Kim, Lee Sol, Viet Anh Cao, Pangun Park and Junghyo Nah
Chungnam National University, Korea, Republic of

9:30AM | Quasi-MPPT Control for Integrating Multiple Energy Harvesters of Different Characteristics [#1020]
Kenji Natori, Ren Kawatatsu and Yukihiko Sato
Chiba University, Japan

Oral Session 39 | DC Grids and Hybrid AC/DC Grids

Room 201A
Chairs: Kevin Bai, Longya Xu

8:30AM | System Identification and Adaptive Control for Boost Converter with Constant Power Loads [#680]
Ignacio Santana, Nicolas Aguero Meineri and Ignacio Galiano Zurbriggen
University of Calgary, Canada

8:50AM | Mixed Monopole and Bipole MTdc Architecture [#912]
Sreenivasa S Jaldanki, Suman Debnath, Jiazi Zhang, Patrick Brown and Joshuua Novacheck
Oak Ridge National Laboratory, United States; National Renewable Energy Laboratory, United States

9:10AM | Variable Voltage Phasing Method for DC Bus Power Oscillation Mitigation in Hybrid DC/AC Residential Buildings with Harmonics [#1449]
Gleisson Balen, Cristian Blanco, Angel Navarro Rodriguez and Pablo Garcia Fernandez
University of Oviedo, Spain

9:30AM | Hybrid Grid Control using Smart Transformer with Multiport Grid Forming Capabilities and Interlinked Primary Control [#1489]
Angel Navarro-Rodriguez, Carlos Gomez-Aleixandre, Marius Langwasser, Pablo Garcia and Marco Liserre
University of Oviedo, Spain; Kiel University, Germany

9:50AM | Coordination of Solid-State Circuit Breakers in Multi-Source DC Microgrids Using Inverse Time-Current Characteristic Profile [#1574]
Reza Kheirollahi, Shuyan Zhao, Shervin SalehiRad, Amr Mostafa, Zilong Zheng, Hua Zhang and Fei Lu
Drexel University, United States; Rowan University, United States

Oral Session 40 | Wireless Power Transfer I

Room 202A
Chairs: Dianxun Xiao, Arnaud Gaillard

8:30AM | A New Push-pull Class-Phi Converter for Multi-MHz Dual-frequency Wireless Power Transfer Applications [#105]
Yining Liu, Prasad Jayathurathnage, Sergei Tretyakov and Jorma Kyyra
Aalto University, Finland; Danfoss Drives, Finland

8:50AM | Investigation of a Multi-modular IPT System On the Efficiency and Current Balancing Due to Inter-/cross Coupling [#221]
Calvin Riekerk, Jianning Dong, Thiago Batista Soeiro and Pavol Bauer
TU Delft, Netherlands; University of Twente, Netherlands

9:10AM | Pushing to the Distance Boundary of Inductive Wireless Power Transfer [#1492]
Lingxiao Xue, Gui-jia Su, Mostak Mohammad, Vandana Rallabandi, Jon Wilkins, Shajjad Chowdhury, Veda Galigekere and Burak Ozpineci
Oak Ridge National Laboratory, United States

9:30AM | Advanced Primary-side Load Monitoring Schemes for Inductive Power Transfer Systems with Enhanced Nonlinear Rectifier Load Models [#27]
Kaiyuan Wang, Junming Zeng, Yun Yang and Huiwen Xiao
Nanyang Technological University, Singapore; The Hong Kong Polytechnic University, Hong Kong

9:50AM | Design of a High-Power Density Multi-MHz Capacitive Wireless Power Transfer System for Mobile Robots [#796]
Syed Saeed Rashid, Dheeraj Etta, Sounak Maji and Khurram Afridi
Cornell University, United States

Oral Session 41 | Single-Phase DC-AC Converters

Room 202B
Chairs: Junichi Itoh, Marco di Benedetto

8:30AM | Reconfigurable Class-E/EF Load-independent Inverter With CC-CV Output [#1032]
Wenqi Zhu, Ayano Komanaka, Yutaro Komiyama, Xiuqin Wei, Kien Nguyen and Hiroo Sekiya
Chiba University, Japan; Chiba Institute of Technology, Japan

8:50AM | DC Link Stability Analysis of a Multi-input Single-output (MISO) Power Distribution System Utilizing Second Life Batteries [#1504]
Zakariya Dalala, Zaka Ullah Zahid and Osama Saadeh
German Jordanian University, Jordan; University of Engineering & Technology, Pakistan

9:10AM | Constant Frequency ZVS-PWM High-Frequency Inverter for Domestic Induction Heating Cooktops [#1545]
Haruka Tomoyasu, Hideki Omori and Tomokazu Mishima
Kobe University Graduate School, Japan; Kobe University, Japan

9:30AM | Design and Modeling of a Two-stage PV Inverter for Single Phase and Three Phase Applications [#717]
Yidi Shen, Reza Asrar Ghaderloo, Chanaka Singhabahu, Rakesh Resalayyan and Alireza Khaligh
University of Maryland, United States

Oral Session 42 | Other Topics in Control of Power Converters

Room 202C
Chairs: Stefano Bifaretti, Leon Tolbert

8:30AM | Dynamic Modeling and Control of unbalanced Dc to Three-Level DC Converters [#828]
Shalini Manna and Giri Venkataramanan
University of Wisconsin - Madison, United States

8:50AM | Continuous Control Set Model Predictive Control of Tri-state Boost Converter [#1220]
Ankit Nandanwar, Harisyam P v, Shailesh Ghotgalkar and Kaushik Basu
Texas Instruments India, India; Indian Institue of Science, India

9:10AM | A Novel Charging Approach to Temperature and State of Charge Management in BEV [#609]
Filippo Gemma, Giulia Tresca, Andrea Formentini, Salvatore Riccardo Di Salvo and Pericle Zanchetta
University of Pavia, Italy; University of Genova, Italy

9:30AM | Optically-Triggered Adaptive Zero-Voltage Switching: Method and Response Analysis [#744]
Borong Hu, Yunlei Jiang, Luke Shillaber, Hengyu Wang, Chengmin Li and Teng Long
University of Cambridge, United Kingdom; Zhejiang University, China; Swiss Federal Institute of Technology, Switzerland

9:50AM | A Comprehensive, Practical and Reliable Soft Start-Up and Shut-down Schemes for a Multi-Function Integrated EV Charger [#1054]
Ziwei Liang, Liyan Zhu, Yue Sun, Jie Li, Ruiyang Qin, Arka Basu, Xin Xia, Rajib Bijukchhe, Daniel Costinett and Hua Bai
University of Tennessee - Knoxville, United States

Oral Session 43 | Switched Reluctance and Flux Switching Machines

Room 208A
Chairs: Roy McCann, Udochukwu B. Akuru

8:30AM | Electric Vehicle Traction Motor with a Reluctance Outer Rotor and a Modular Stator with AC Concentrated Toroidal Windings and PM or DC Wave Winding Excitation [#877]
Oluwaseun A. Badewa, Ali Mohammadi, Dan M. Ionel, Somasundaram Essakiappan and Madhav Manjrekar
SPARK Laboratory, ECE dept., Uni. of Kentucky, United States; ECE dept., University of North Carolina, United States

8:50AM | High Torque Capability Non-Permanent Magnet Hybrid Excited Switched Reluctance Motor for Electric Vehicle Application [#694]
Vijina Abhijth, Jahangir Hossain, Gang Lei, Premlal Ajikumar Sreelekha and Sandeep B.Kadam
University of Technology, Sydney, Australia; Entuple Emobilities, India; TechEmbers, India

9:10AM | Implementing a Bearingless Separated-Stator Flux-Switching Slice Motor [#456]
Stefan Mallinger, Sadjad Madanzadeh, Rafal Jastrzebski and Wolfgang Gruber
Johannes Kepler University Linz, Austria; Lappeenranta-Lahti University of Technology, Finland

9:30AM | Rotor Saliency Optimization for High-Power Density Wound-Field Flux-Switching Machines [#1255]
Mostafa Fereydoonian, Kangbeen Lee, Gilsu Choi and Woongkul Lee
Michigan State University, United States; Inha University, Korea (South)

9:50AM | FEA Based Electromagnetic and NVH Design Optimization for Switched Reluctance Machines [#1447]
Md Khalid Mahmud Bin Azam, Mohammad Muntasir Islam and Yilmaz Sozer
University of Akron, United States

Oral Session 44 | Bearingless and High-Speed Machines

Room 209A
Chairs: Eric Severson, Wolfgang Gruber

8:30AM | Rotor Designs in Pyrolytic Graphite Bearingless Motor for Increased Passive Radial Stiffness [#1570]
Hiroya Sugimoto and Shotaro Meki
Tokyo Denki University, Japan

8:50AM | Shear Mode Operated Radial Position Sensor for Bearingless Slice Motor [#958]
Krishan Kant and David Trumper
MIT, United States

9:10AM | Analytical Modeling of a Six-Phase Bearingless Synchronous Reluctance Machine Using Winding Function Theory [#1582]
Firdausa Ahmed, Floran Martin, Nirangkush Das and Marko Hinkkanen
Aalto University, Finland

9:30AM | Self-excitation and Speed Hysteresis of a Bearingless Slice Motor [#1241]
Ouyang Chen, Ryozo Nagamune and Minkyun Noh
University of British Columbia, Canada; Korea Advanced Institute of Science & Technology, Korea (South)

9:50AM | Modelling of Stress Development in High Pre-load Filament Banding of High-speed Rotors for PMSM Applications [#467]
Kelvin Hoi Hei Wong, David Klink, Greg Heins and Behrooz Bahrani
Monash University, Australia

Oral Session 45 | PM Drives I

Room 209B
Chairs: David Reigosa, Nidhi Haryani

8:30AM | Modular Torque Control of Multi-Three-Phase Synchronous Motor Drives [#1129]
Luisa Tolosano, Eric Armando, Sandro Rubino, Fabio Mandrile and Radu Bojoi
Politecnico di Torino, Italy

8:50AM | Online Torque Control of IPMSM for Flux Weakening Operation Using Sequential Quadratic Programming [#1089]
Jaeyeon Park, Hyung-June Cho, Hwigon Kim and Seung-Ki Sul
Seoul National University, Korea (South)

9:10AM | Strategy and Implementation of Harmonic-Reduced Synchronous Optimal PWM for High Speed PMSM [#1157]
Zhihao Song, Wenxi Yao and Wuhua Li
Zhejiang University, China

9:30AM | Finite Control-set Predictive Direct Torque Control with Maximum Torque per Current Criteria for Synchronous Motor Drives [#1156]
Ismaele De Martin, Nicolo Panozzo, Fabio Tinazzi and Mauro Zigliotto
University of Padua, Italy

9:50AM | Synchronous Single Vector Modulation Strategy for Low-carrier-ratio High-power Applications [#1178]
Wenjing Zhang and Wenxi Yao
Zhejiang University, China

Oral Session 46 | Packaging I - Modeling and Design

Room 204
Chairs: Helen Cui, Haiguo Li

8:30AM | Copper Nanowired Interconnection for Embedding Power Dies in PCB [#577]
Caio Cesar De Oliveira Mendes, Julien Morand, Vincent Bley and Jean-Pascal Cambronne
Mitsubishi Electric R&D Centre Europe, France; University of Toulouse, France

8:50AM | Simulating Switching of Power Electronic Devices via Generic State-Space Models [#225]
Christoph Henrik van der Broeck, Dennis Bura and Luis Camurca
Robert Bosch GmbH, Corporate Research, Germany; Robert Bosch GmbH, Powertrain Solutions, Germany

9:10AM | Switch Cell Design for Novel High-frequency Press-pack SiC FET Modules [#1440]
Ekaterina Muravleva, Bogac Canbaz, Jun Wang, Liyan Qu and Jerry Hudgins
University of Nebraska-Lincoln, United States

9:30AM | Medium-Voltage Co-Packaged Charge-Balanced GaN SHJ-SBD with a SiC MOSFET in a Boost Phase-Leg Power Module [#1166]
Danielle Lester, Mark Cairnie and Christina DiMarino
Virginia Tech Center for Power Electronic System, United States

9:50AM | Dynamic Performance Comparison of SiC Power Modules With and Without Schottky Diode Operating from 25 to 250degC Junction Temperature [#1013]
Da Zhou, Zhiqiang Wang, Cheng Qian, Yimin Zhou, Guoqing Xin and Xiaojie Shi
Huazhong University of Science and Technology, China

Wednesday, November 1 10:40AM – 12:20PM

Oral Session 47 | Power Converters for Grid Applications

Room 201B
Chairs: Mohammed Alsolami, Heng Wu

10:40AM | A Zeta-Based Multiport Converter with Soft-Switching and Hard-Switching Approaches for Microgrid Applications [#1245]
Mojtaba Salehi and Mahshid Amirabadi
Northeastern University, United States

11:00AM | A Hybrid Modulation Strategy for the Modular Quad-Active Bridge Converters with the Aid of DC Blocking Capacitors [#317]
Di Mou, Liqiang Yuan, Haoyu Wang, Yangbin Zeng, Jialin Zheng and Weicheng Liu
Tsinghua university, China; Tsinghua University, China

11:20AM | A Three-Phase Soft-Switched AC/DC Active Front End Converter for Solid-State Transformer Applications [#907]
Anup Anurag and Peter Barbosa
Delta Electronics (Americas) Ltd., United States

11:40AM | Interleaved AC/DC Converter Operating with ZVS Sinusoidal Triangular-Current-Mode (S-TCM) and Reduced Voltage Harmonics Generation [#1159]
Yang Wu, Zian Qin, Thiago Soeiro and Pavol Bauer
Delft University of Technology, Netherlands; University pf Twente, Netherlands

Oral Session 48 | Battery Energy Storage Systems

Room 208B
Chairs: Tianqi Hong, Qing Ye

10:40AM | Implementation Techniques for Online Impedance Measurement of Li-ion Batteries [#1025]
Minh Tran, Jussi Sihvo, Leevi Lignell and Tomi Roinila
Tampere University, Finland

11:00AM | Inter-Submodule Remaining Lifetime Balancing in a Battery Energy Storage System for Extended System Lifespan [#935]
Enrique Nunes, Gaowen Liang, Ezequiel Rodriguez, Glen G. Farivar and Josep Pou
Nanyang Technological University, Singapore; University of Melbourne, Australia

11:20AM | State-Feedback-Control-Based Optimal Management of a Modular Second-Life Battery for Grid Energy Storage [#1490]
Dibyendu Khan, Wei Qiao and Liyan Qu
University of Nebraska-Lincoln, United States

11:40AM | DP-Based Optimization of BESS to Substitute RICE Reserves for Improved Economic Benefits [#1249]
Uthandi Selvarasu, Mahshid Amirabadi, Yuan Li, Caleb Crow and Brad Lehman
Northeastern University, United States; Florida State University, United States; City of Tallahassee Electric & Gas Utility, United States

12:00PM | Bidirectional inverting piezo resonator-based (BIPR) converter for cell balancing applications [#1029]
Jack Forrester, Jonathan Davidson and Martin Foster
University of Sheffield, United Kingdom

Oral Session 49 | Wireless Power Transfer II

Room 202A
Chairs: Dianxun Xiao, Arnaud Gaillard

10:40AM | Wireless Power Transfer system with Flying Capacitor Converter for Current Harmonics Reduction [#414]
Kusui Rintaro, Keisuke Kusaka and Jun-ichi Itoh
Nagaoka Univercity of Technology, Japan

11:00AM | An LC/LCLC Compensated Capacitive Wireless Power Transfer System for Constant Current Output [#656]
Lifang Yi and Jinyeong Moon
Florida State University, United States

11:20AM | Ultra-high Efficiency Wireless Power Transfer Systems Based on Novel Multi-variable Control Strategy [#1308]
Yongbin Jiang, Yue Wu, Yaohua Li, Zhou He, Ziheng Xiao, Huajia Wang, Xiaohua Wang and Yi Tang
Nanyang Technological University, Singapore; Xi'an Jiaotong University, China; Huazhong University of Sci. & Tech., China; Nanyang Technological University, China; State Grid Shandong Electric Power Research Int, China

11:40AM | Dynamic Improvement of Direct Inductive Power Transfer Systems Using Transmitter-Side Model Predictive-Based Phase Shift Control [#535]
Huiwen Xiao, Yun Yang, Kaiyuan Wang and Jiayang Wu
The Hong Kong Polytechnic University, Hong Kong; Nanyang Technological University, Singapore

12:00PM | A Frequency Multiplier Architecture for High-Power High-Frequency Capacitive Wireless Charging Systems [#845]
Sounak Maji, Yuetao Hou, Dheeraj Etta and Khurram Afridi
Cornell University, United States

Oral Session 50 | DC-AC Multi-phase Inverter

Room 202B
Chairs: Kahyun Lee, Zhehui Guo

10:40AM | Advanced DPWM method for Dual Induction Motors Fed by Five-Leg Inverter [#760]
EunWoo Lee, TaeHyeong Kim, DoHyeon Kim, June-Hee Lee and June-Seok Lee
Dankook university, Korea (South); Korea Railroad Research Insitute, Korea (South)

11:00AM | Design Algorithms for Dynamic Voltage Balancing Across Series Connected 10kV SiC MOSFETs and 10kV SiC JBS Diodes in 3L-NPC Soft Switched Power Converter with Minimized Snubber Losses and DC Offset Voltage [#1235]
Sanket Parashar, Nithin Kolli, Raj Kumar Kokkonda and Subhashish Bhattacharya
North Carolina State University, United States

11:20AM | Design of a 200kVA Soft-switching IGBT Three-phase Inverter [#929]
Yuying Wu and Dehong Xu
Zhejiang University, China

11:40AM | Split Inductor Design Considerations for Split-Phase Three-Phase Inverter [#261]
Abdul Basit Mirza, Sama Salehi Vala, Gaurav Bhansali, Balaji Narayanasamy and Fang Luo
Stony Brook University, United States; Tesla, United States

12:00PM | Comprehensive Analysis for DC-Link Capacitor Sizing for a Three-Phase Current-Controlled Voltage-Source Inverter [#1656, Post Journal]
Ali Safayet, Mohammad Islam and Tomy Sebastian
Halla Mechatronics, United States

Oral Session 51 | Modern Control Aspects in Power Electronics

Room 202C
Chairs: Petros Karamanakos, Yonghao Gui

10:40AM | Median Filters for Switching Noise Mitigation in Oversampled Power Electronics Control Systems [#131]
Ruzica Cvetanovic, Ivan Petric, Paolo Mattavelli and Simone Buso
University of Padua, Italy; Electric Hydrogen Co., United States

11:00AM | Control of Single Source Multilevel Inverter Driving High Inductance Actuators with AC and DC Currents [#1450]
Krishan Kant and David Trumper
MIT, United States

11:20AM | A Method for Dynamically Adapting the Order of a Nonlinear Blackbox Model for DC-DC Converters [#212]
Fernando Perez, Airan Frances and Javier Uceda
Universidad Politecnica de Madrid, Spain

11:40AM | Instantaneous Dual Flux Control for Three-Phase Dual-Active Bridge [#1140]
Jonghun Yun, Shenghui Cui and Seung-Ki Sul
Seoul National University, Korea, Republic of

12:00PM | Arm-current-based Model Predictive Control for Modular Multilevel Converters with a New Current Reference Generation Method [#1064]
Tiago Oliveira, Andre Mendes and Luis Caseiro
University of Coimbra/Instituto Telecomunicacoes, Portugal; Eneida.io / IT, Portugal

Oral Session 52 | IPM and Synchronous Reluctance Machines I

Room 208A
Chairs: Nicola Bianchi, Gilsu Choi

10:40AM | Detection of Misalignment in Synchronous Reluctance Machines via Transient Analysis of Current Signals [#215]
Angela Navarro-Navarro, Vicente Biot-Monterde, Jose Enrique Ruiz-Sarrio and Jose A Antonino-Daviu
Universitat Politecnica de Valencia, Spain

11:00AM | Achieving Constant Power Flux Weakening in MnBi Interior Permanent Magnet Motors [#190]
Ryan Brody, Paul Ohodnicki, Mohendro Ghosh and Brandon Grainger
University of Pittsburgh, United States

11:20AM | Low-Noise and High-Power Spoke-Type Magnet-Assisted Flat-Plate IPMSM for Integrated Starter Generator Motor [#208]
Kodai Okazaki, Yoshihiro Miyama, Tomohira Takahashi, Naoki Ohashi, Naomichi Ota, Junji Kitao, Kengo Kumagai and Fumitaka Totsuka
Mitsubishi Electric Co., Ltd., Japan

11:40AM | Multi-Objective Design Optimization and Comparison of 2-layer versus 3-layer PM-Assisted Synchronous Reluctance Machines using a Blend of Rare-Earth and Rare-Earth-Free Magnets [#821]
Praveen Kumar, Robin Wilson, Towhid Chowdhury and Ayman El-Refaie
Marquette University, United States

12:00PM | Exploration of the Torque Density of a Triple Three Phase Synchronous Reluctance Machine with AC and DC Stator Winding Excitations [#1527]
Musayyibi Shuaibu and Olorunfemi Ojo
Tennessee Tech University, United States

Oral Session 53 | Additive Manufacturing in Electric Machines

Room 209A
Chairs: Luigi Alberti, Fan Wu

10:40AM | Cooling Strategies for an Electric Motor with Additively Manufactured Hollow Conductors and Distributed Power Electronics Integrated with Heat Pipes [#1037]
Towhid Chowdhury, Salar Koushan, Sina Vahid, Ayman El-Refaie, Xuhui Feng, Emily Cousineau and Bidzina Kekelia
Marquette University, United States; NREL, United States

11:00AM | On the performance of PMAREL and REL Synchronous Motor Prototypes with Printed Rotor [#346]
Daniele Michieletto and Luigi Alberti
University of Padova, Italy

11:20AM | High Current Density Winding with 3D Printed Heat Exchanger for Electric Machines [#889]
Ahmed Hembel and Bulent Sarlioglu
University of Wisconsin - Madison, United States

11:40AM | Solid High-Speed Synchronous Reluctance Rotor Enabled by Multi-Material Additive Manufacturing [#867]
Dante Newman, Patrick Faue, Fnu Nishanth, Behzad Rankouhi, Frank Pfefferkorn, Dan Thoma and Eric Severson
University of Wisconsin-Madison, United States

12:00PM | Direct Thermal Management of Windings Enabled by Additive Manufacturing [#1637, Post Journal]
Nick Simpson
University of Bristol, United Kingdom

Oral Session 54 | PM Drives II

Room 209B
Chairs: Arshiah Mirza, Maria Martinez

10:40AM | Magnetic Model Identification of Multi-Three-Phase Synchronous Motors [#1520]
Sandro Rubino, Luisa Tolosano, Fabio Mandrile, Simone Ferrari, Eric Armando and Radu Bojoi
Politecnico di Torino, Italy

11:00AM | Flexible Control for Wide Speed Range Operation of High Polarity Stator Coreless AFPM Machines with WBG Semiconductor Devices [#1295]
Yaser Chulaee, Ali Mohammadi, Aaron Cramer and Dan M. Ionel
University of Kentucky, United States

11:20AM | MC-PWM Harmonic Losses Determination in IPMSM Drive Fed by Cascaded H-Bridges Multilevel Inverter [#1137]
Antonino Oscar Di Tommaso, Rosario Miceli, Claudio Nevoloso, Gioacchino Scaglione, Giuseppe Schettino and Ciro Spataro
University of Palermo, Italy

11:40AM | Control of a Split Rotor SPM Synchronous Machine for Very Wide Flux Weakening Operations [#1049]
Francesco Lelli, Federico Marcolini, Fabio Giulii Capponi and Federico Caricchi
Sapienza - University of Rome, Italy

Oral Session 55 | Packaging II - New Concepts

Room 204
Chairs: Haiguo Li, Andrew Lemmon

10:40AM | Packaging a 100kW All-GaN-based Three-level Active Neutral Point Clamped Power Module for Electric Vehicle Motor Drives [#963]
Yue Sun, Hua Bai, Han Cui, Daniel Costinett, Leon Tolbert, Fei (Fred) Wang, Ruediger Kusch, Hendrik Mainka and Andrew Foote
University of Tennessee - Knoxville, United States; Volkswagen Group AG, Germany; Volkswagen Group of America, United States

11:00AM | Design and Characterization of a Novel Double-side Cooled Press-pack Packaging Structure [#1260]
Junhong Tong and Alex Q. Huang
The University of Texas at Austin, United States

11:20AM | Suppression of Parasitic Voltage Oscillation in Power Modules by Turn-Off Current Zero Placement [#1293]
Veda Galigekere, Emre Gurpinar, Shajjad Chowdhury and Jason Pries
Oak Ridge National Laboratory, United States; Sikorsky Aircraft, United States; Industry, United States

11:40AM | Integrated Design for Enhanced Power Module Thermal Tolerance Utilizing the Phase Change Material and Thermal Anisotropic Graphite [#496]
Jinpeng Cheng, Xu Zhang, Jinxiao Wei, Hao Feng and Li Ran
Chongqing University, China; University of Warwick, United Kingdom

12:00PM | Packaging of a 10-kV Double-Side Cooled Silicon Carbide Diode Module With Thin Substrates Coated by a Nonlinear Resistive Polymer-Nanoparticle Composite [#1668, Post Journal]
Guo-Quan Lu and Zichen Zhang
CPES, Virginia Tech, United States

Oral Session 56 | Industry Design and Testing

Room 205B
Chairs: Cheng Xue, Yue Zhang

10:40AM | Geoelectric Field Model Validation in the Southern California Edison System: Case Study [#287]
Christopher Balch, Chaoyang Jing, Anna Kelbert, Patricia Arons and Kevin Richardson
CIRES University of Colorado, NOAA/SWPC, United States; Southern California Edison, United States; USGS Geomagnetism Program, United States

11:00AM | A Method to Measure the Arc Energy in DC Circuit Breakers [#754]
Mohammadamin Moghbeli and Shahab Mehraeen
Electrical and Computer Engineering Department, United States

11:20AM | Surface Merging Technique to Design GA-Optimized Heat Sinks [#1097]
Himel Barua, Lingxiao Xue and Burak Ozpineci
Oak Ridge National Lab, United States

11:40AM | Graph-Theory-Based Derivation, Modeling, and Control of Power Converter Systems [#1717, Post Journal]
Yuzhuo Li, Johannes Kuprat, Yunwei Li and Marco Liserre
University of Alberta, Canada; Kiel University, Germany

12:00PM | Overview of Talkative Power Conversion Technologies [#1720, Post Journal]
Marco Liserre, Hamzeh Beiranvand, Yang Leng, Rongwu Zhu and Peter A. Hoeher
Kiel University, Germany; Harbin Institute of Technology, China

Wednesday, November 1 2:00PM – 3:40PM

Oral Session 57 | Energy Storage: System Integration and Control

Room 208B
Chairs: Ghanshyamsinh Gohil, Arijit Banerjee

2:00PM | Bi-level Optimization of Component Sizing and Energy Management in Fuel Cell Hybrid Electric Trucks [#956]
Jinyuan Zhang, Hengzhao Yang and Qian Xun
ShanghaiTech University, China; Chalmers University of Technology, Sweden

2:20PM | A Universal Modeling Framework for Real and Virtual Energy Storage [#951]
Derek Jackson and Yue Cao
Oregon State University, United States

2:40PM | An Energy Management Framework with Two-Stage Power Allocation Strategies for Electric-Hydrogen Energy Storage Systems [#957]
Yuzhen Tang, Hengzhao Yang, Qian Xun and Marco Liserre
ShanghaiTech University, China; Fraunhofer Institute for Silicon Technology, Germany; Kiel University, Germany

3:00PM | Data Driven Model Predictive Control for Fast-frequency Support [#558]
Astha Rai, Niranjan Bhujel, Ujjwol Tamrakar, Donald Hummels and Reinaldo Tonkoski
University of Maine, United States; Sandia National Laboratories, United States

3:20PM | Performance Assessment of a Flywheel Energy Storage System for Households [#897]
Elena Macrelli, Alberto Bellini, Ambra Torreggiani and Claudio Bianchini
University of Bologna, Italy; Raw Power srl, Italy; University of Modena and Reggio Emilia, Italy

Oral Session 58 | Solid-State Transformers

Room 201B
Chairs: Behrooz Mirafzal, Juan Carlos Balda

2:00PM | A Transformer Design with PCB Litz Wire Concept for Solid State Transformer [#1191]
Zheqing Li, Feng Jin, Xin Lou, Yi-Hsun Hsieh, Qiang Li and Fred C. Lee
CPES, Virginia Tech, United States

2:20PM | A Triple Active Bridge (TAB) Based Solid-State Transformer (SST) for DC Fast Charging Systems: Architecture and Control Strategy [#1009]
Hui Cao, Liyang Du, Feng Guo, Zhuxuan Ma and Yue Zhao
University of Arkansas, United States

2:40PM | Design and Experimental Analysis of a Modular Smart Transformer Architecture [#1186]
Levy Costa, Youngjong Ko and Marco Liserre
Eindhoven University of Technology, Netherlands; Pukyong National University, Korea (South); Kiel University, Germany

3:00PM | Disturbance Rejection Ability Comparison for Different Solid-State Transformer Control Strategies [#1074]
Radhika Sarda, Ezequiel Rodriguez Ramos, Glen G. Farivar, Josep Pou, V.B. Sriram and Anshuman Tripathi
NTU, Singapore; University of Melbourne, Australia

Oral Session 59 | Battery Management for Electric Vehicles

Room 202B
Chairs: Xiaofeng Yang, Jungwon Choi

2:00PM | Current Sensorless Broadband Impedance Measurement Technique for Li-ion Battery Applications [#47]
Jussi Sihvo, Tomi Roinila and Daniel-Ioan Stroe
Tampere University, Finland; Aalborg University, Denmark

2:20PM | A Smart, Health-conscious, Dual-stage Hybrid Lithium-ion Battery Cell Voltage Balancing Strategy [#1258]
Alvin Huynh, Akash Samanta, Chandan Chetri, Latha Anekal and Sheldon Williamson
Graduate Research Scholar, Canada; Doctoral Research Scholar, Canada; Professor and Canada Research Chair, Canada

2:40PM | Multi-mode Control of the Energy Transfer Unit in Capacitively-coupled Hybrid Battery Packs for Enhanced Auxiliary DC Bus Regulation [#525]
Marium Rasheed, Craig Simpson, Hongjie Wang and Regan Zane
Utah State University, United States

3:00PM | Li-ion Battery Prognostics with Statistical Model and RNN Trained with EIS-Based Features [#1167]
Bogdan Breazu, Seyedreza Azizighalehsari, Prasanth Venugopal, Gert Rietveld and Thiago Batista Soeiro
University of Twente, Netherlands

3:20PM | Fuel Cell and Battery Sizing For Class 8 Vehicle Applications [#267]
Trenton Kilgore, Alexis Scida and Zachary Barra
Daimler Truck North America, United States

Oral Session 60 | Charging for Electric Vehicles

Room 202C
Chairs: Lingxiao Xue, Liran Zheng

2:00PM | An All-the-Time Synchronization Technique for 2.2 kW Bidirectional Inductive Power Transfer System [#1152]
Bowang Zhang, Weikang Hu, Youhao Hu, Dianxun Xiao and Wei Han
HKUST(GZ), China

2:20PM | Charging Pad as the Transformer: Integration of On-board Charger, Auxiliary Power Module and Wireless Charger for Electric Vehicles [#993]
Liyan Zhu, Ziwei Liang, Yue Sun, Jie Li, Ruiyang Qin, Arka Basu, Daniel Costinett and Hua Bai
University of Tennessee-Knoxville, United States

2:40PM | Double Coupling in Wheel Dynamic IPT for EV Charging [#245]
Valter S. Costa, Emanuel G. Marques, Miguel Torres, Andre M. S. Mendes and Marina S. Perdigao
University of Coimbra; IT, Portugal; Polytechnic Institute of Coimbra; IT, Portugal

3:00PM | Overview of Electrically Conductive and Active Shielding for Wireless Power Transfer with a Polyphase Wireless Electric Vehicle Charging Study [#1261]
Donovin D. Lewis, Badewa A. Oluwaseun, Omer Onar, Mostak Mohammad, John F. Eastham and Dan M. Ionel
SPARK Lab, ECE Dept., University of Kentucky, United States; Oak Ridge National Laboratory, United States; University of Bath, United Kingdom

3:20PM | Improving EV Charging Resilience under a Device Fault Condition [#268]
Namwon Kim, Michael Starke and Benjamin Dean
Oak Ridge National Laboratory, United States

Oral Session 61 | Multilevel Converters I

Room 204
Chairs: Yeonho Jeong, Zhicheng Guo

2:00PM | Comparative Study of PWM Modes for GaN-based Three-Level ANPC Inverter [#745]
Subhransu Satpathy, Partha Pratim Das, Subhashish Bhattacharya and Victor Veliadis
NC State University, United States

2:20PM | Multi-Phase-Shifting Control and Soft-Switching Performance Optimization for a Four-Level ANPC Dual Active Bridge DC-DC Converter [#709]
Jupeng Pang, Wei Zhou, Kui Wang, Zedong Zheng and Yongdong Li
Tsinghua University, China

2:40PM | Embedded Multi-port Converters for Synthesis and Enhancement of Hybrid-Clamped Multilevel Converters [#977]
Yuzhuo Li, Pasan Gunawardena, Hao Tian and Yunwei Li
University of Alberta, Canada; Shandong University, China

3:00PM | Neutral-Point-Less (NPL) Multilevel Inverter with Discontinuous Pulse Width Modulations: X-type Inverter [#1213]
Mikayla Benson, Xiaofeng Dong, Kangbeen Lee, Jinyeong Moon and Woongkul Lee
Michigan State University, United States; Florida State University, United States

3:20PM | A New Fault-Tolerant Boost Inverter Topology with Multi-Switch Fault [#475]
Marif Daula Siddique, Prasanth Sundararajan, Mrutyunjaya Sahani and Sanjib Kumar Panda
National University of Singapore, Singapore

Oral Session 62 | Modulation Methods for Power Converters

Room 205A
Chairs: Tobias Geyer, Petros Karamanakos

2:00PM | A Five-Level Converter Interfacing Medium-Voltage [#298]
Haihong Long, Jinyi Deng, Xin Wu, Yujie Jiang and Dehong Xu
Zhejiang University, China

2:20PM | Alternative Vector Modulation for CSI Common-mode Voltage Reduction Under Voltage-boost Operation [#824]
Sangwhee Lee, Feida Chen, Thomas Jahns and Bulent Sarlioglu
University of Wisconsin-Madison, United States

2:40PM | Space Vector Modulation Strategy for a Three-Phase 7-Level Multiplexed Converter [#224]
Bembich Pier Paolo, Lidozzi Alessandro, di Benedetto Marco, Solero Luca and Meynard Thierry
Roma Tre University, Italy; University of Toulouse Toulouse, Italy

3:00PM | Duty and Phase Control of a Class E Rectifier with Nonlinear Capacitance of FETs [#1562]
Minki Kim and Jungwon Choi
University of Minnesota, Twin Cities, United States; University of Washington, Seattle, United States

Oral Session 63 | Materials, Losses, Thermal and Manufacturing Issues II

Room 208A
Chairs: Antonio Griffo, Sandro Rubino

2:00PM | Analysis and Compensation of PM Manufacturing Tolerances on PMSMs Temperature Estimation During Six-Step Operation Using the D-Axis Current [#471]
Marcos Orviz, Diego F. Laborda, Toru Matsuura, Giorgio Lovison, Kensuke Sasaki and David Reigosa
Universidad de Oviedo, Spain; Nissan Motor Co. Ltd, Japan

2:20PM | Influence of Symmetric BH Loop Fluctuations on Hysteresis Loss by Play Model [#282]
Kazuki Semba, Tomohisa Sato, Hiroyuki Sano, Yusaku Suzuki and Takashi Yamada
JSOL Corporation, Japan

2:40PM | Advanced Electrical Machines for Electric Vehicle and Aerospace Applications [#373]
Mousalreza Faramarzi Palangar, Wen L Soong and Charles Matheou
Adelaide University, Australia; Electric Motor Power, Australia

3:00PM | Variations in Excess Losses in Thin FeSi Sheets Due to the Cutting Process [#894]
Zbigniew Gmyrek, Silvio Vaschetto and Andrea Cavagnino
Lodz University of Technology, Poland; Politecnico di Torino, Italy

3:20PM | Analysis of Uncertainty in Efficiency of an Automotive Electric Machine with Active Rectifier [#106]
Chase Kitzmiller, Kevin Yost and Will Perdikakis
UES, Inc., United States; Air Force Research Laboratory, United States; PC Krause and Associates, United States

Oral Session 64 | Wound Field and PM Machines I

Room 209A
Chairs: Zhongze Wu, Lakshmi Varaha Iyer

2:00PM | Effect of Armature Reaction on Asymmetric PM Loss and Temperature Distributions of SPMSMs Accounting for Slot/Pole Number Combinations [#144]
Zheng Yinzhao, Liang Dawei, Zhu Zi-Qiang, Zhou Yanjian, Liu Hailong and Xu Hai
University of Sheffield, United Kingdom; Corporate Research Center/ Midea Group, China

2:20PM | Fluid Dynamic-based Pole Shaping for Electrically Excited Synchronous Motor [#928]
Luca Cinti, Chiara Conto' and Nicola Bianchi
University of Padova, Italy

2:40PM | Design and Comparison of Surface Inset Permanent Magnet Machine and Surface Permanent Magnet Machine without Heavy Rare Earth Magnets for Traction Applicatons [#1170]
Wenda Feng, Ken Chen, Justin Paddock, Thomas Jahns and Bulent Sarlioglu
University of Wisconsin- Madison, United States

3:00PM | Winding Embedded Liquid Cooling for Slotless Motors in Transportation Applications [#1618, Post Journal]
Ritvik Chattopadhyay, Md Sariful Islam and Iqbal Husain
North Carolina State University, United States; Halla Mechatronics, United States

3:20PM | Wound Field Synchronous Motor Using a Non-Salient Pole Rotor with Distributed Winding [#653]
Fahmi Ismail Wibisono and Junichi Asama
Shizuoka University, Japan

Oral Session 65 | Control of Electric Drives I

Room 209C
Chairs: Ali Bazzi, Marcello Pucci

2:00PM | Distributed Current and Flux Observers of Modular Motor Drives for Deadbeat-Direct Torque and Flux Control [#1091]
Zhouzhou Wang and Bulent Sarlioglu
University of Wisconsin-Madison, United States

2:20PM | Impact of closed loop pole placement on the low speed performance of VFDs using low-resolution position sensors [#1511]
Luigi Danilo Tornello, Giacomo Scelba, Gaetano Turrisi, Giulio De Donato, Giuseppe Scarcella and Fabio Giulii Capponi
University of Catania, Italy; Sapienza University of Rome, Italy

2:40PM | Generalized Inversion of n-dimensional Flux Maps for Unified Nonlinear Machine Models and Predictive Control Algorithms [#491]
Leonard Geier, Johannes Stoss, Andreas Liske and Marc Hiller
Karlsruhe Institute of Technology, Germany

3:00PM | Extended MTPA and Flux-Weakening Control with Total Copper Loss Minimisation and Transient Torque Compensation for Wound-Rotor Synchronous Machines [#1472]
Riccardo Breda, Giacomo Andrioli, Sandro Calligaro and Roberto Petrella
University of Udine, Italy

3:20PM | Optimized Finite Control Set Model Predictive Control for a Three-Phase Five-Level Cascaded H-Bridge Multilevel Inverter fed Interior Permanent Magnet Synchronous Machine With On-Line Candidate Switching State Selection [#453]
Antonino Oscar Di Tommaso, Rosario Miceli, Claudio Nevoloso, Gioacchino Scaglione and Giuseppe Schettino
University of Palermo, Italy

Oral Session 66 | Emerging Concepts on Devices, Topologies, Thermal Management and Control

Room 205B
Chairs: Ashish Kumar, Sumeet Singh

2:00PM | Hybrid Thyristor and SiC FET Power Module for High-Efficiency AC Motor Control [#179]
Chunmeng Xu, Adam J. Morgan, Douglas C. Hopkins and Pietro Cairoli
ABB Inc, United States; NoMIS Power, United States; North Carolina State University, United States

2:20PM | Improved Sensing Circuit for On-State Resistance Measurement of High and Low-Side GaN FETs [#725]
Hussain Sayed and Harish S Krishnamoorthy
University of Houston / ECE Department, United States

2:40PM | Distributed Position Sensing in Bioinspired Modular Synchronous Machines [#842]
Bryan P. Ruddy, Matthew Nocete and Awhina Hona
University of Auckland, New Zealand

3:00PM | Heat Pump Integrated On-Board Charger [#472]
Simon Goodwin, Shafiq Odhano and Glynn Atkinson
Newcastle University, Great Britain

3:20PM | A High Performance Liquid Metal-based Cooling System for an Ultra High Power Density Inverter [#1237]
Fan Junchong, Shah Siddhant, Zhang Zhining and Wang Jin
The Ohio State University, United States

Wednesday, November 1 4:10PM – 5:50PM

Oral Session 67 | Electronic Grid Infrastructrure

Room 201B
Chairs: Yue Zhao, Levy Costa

4:10PM | Analysis and Enhancement of High Voltage Insulation for Planar Transformer [#527]
Hanyu Liu, Kai Sun, Guoen Cao and Zheyuan Yi
Tsinghua University, China; Chinese Academy of Sciences, China

4:30PM | Thermal Capability Estimation of Power Devices in Smart Transformer under Line-to-Line LVAC Grid Fault [#638]
Thiago Pereira, Sante Pugliese, Hrishikesan Madhavan and Marco Liserre
Kiel University, Germany

4:50PM | Development of a High Power Medium Frequency Transformer for Medium Voltage Applications [#1407]
Ahmad El Shafei, Saban Ozdemir, Necmi Altin and Adel Nasiri
University of Wisconsin Milwaukee, United States; Gazi University, Turkey; University of South Carolina, United States

5:10PM | Efficient and Parameter Robust Phase-Shift-Modulation Strategy for LCR-DAB Converter [#954]
Lee Jaehong, Kim Hyunseob, Kim DongUk, Cui Kehan, Kim Sungmin and Lee Seung-Hwan
University of Seoul, Korea (South); Hanyang University, ERICA Campus, Korea (South)

5:30PM | 13.8kV/400kW Solid State Transformer DC Fast Charger (SST-DCFC) Based on 15kV SiC AC Switch [#26]
Wei Xu, Sanjay Rajendran, Zhicheng Guo, Adithyan Vetrivelan and Alex Q. Huang
University of Texas at Austin, United States

Oral Session 68 | Advances in Grid-Forming Technologies

Room 208B
Chairs: Jing Wang, Yushi Miura

4:10PM | Hybrid Threshold Virtual Impedance for Fault Current Limiting in Grid-Forming Converters [#1438]
Zexian Zeng, Prajwal Bhagwat, Maryam Saeedifard and Dominic Gross
Georgia Institute of Technology, United States; University of Wisconsin-Madison, United States

4:30PM | Effect of Current Observers in Dual-Loop State-Space Controllers for Grid-Forming Converters [#351]
Diego Rios-Castro, Diego Perez-Estevez and Jesus Doval-Gandoy
University of Vigo, Spain

4:50PM | PLL-Based Inertia Emulation for Grid Supporting Power-to-Gas Systems [#1121]
Gedeon Rusatira, Gawoo Park and Kyungsoo Lee
G-PHILOS, Korea (South); Tech University of Korea, Korea (South)

5:10PM | Modified Virtual Oscillator based Operation of Grid Forming Converters with Single Voltage Sensor [#937]
Vikram Roy Chowdhury, Akanksha Singh and Barry Mather
National Renewable Energy Laboratory, United States; Det Norske Veritas, United States

5:30PM | Virtual Inertia Control Using Energy Stored in Modular Multilevel Converters of the HVDC Transmission System [#125]
Kenichiro Sano and Tatsuki Kato
Tokyo Institute of Technology, Japan

Oral Session 69 | Modeling and Analysis of Energy and Storage Applications

Room 202A
Chairs: Jun Wang, Pinjia Zhang

4:10PM | Multi-step Machine Learning Forecasting of Power Consumption and PV Generation for Distributed Energy Management Applications [#1399]
Oscar Pasarin, Pablo Garcia, Leticia Gonzalez and Geber Villa
University of Oviedo, Spain; Enfasys, Spain

4:30PM | Estimation of Battery Capacity Fade using Real-World Vehicle Data for Diagnosis of Abnormal Capacity Loss [#1564]
Zirun Jia, Zekun Zhang, Zhenyu Sun, Peng Liu, Zhenpo Wang and Zhaosheng Zhang
Beijing Institute of Technology, China; Beijing Jingwei Hirain Technologies Co., Inc., China; Sunwoda Power Technology Co., Ltd., China

4:50PM | Single-Phase Transformerless UPS with Interleaved Boost Converters for Battery Discharging [#623]
Alan Robson Andrade Pinto, Filipe Antonio da Costa Bahia, Reuben Palmer Rezende de Sousa, Jose Renes Pinheiro and Fabiano Fragoso Costa
Federal University of Bahia, Brazil; Federal University of Pernambuco, Brazil

5:10PM | Solar Power Forecasting Using EEMD Decomposition Followed by LSTM [#1254]
Bibek Bimali and Daniela Wolter Ferreira Touma
University of South Alabama, United States

5:30PM | State-of-Health Forecasting for Battery Cells using Bayesian Inference and LSTM-based Change Point Detection [#532]
Meriam Chelbi, Wael Hassanieh, Ala Hussein and Abdallah Chehade
University of Michigan-Dearborn, United States; Prince Mohammad Bin Fahd University, Saudi Arabia

Oral Session 70 | Solid State Circuit Breaker for Transporation Applications

Room 202B
Chairs: Di Zhang, Pengyu Fu

4:10PM | A High Efficiency 750V, 100A Cryogenically Cooled SSCB Module for Aviation Application [#1233]
Ching-Hsiang Yang, Shimul K. Dam, Zhou Dong, Dehao Qin, Ruirui Chen, Fred Wang, Hua Bai and Zheyu Zhang
University of Tennessee, Knoxville, United States; ABB US Research Center, Raleigh, United States; Clemson University, United States; Rensselaer Polytechnic Institute, United States

4:30PM | Design and Analysis of High-Voltage Smart Fuse for EV Applications [#280]
Renato Amorim Torres, Muhammad Alvi, Chandra Namuduri and Rashmi Prasad
General Motors, United States

4:50PM | Load Commutation Switch for a Hybrid DC Circuit Breaker in Cryogenic Environment [#869]
Zhongying Wang, Xianwu Zeng, Jiawen Xi, Emelie Nilsson, Jean-francois Rouquette, Jean Rivenc, Ravi Kiran Surapaneni, Gowtham Galla and Xiaoze Pei
University of Bath, United Kingdom; Airbus, France; Airbus, Germany

5:10PM | The Analysis Design and Optimization of an Electronic MOV Circuit for the Solid-State Circuit Breaker Applications [#911]
Yuntao Xu, Di Zhang, Keck Brandon, Ravi Lakshmi, Dehao Qin and Zheyu Zhang
Naval Postgraduate School, United States; Virginia Tech, United States; Clemson University, United States

5:30PM | Performance of Snubber Capacitors and TVS Diodes for Cryogenic Power Electronics [#923]
Zhongying Wang, Xianwu Zeng, Adel Deriszadeh, Emelie Nilsson, Jean-francois Rouquette, Ravi Kiran Surapaneni, Gowtham Galla, Ludovic Ybanez and Xiaoze Pei
University of Bath, United Kingdom; Airbus, France; Airbus, Germany

Oral Session 71 | Multilevel Converters II

Room 204
Chairs: Yeonho Jeong, Zhicheng Guo

4:10PM | A Highly Efficient Si/SiC Based Hybrid Modular Multilevel H-bridge Converter for MV Application [#855]
Rajat Shahane and Anshuman Shukla
IIT Bombay, India

4:30PM | Quasi two-Level Modulation for the MMC-Based Isolated DC/DC Converter [#1151]
Sattar Bazyar, Jun-Hyung Jung, Hamzeh Beiranvand, Joao Victor Matos Farias and Marco Liserre
Kiel University, Germany; Fraunhofer ISIT, Germany

4:50PM | A Protective Submodule Design for Increased Resiliency in Modular Multilevel Converters [#801]
Araz Saleki, Bahram Jahanbakhshi Pordanjani and Mahima Gupta
Portland State University, United States; K. N. Toosi University of Technology, Iran

5:10PM | Hybrid Modular Multilevel Converters for High-AC/Low-DC Medium-Voltage Applications [#1683, Post Journal]
Jayesh Kumar Motwani, Jian Liu, Rolando Burgos, Zhi Zhou and Dong Dong
Center for Power Electronics Systems (CPES), VT, United States; GE Power Conversion of GE Vernova, United States

5:30PM | Closed-Loop Capacitor Voltage Balancing Scheme for Modular Multilevel Converters Operated in Switching-Cycle Balancing Mode [#1666, Post Journal]
Jayesh Kumar Motwani, Boran Fan, Yu Rong, Dushan Boroyevich, Dong Dong and Rolando Burgos
Center for Power Electronics Systems (CPES), VT, United States

Oral Session 72 | AC Link Converter Control

Room 205A
Chairs: Kevin Bai, Mostak Mohammad

4:10PM | Sub-Module Voltage Control in DAB Assisted Modular Multilevel Converter for Low Voltage Applications [#171]
Aguilar Villaseca Rodrigo Ignacio, Tarisciotti Luca and Pereda Torres Javier
Pontificia Universidad Catolica de Chile, Chile; Universidad Andres Bello, Chile

4:30PM | Resolving Practical Control Issues in an Industrial Scale 1.2 kW LLC Converter in Closed Loop Operation [#409]
Debanjan Chatterjee, Jing Xu and Pietro Cairoli
ABB, United States

4:50PM | Switching Transition Analysis in a Subresonant Half-Bridge Series Resonant Converter for High Power and High Switching Frequency Applications [#232]
Anton Gorodnichev, Daniel Haake, Matthias Klee and Marco Jung
Fraunhofer IEE, Germany; Hochschule Bonn-Rhein-Sieg, Germany

5:10PM | Multimode Control of HF Link Universal Minimal Converters - Part I: Principles of Operation [#1045]
Ruomu Hao, Satish Belkhode, Joseph Benzaquen and Deepak Divan
Georgia Institute of Technology, United States

5:30PM | Transient DC Bias Current Mitigation for an ANPC based Triple-Active-Bridge (TAB) Converter [#378]
Hui Cao, Feng Guo, Peyman Darvish and Yue Zhao
University of Arkansas, United States

Oral Session 73 | Converter Power Quality

Room 205B
Chairs: Lakshmi Ravi, Rafal Wojda

4:10PM | A Two-Stage Current Limiting Control Strategy for Improved Low-Voltage Ride-Through Capability of Direct-Droop-Controlled, Grid-Forming Inverters [#128]
Wei Du and Sheik Mohiuddin
Pacific Northwest National Laboratory, United States

4:30PM | Review of Totem Pole PFC Soft-switching Methods with Market Survey [#795]
Sumana Ghosh, Yuequan Hu and Issa Batarseh
Wolfspeed Inc., United States; University of Central Florida, United States

4:50PM | Single-phase Transformerless Unified Power Quality Conditioner Based on Three-Leg and Standby Converters [#1031]
Jean Torelli Cardoso, Cursino Brandao Jacobina, Alan Santana Felinto, Ademar Alves dos Santos Junior and Mauricio Beltrao Rossiter Correa
Federal University of Campina Grande, Brazil

5:10PM | Harmonic-Invariant Scaling Method for Power Electronic Converters in Power Hardware-in-the-Loop Test Beds [#1641, Post Journal]
Joseph Kiran Banda, Daniel Dos Santos Mota, Ayotunde Adekunle Adeyemo and Elisabetta Tedeschi
Norwegian University of Science and Technology, Norway; SINTEF Energy Research AS Energy, Norway

5:30PM | Modeling and Validation of Common-mode Emissions of Silicon Carbide Enabled Motor Drive in Extended EMC Frequency Range Between 2 kHz to 30 MHz [#1198]
Tianchen Li, Ryan Olson, Hassan Abdallah, Niveditha Sivadanam and Robert Cuzner
University of Wisconsin-Milwaukee, United States

Oral Session 74 | Control of Electric Drives II

Room 209C
Chairs: Sara Roggia, Roberto Petrella

4:10PM | Zero-Sequence Current Control Dual-Inverter with Common Source During the Single-Side 6-Step Operation [#252]
Jun Ohata, Hitoshi Haga, Masaaki Konoto and Qingyun Piao
Nagaoka University of Technology, Japan; Shizuoka University, Japan; Yanmar Holdings Co., Ltd., Japan

4:30PM | Look-up Table Size Reduction Strategy for Synchronous Optimal Pulse Width Modulation [#247]
Battur Batkhishig, Pedro Filipe da Costa Goncalves, Babak Nahid-Mobarakeh and Ali Emadi
McMaster University, Canada

4:50PM | Ensuring a Smooth Transition from Linear Modulation, through Overmodulation, and into Six-Step [#711]
Yang Sun and Caleb Secrest
BorgWarner INC, United States

5:10PM | An Online, Self-Contained, Method to Correct Current Sensor Gain Mismatch and Offset Errors in Three-Phase Drive Systems [#1053]
Caleb Secrest, Siddharth Ballal, Hassan Eldeeb and Chikezie Emeghara
BorgWarner Inc.- Power Drive Systems, United States; SLPT Automotive - SLPT Global Pump Group, United States; BorgWarner Inc.- Noblesville Technical Center, United States

5:30PM | Flux Maps Spatial Harmonic Modeling and Measurement in Synchronous Reluctance Motors [#1502]
Anantaram Varatharajan, Paolo Pescetto, Simone Ferrari and Pellegrino Gianmario
Politecnico di Torino, Italy

Oral Session 75 | Device Testing and Monitoring Methods

Room 205C
Chairs: Emre Gurpinar, Francesco Iannuzzo

4:10PM | Integrated AC Power Cycling Platform with Automated Characterization for T-Type Power Module [#650]
Ahmed Siraj, Cheng Wan, Dehao Qin, Yi Li, Zheyu Zhang, Miles Russell and Matt Ursino
Clemson University, United States; Yaskawa Solectria Solar, United States

4:30PM | Impact of PCB Parasitic Capacitance on Switching Transients in Split-Phase Inverter Utilizing TO-247 SiC Devices [#265]
Abdul Basit Mirza, Yang Xie, Sama Salehi Vala and Fang Luo
Stony Brook University, United States

4:50PM | Origin of Common Source Inductance in Power Device Packages with Kelvin Source Terminal [#1424]
Kotaro Kobashi, Kazuhiro Umetani, Akihiro Konishi, Takuto Hayashi, Yu Takehara, Masataka Ishihara and Eiji Hiraki
Okayama University, Japan

5:10PM | Practical Insulation Testing of 10 kV SiC MOSFET Modules [#1248]
Joshua Stewart, David Nam, Arthur Mendes, Xiang Lin, Dong Dong and Rolando Burgos
Virginia Tech - CPES, United States; Tesla, United States

5:30PM | Temperature Sensitive Electrical Parameters Selection for 10 kV SiC Power Module [#229]
Min Lin, Ruirui Chen, Dingrui Li, Leon Tolbert, Fred Wang and Hua Bai
University of Tennessee, United States

Oral Session 76 | Latest Applications of Power Electronics and Electric Machines

Room 209A
Chairs: Yuzhuo Li, Li Ding

4:10PM | Modeling MOSFETs for Fault-managed Power Systems: A Transient Analysis Based on capacitance Dynamics [#270]
Tamal Sarkar, Jonathan Casey and Noah Lutz
Engineering Research, VoltServer Inc., United States

4:30PM | Subarray Arrangement Method Based on Orthogonal Radiation Algorithm for Microwave Wireless Power Transmission [#352]
Jing Gao, Ke Jin, Weiyang Zhou and Jiang Zhu
Nanjing University of Aeronautics & Astronautics, China

4:50PM | A Review of Advances in Lighting Systems' Technology – The Way Towards Lighting 4.0 Era [#1638, Post Journal]
Georges Zissis
Universite de Toulouse 3 - LAPLACE, France

5:10PM | Fast and Accurate Analytical Thermal Modeling for Planar PCB Magnetic Components [#1687, Post Journal]
Lucia Clavero Ordonez, Alberto Delgado Exposito, Pedro Alou Cervera, Miroljub Bakic and Thiwanka Wijekoon
Universidad Politecnica de Madrid, Spain; Huawei Technologies Duesseldorf GmbH, Germany

5:30PM | Design Guidelines for Shield-Less PCB-Based Rogowski Coil Sensors With Passive Offset Compensation for Switching Current Measurement [#714]
Ali Parsa Sirat, Hossein Niakan, James Gafford and Babak Parkhideh
University of North Carolina at Charlotte, United States

Thursday, November 2 8:30AM – 10:10AM

Oral Session 77 | Control of Renewable Energy Systems

Room 201B
Chairs: Sanjida Moury, Hengzhao Yang

8:30AM | Hierarchical Control for Energy Management in a Wind-Solar-Battery Based Hybrid Power Plant [#876]
Deepak Kumar, Mohd Shadab, Tanmoy Bhattacharya, Dheeman Chatterjee and Sakshi Singh
Indian Institute of Technology, Kharagpur, India

8:50AM | Multi-physics Modeling of Hydrokinetic Turbine Energy Conversion System [#962]
Md Tariquzzaman, Samuel J. Barton, Peidong Li, Alastair P. Thurlbeck, Trenton Kilgore, Ted Brekken and Yue Cao
Oregon State University, United States; National Renewable Energy Lab, United States; Daimler Truck North America, United States

9:10AM | A Fault-Tolerance MPPT Design and Model Analysis for Hydrokinetic Turbine Systems [#1061]
Peidong Li and Yue Cao
Oregon State University, United States

9:30AM | Grid Forming Inverters: A Comparison of Virtual Oscillator Controller and Synchronous Reference Frame PLL based Control Approaches [#1042]
Anuprabha Ravindran Nair, Deepak Ramasubramanian and Evangelos Farantatos
UNC, Charlotte, United States; EPRI, United States

9:50AM | Modified Steady-State Power Flow for Grid with High Penetration of Inverter-Based Resource [#369]
Sangwon Seo, Quan Nguyen, Sohom Datta, Nader A. Samaan, Eduard Muljadi, Bharat Vyakaranam, Wei Du, Yuan Liu, Yousu Chen, Jinho Kim and Manisha Maharjan
Auburn University, United States; Pacific Northwest National Laboratory, United States

Oral Session 78 | Smart Grid and Utility Applications

Room 208B
Chairs: Sudip K. Mazumder, Dan Ionel

8:30AM | A Low-cost Miniature DC/AC-compatible Switched-Rogowski Current Sensor [#636]
Ruomu Hao, Pranjal Gajare, Shreyas Kulkarni, Joseph Benzaquen and Deepak Divan
Georgia Institute of Technology, United States; GigaGrid LLC, United States

8:50AM | Novel XGBoost Classifier Based Relaying Approach with 2 Classes of Protection Zones [#1381]
Farzad Banihashemi and Robert Cuzner
University of Wisconsin Milwaukee, United States

9:10AM | Analytical Determination of the Harmonic Disturbance Rejection in a Synchronous Reference Frame Phase Locked Loop [#1461]
Aaron Stinson, Brendan McGrath, Richardt Wilkinson and Carlos Teixeira
RMIT University, Australia

9:30AM | Hardware-based Advanced Electromagnetic Transient Simulation for A Large-Scale PV Plant in Real Time Digital Simulator [#1002]
Jongchan Choi, Phani Ratna Vanamali Marthi, Suman Debnath, Nicole Rexwinkel, Md Arifujjaman, Farzad Khalilpour, Andrew Arana and Huzaifa Karimjee
Oak Ridge National Laboratory, United States; Southern California Edison, United States; Florida Power & Light, United States

9:50AM | Individual-Phase Fundamental Reactive Current Control Strategy With Suppressed Neutral-Line Current for an Active Power-Line Conditioner in Three-Phase Four-Wire Distribution Feeders [#1105]
Yuka Sabi, Hiroaki Yamada, Toshihiko Tanaka, Fuka Ikeda, Masayuki Okamoto and Seong Ryong Lee
Yamaguchi University, Japan; National Institute of Technology, Ube College, Japan; Kunsan National University, Korea, Republic of

Oral Session 79 | Grid-Forming Inverters for Microgrids

Room 201A
Chairs: Xiongfei Wang, Wei Du

8:30AM | Experimental Characterization Test of a Grid-forming Inverter for Microgrid Applications [#942]
Jing Wang, Subhankar Ganguly, Mariko Shiraz, Jack Flicker and Ben Kroposki
National Renewable Energy Laboratory, United States; University of Alaska Fairbanks, United States; Sandia National Laboratory, United States

8:50AM | Self-Synchronization Grid Forming Inverters Connected to a Microgrid System Consisting of a Diesel Synchronous Generator [#802]
Qiang Lin, Kenichiro Ogawa, Hiroshi Uno, Yasuhiro Kanekiyo and Tetsu Shijo
Toshiba Corporation, Japan

9:10AM | A Power and Unbalanced-Current Inverter Controller for Three-Phase Microgrids capable of Islanded Operation [#102]
Andrea Lauri, Tommaso Caldognetto, Davide Biadene and Paolo Mattavelli
University of Padova, Italy

9:30AM | Inverter Controls for Smooth Transition Operation and Voltage Balancing of Networked Microgrids [#822]
Jay Ramesh Sawant, Rishabh Jain and Annabelle Pratt
National Renewable Energy Laboratory, United States

9:50AM | Stability Analysis of Virtual Impedance Control in Islanded Microgrids [#275]
Oroghene Oboreh-Snapps, A. Arnold Fernandes, Kartikeya Jayadurga Prasad Veeramraju, Alvaro Cardoza and Jonathan W Kimball
Missouri University of Science and Technology, United States

Oral Session 80 | Electric Machine for Transportation Electrification

Room 202A
Chairs: Pengyu Fu, Tianjie Zou

8:30AM | Outer Rotor Design of a High-Power Density Aviation Motor [#895]
Wenping Zhao, Huan Zhang, Zaffir Chaudhry, Andrzej Kuczek and Jagadeesh Tangudu
Raytheon Technologies Research Center, United States

8:50AM | Scaling an Axial Flux Permanent Magnet Motor for Different Electrified Aviation Applications [#1455]
Sri Vignesh Sankarraman, Sina Khalesidoost, Dorsa Talebi, S. Mehdi Seyedi and Matthew Gardner
The University of Texas at Dallas, United States; Texas A & M University, United States

9:10AM | Systematic Motor Drive Reliability Improvement Methodology Using Fault-Tolerant Modular Motor Drives [#1083]
James Swanke, Hao Zeng, Bulent Sarlioglu and Thomas Jahns
University of Wisconsin-Madison, United States

9:30AM | Stator Prototype for a High Current Density Electric Motor: Assembly, Evaluation, and Testing [#857]
Kimberly Saviers, Ryan Regan, Wenping Zhao, Andrzej Kuczek, Stephen Du, Abbas Alahyari, Justin Weibel and Jagadeesh Tangudu
Raytheon Technologies Research Center, United States; Purdue University, United States

9:50AM | Torque Ripple Minimization Using Stator Tooth Shaping in A Triple Rotor Architecture [#961]
Zhentao Stephen Du, Joe Coldwate and Jagadeesh Tangudu
Raytheon Technologies Research Center, United States; Collins Aerospace, United States

Oral Session 81 | Converter Fault Detection, Protection, and Online Health Diagnosis

Room 205B
Chairs: Yonghao Gui, Yuzhuo Li

8:30AM | A Novel Converter-level Online Junction Temperature Estimating Method for SiC MOSFETs Based on Bus Current Overshoot [#85]
Qinghao Zhang and Zhang Pinjia
Tsinghua University, China

8:50AM | Fault Detection in Parallel Devices of H-Bridge Inverters Using On-state Voltages and Load Current [#1035]
Muhammed Ali Gultekin, Pengwei Li and Ali Bazzi
University of Connecticut, United States

9:10AM | An Online Correction Method of IGBT Collector Current Estimation Based on Gate Current [#111]
Zifan Li, Meng Huang, Yi Liu and Xiaoming Zha
Wuhan University, China

9:30AM | System-level Parameters Identification for DC-DC Converters Based on Artificial Neural Network Algorithm [#217]
Chuangchuang Lu, Jincheng Li, Kai Chen, Weiyang Zhou, Qunfang Wu and Ke Jin
Nanjing University Of Aeronautics & Astronautics, China

9:50AM | Parameters Estimation of a 3-Phase AC-DC Converter based on the Digital Twin Method [#601]
Giulia Di Nezio, Sergio de Lopez Diz, Marco di Benedetto, Alessandro Lidozzi, Luca Solero and Emilio Bueno Pena
Roma Tre University, Italy; Universidad de Alcala, Spain

Oral Session 82 | IPM and Synchronous Reluctance Machines II

Room 208A
Chairs: Ramakrishnan Rajavenkitasubramony, Lavanya Vadamodala

8:30AM | High-Speed IPM Machines With Structurally Loaded Magnets [#121]
Derek Lahr, Alireza Fatemi and Anthony Coppola
General Motors, United States

8:50AM | Design of a Novel SMC Spoke-type PM Machine with Vertical-Shaped Copper Conductors [#1060]
Mohanraj Muthusamy, Mathews Boby, James Hendershot and Pragasen Pillay
Concordia University, Canada; Motorsolver, United States

9:10AM | Design of Dual Three-Phase Synchronous Reluctance Starter Generator for Aircraft [#814]
Kuo-Yuan Hung, Nai-Wen Liu and Shih-Chin Yang
National Taiwan University, Taiwan

9:30AM | Design and Optimization of High-Performance Rare-Earth Free Interior Permanent Magnet Motors for Electric Vehicles Enabled by Iron Nitride Magnets [#1353]
Ali Al-Qarni and Ayman El-Refaie
Marquette University, United States

9:50AM | Finite Element Method Modeling of Stranded Conductors - Homogenization and Equivalent Model [#295]
Abdessamed Soualmi, Philippe Wendling, Farid Zidat and Patrick Lombard
Altair engineering, France; Altair engineering, United States

Oral Session 83 | Modelling and Analysis of Electrical Machines II

Room 209A
Chairs: Avoki Omekanda, Hossein Ehya

8:30AM | Study of Geometric Design Parameters Range Optimization [#279]
Hiroyuki Sano, Nicolas Schneider, Kazuki Semba, Yusaku Suzuki and Takashi Yamada
JSOL Corporation, Japan

8:50AM | Validation of a Thermal Model for Electromagnetic Co-Optimization of Electric Machines [#909]
Jacob Luta, Haotian Liu, Daniel Moguel, Steven Pekarek and Justin Weibel
Purdue University, United States

9:10AM | Generalized High-frequency Small-signal Modeling of Electric Machines using Electromagnetic FEA [#1397]
Peng Han, Jingchen Liang, Pavani Gottipati and Mark Solveson
Ansys, Inc., United States

9:30AM | Computational Efficient Design Framework for Low AC Loss, 3D Printed Windings [#945]
Philip Mellor, Nick Simpson and Dominic North
University of Bristol, United Kingdom

9:50AM | Fourier-based Modeling of a Slotless Hybrid Homopolar Radial Magnetic Bearing with Passive Axial Stabilization [#534]
Francois Boulanger, Sebastien Bosschaert, Guillaume Colinet and Bruno Dehez
Universite Catholique de Louvain (UCLouvain), Belgium

Oral Session 84 | Sensorless Drives

Room 209B
Chairs: Ramakrishnan Rajavenkitasubramony, Michael Harke

8:30AM | Injection-Based Self-Sensing of Rotor Displacement in Combined Winding Bearingless Motors [#832]
Nathan Petersen and Eric Severson
University of Wisconsin, Madison, United States

8:50AM | Online Multiparameter Estimation with Position Error Correction for Unified Synchronous Machine Sensorless Drives [#74]
Zirui Liu, Wubin Kong, Xinggang Fan, Fei Wang and Ronghai Qu
Huazhong University of Science and Technology, China

9:10AM | Estimation of Induction Motor Rotor Temperature Exploiting Intermodulation Saliency [#454]
Eduardo Rodriguez Montero, Markus Vogelsberger and Thomas Wolbank
TU Wien, Austria; ALSTOM Transport Austria GmbH, Austria

9:30AM | Back-EMF Based Self-Sensing Vector Control for Ultra-High-Speed Surface Mount PMSM [#1379]
Anirudh Upadhyaya, Aravind Nair, Nathan Petersen and Eric Severson
University of Wisconsin-Madison, United States

9:50AM | Investigation of Low Frequency Radiated EMI of the Three Phase Electric Motor System [#1019]
Yanwen Lai, Shuo Wang, Huang Qinghui, Yirui Yang, Zhedong Ma and Boyi Zhang
University of Florida, United States; Delta Electronics, United States

Oral Session 85 | Packaging III - Optimization

Room 204
Chairs: Helen Cui, Andrew Lemmon

8:30AM | GaN-HEMT Power Module Structure with Single-sided and Double-sided Aluminum-Clad Printed-Circuit Boards for Small Power Loop Inductance and High Cooling Performance [#1497]
Kazuhiro Umetani, Yu Takehara, Masataka Ishihara and Eiji Hiraki
Okayama University, Japan

8:50AM | Design, Packaging and Characterization of a 6.8kV/160A SiC SuperCascode Half-Bridge Module for Medium Voltage Applications [#44]
Junhong Tong, Ruiyang Yu and Alex Q. Huang
The University of Texas at Austin, United States

9:10AM | Graphite Heat Spreader Embedded in a PCB Package for Improved SiC Die RthJC [#163]
Ahmed Sabry Eltaher Ahmed, Remi Perrin, Guillaume Lefevre, Cyril Buttay and Jacques Jay
Mitsubishi Electric R&D Centre Europe/INSA Lyon, France; Mitsubishi Electric R&D Centre Europe, France; Univ Lyon, CNRS, INSA Lyon, ECL, Ampere,UMR 5005, France; Universite de Lyon, INSA Lyon, CETHIL, UMR 5008, France

9:30AM | Design and Optimization of a Novel Monolithic Spring for High-frequency Press-pack SiC FET Modules [#1501]
Bogac Canbaz, Ekaterina Muravleva, Jun Wang, Liyan Qu and Jerry Hudgins
University of Nebraska-Lincoln, United States

9:50AM | Steinmetz-Type Loss Modeling for Non-Linear Class II Multilayer Ceramic Capacitors [#1676, Post Journal]
David Menzi
ETH Zurich, Switzerland

Oral Session 86 | Magnetics I - Transformers

Room 202C
Chairs: Srivatsa Raghunath, Tanya Gachovska

8:30AM | Electro-thermal Co-design of Medium-Frequency Transformer for Medium Voltage DC Collection Network [#398]
Zhicheng Guo, Chen Chen, Zibo Chen and Alex Huang
UT Austin, United States

8:50AM | Design Challenges of High Frequency High Step Ratio PCB-Based Planar Transformer for GaN Based Dual Active Bridge Converter [#1267]
Abdul Muneeb, John Kaplun, Deepi Singh, Mustafeez Ul Hassan and Fang Luo
Stony Brook University, United States

9:10AM | Accurate Analysis of Core Loss Considering the Non-uniform Magnetic Flux Distribution for High-Frequency-Transformer in Dual-Active-Bridge DC-DC Converter [#1040]
Zhanlei Liu, Lingyu Zhu, Yongliang Dang, Cao Zhan and Shengchang Ji
Xi'an Jiaotong University, China

9:30AM | Pareto Optimised High-Frequency Planar Transformers for Electric Vehicle Chargers [#1147]
Hans Wouters, Lin Wei-Ren and Wilmar Martinez
KU Leuven - EnergyVille, Belgium

Thursday, November 2 10:40AM – 12:20PM

Oral Session 87 | Wind Power

Room 201B
Chairs: Ed Muljadi, Woongkul Lee

10:40AM | Operating Wind Power Plants Under Weak Grid Conditions Considering Voltage Stability Constraints [#1600, Post Journal]
Heng Wu and Xiongfei Wang
Aalborg University, Denmark

11:00AM | Inverter-embedded DFIG Rotor Winding Insulation Testing for Wind Energy Applications [#199]
Cheol-hui Park, Adrian Salcedo Bolanos, Namhyuk Byun, Sang Bin Lee, Marcos Orviz, David Reigosa, Fernando Briz and Mohamed Osama
Korea University, Korea, Republic of; University of Oviedo, Spain; General Electric, Germany

11:20AM | Fault Ride-through Operation Using an MMC based 12-Pulse DAB in Platform-less DC Collection System for Offshore Wind Farms [#838]
Sakshi Singh, Dheeman Chatterjee and Tanmoy Bhattacharya
Indian Institute of Technology, Kharagpur, India

11:40AM | Thermal Boundary Portrait of Wind Power Converter under Low Voltage Ride-Through with Maximum Reactive Power Capability [#1128]
Siyu Cao, Zhenyan Deng, Han Wang, Ke Ma, Yunfeng Cao, Xu Cai, Jiaoze Chen, Bin Hu and Zhenyuan Zhang
Shanghai Jiao Tong University, China; Shenzhen Hopewind Electric Co., Ltd., China

12:00PM | Control of DAB Converters in Series-DC Wind Farm Based on 2DOF PI Controller [#1471]
Hussain Hussain
Kuwait University, Kuwait

Oral Session 88 | FACTS Devices and Technologies

Room 208B
Chairs: Leon Tolbert, Junichi Itoh

10:40AM | Rapid Online Identification of Non-Linear Current-Controller Bandwidth in STATCOM Application [#345]
Hikmat Basnet, Matias Berg, Minh Tran and Tomi Roinila
Tampere University, Finland; GE Vernova, Finland

11:00AM | Line Loss Minimization and Current Regulation in a Loop Distribution System using Full-bridge Series Compensator [#1340]
Hayato Tamura, Takanori Isobe and Tomoyuki Mannen
University of Tsukuba, Japan

11:20AM | Study on the Operation of MMC-STATCOM under Unbalanced Grid Voltage [#197]
Kaho Nada, Toshiyuki Fujii, Ryosuke Uda, Kota Hamanaka and Ryota Okuyama
Mitsubishi Electric Corporation, Japan; Toshiba Mitsubishi-Electric Industrial Systems, Japan

11:40AM | Comparison of Three-Clamping-Level and Two-Clamping-Level Discontinuous Modulations in Cascaded H-Bridge Static Compensators [#1373]
Qingxiang Liu, Ezequiel Rodriguez Ramos, Glen Ghias Farivar, Christopher David Townsend, Josep Pou and Ramon Leyva
Nanyang Technological University, Singapore; University of Melbourne, Australia; University of Western Australia, Australia; Universitat Rovira i Virgili, Singapore

12:00PM | Load Characterization Tuning Strategy to Reduce Switching Losses in Power Quality Compensators [#608]
Morcos Metry, Wesam Rohouma and Robert S. Balog
Texas A&M University at Qatar, Qatar; University of Doha for Science and Technology, Qatar; Texas A&M University, United States

Oral Session 89 | Power System Modeling and Analysis

Room 202B
Chairs: Liang Du, Wilmar Martinez

10:40AM | Hierarchical Data-Driven Protection for Microgrids with 100% Renewables [#1046]
Ahmed Zamzam and Jing Wang
National Renewable Energy Laboratory, United States

11:00AM | Hierarchical Digital Twin of a Naval Power System [#23]
Kerry Sado, Jack Hannum, Eric Skinner, Herbert L Ginn and Kristen Booth
University of South Carolina, United States

11:20AM | Modeling Appliance Usage Privacy of a Group of Consumers using Smart Meter Data [#593]
Soumyajit Gangopadhyay and Sarasij Das
Indian Institute of Science, India

11:40AM | Online Identification of Wind Farm Wide Frequency Admittance with Power Cables using the Artificial Neural Network [#1401]
Li Cheng, Yang Wu, Xiongfei Wang, Minjie Chen, Yufei Li, Lars Nordstrom and Frans Dijkhuizen
KTH Royal Institute of Technology, Sweden; Aalborg University, Denmark; Princeton University, United States; Hitachi Energy Research, Sweden

12:00PM | Instability Detection for Operation State Monitoring of the Grid-tied Inverter [#322]
Jiayu Fang and Shuying Yang
Hefei University of Technology, China

Oral Session 90 | System Monitoring, Diagnosis and Security

Room 202C
Chairs: Subham Sahoo, Jin Ye

10:40AM | FPGA-based Degradation Evaluation for Traction Power Module with Deep Recurrent Autoencoder [#908]
Shuai Zhao, Jiahong Liu, Chu Kaiqi, Mu Shujia and Huai Wang
Aalborg University, Denmark; CRRC Qingdao Sifang Co., Ltd., China

11:00AM | A Machine Learning Based Non-Destructive Power Line Health Monitoring [#1173]
Andrew Cihon-Scott, Yilmaz Sozer and Alex De Abreu-Garcia
University of Akron, United States

11:20AM | Prognostic Health Monitoring of DC Microgrid with Fault Detection and Localization using Machine Learning Techniques [#955]
Bharat Bohara and Harish S. Krishnamoorthy
University of Houston, United States

11:40AM | An AI-Based Real-time Intrusion Detection System for Power Electronics-Dominated Grid: Attack on Inverters PQ Set-Points [#899]
Asef Zadehgol Mohammadi, Matthew Baker and Mohammad B. Shadmand
University of Illinois Chicago, United States

12:00PM | Exploring Ransomware Attacks on Smart Inverters [#920]
BoHyun Ahn, Alycia Jenkins, Taesic Kim, Jianwu Zeng, Lifford McLauchlan and Sung-Won Park
Texas A&M University-Kingsville, United States; Minnesota State University, Mankato, United States

Oral Session 91 | Motor Drive for Transportation Applications

Room 202A
Chairs: Ashish Kumar, Matthias Preindl

10:40AM | Dual-Three Phase SiC Based Integrated PMSM Motor Drive Design, Optimization, and Validation [#1168]
Md Ehsanul Haque, Shuvajit Das, Arifur Rahman, Mehmet Fesli, Anik Chowdhury, Ashraf Siddiquee and Yilmaz Sozer
University of Akron, United States

11:00AM | A High-Power Density Segmented Traction Drive Inverter [#1000]
Gui-Jia Su, Jon Wilkins, Lincoln Xue, Burak Ozpineci, Raj Sahu and Emre Gurpinar
Oak Ridge National Lab, United States

11:20AM | High-Density High-Power Converter using 3.3-kV All-Silicon Carbide Modules [#1250]
Ahmed Ismail, Zhuxuan Ma, Eric Allee, Ahmad Al-Hmoud, Feng Guo, Yue Zhao, Ashish Kumar and Kraig Olejniczak
University of Arkansas, United States; Wolfspeed, Inc, United States

11:40AM | Genetic Algorithm Enabled Multi-Objective Design Optimization of Power Converters for Electric Aircraft Propulsion [#1207]
Benjamin Luckett and JiangBiao He
University of Kentucky, United States

12:00PM | Encapsulation Residual Stress and Ferrite Loss in Inductive Coil Assemblies [#991]
Andrew Foote, Daniel Costinett, William Henken, Ruediger Kusch, Mostak Mohammad and Omer Onar
Volkswagen Group of America, UT-Knoxville, United States; University of Tennessee-Knoxville, United States; Volkswagen AG, Germany; Oak Ridge National Laboratory, United States

Oral Session 92 | AC-AC Converters

Room 204
Chair: Zhehui Guo

10:40AM | Zeta-Based Universal Converter with Zero-Current Switching [#1247]
Mojtaba Salehi and Mahshid Amirabadi
Northeastern University, United States

11:00AM | A Generalized Modulation Method for Capacitive AC-Link Universal Converter with Wide Reactive Power Range [#1270]
Karen Abbaskhanian and Mahshid Amirabadi
Northeastern University, United States

11:20AM | FPGA-based Voltage Controller for a Three-Phase PWM Active Rectifier [#671]
Imer Francisco Castillo-Aguilar, Jose Antonio Juarez-Abad, Jesus Linares-Flores and Arturo Hernandez-Mendez
Universidad Tecnologica de la Mixteca (UTM), Mexico

11:40AM | Current and Voltage-Balancing Control of A Grid-Connected Single-Stage Modular PV Plus Storage Solid State Transformer (PVS-SST) [#1388]
Adithyan Vetrivelan, Wei Xu, Ruiyang Yu and Alex Q. Huang
University of Texas at Austin, United States

12:00PM | A Novel Power Flow Controller for Behind the Meter Demand Response [#1369]
Houshang Salimian Rizi, Tianxiang Chen and Alex Q. Huang
The University of Texas at Austin, United States

Oral Session 93 | Power Converter EMI

Room 201A
Chairs: Abhishek Anand, Fang Luo

10:40AM | RLC Balance Technique of Transformer to Reduce CM EMI for Isolated DC-DC Converters [#756]
Qinghui Huang, Yiming Li, Zhedong Ma, Yirui Yang, Yanwen Lai and Shuo Wang
University of Florida, United States

11:00AM | Investigation and Mitigation of Radiated EMI due to Near-field Coupling in a High-density Active-clamp Flyback Power Adapter [#731]
Zhedong Ma, Yanwen Lai, Qinghui Huang, Yirui Yang and Shuo Wang
University of Florida, United States

11:20AM | Simplified Wide-Band Frequency Models for Single and Multi-layered Boost Inductors [#973]
Ripun Phukan, Shin-Yu Chen, Dong Dong and Rolando Burgos
Delta Electronics, United States; Virginia Tech, United States

11:40AM | Modeling of Conducted EMI Emissions in 10 kV SiC MOSFET Based Power Electronics Building Blocks [#1494]
Ashkan Barzkar, Boran Fan, He Song, Joshua Stewart, Rolando Burgos, Dong Dong and Dushan Boroyevich
Virginia Tech, United States

12:00PM | Influence of Position and Current Sensor on Torque Ripple Harmonic Orders in Electric Drives [#1346]
Anant Singh, Jyothis Joseph, Raja Ramakrishnan and Tomy Sebastian
Halla Mechatronics, United States

Oral Session 94 | Wound Field and PM Machines II

Room 209A
Chairs: Shuvajit Das, Wei Xu

10:40AM | Hybrid Sub-Harmonic Synchronous Machines Using Series and Parallel Consequent Permanent Magnet [#1337]
S M Sajjad Hossain Rafin, Qasim Ali and Osama A. Mohammed
Florida International University, United States; Sukkur IBA University, Pakistan

11:00AM | Novel PM Configuration for the Trans-Rotary Magnetic Gear with Enhanced PM Utilization [#950]
Ramin Safarpour, Chris Hansen, Amy Peterson and Siavash Pakdelian
University of Massachusetts Lowell, United States

11:20AM | Performance Analysis of Non-overlap Winding Technologies of a Large Wound Rotor Synchronous Generator for Wind Energy Conversion [#995]
Karen Garner and Udochukwu Akuru
Stellenbosch University, South Africa; Tshwane University of Technology, South Africa

11:40AM | Effect of Stator/Rotor Pole Number Combinations on Contributions of Stator Slot PMs in Multi-tooth Dual-PM Machines [#358]
Hai Xu, Zi-Qiang Zhu, Yanjian Zhou and Liang Chen
The University of Sheffield, Great Britain; Corporate Research Center of the Midea Group, China

12:00PM | Rated and Overload Capability of a Synchronous PM Spoke Motor for e-bike Application [#1052]
Chiara Conto and Nicola Bianchi
University of Padova, Italy

Oral Session 95 | Monitoring, Diagnostics, Reliability and EMI

Room 209B
Chairs: Antonio J. Marques Cardoso, Giacomo Scelba

10:40AM | Hybrid Graphical Filter Design for Reflected Wave Phenomenon in Long-Cable-Fed Motor Drives [#1055]
Masayuki Hijikata, Kushan Choksi, Yuxuan Wu, Deepi Singh and Fang Luo
Stony Brook University, United States

11:00AM | Mitigation of the Performance Derating in SiC Motor Drive Inverters Operating at Low Output Current Frequency [#1231]
Fausto Stella, Gianmario Pellegrino, Sandro Rubino and Eric Armando
Politecnico di Torino, Italy

11:20AM | Mitigation of Position Sensor Offset Error in PMSM Drives via Current Reference Remapping [#49]
Collin Schultz and Sandun Kuruppu
Nexteer Automotive, United States; Western Michigan University, United States

11:40AM | Simultaneous PM Temperature and Magnetization State Estimation in Variable Flux PMSMs Based on the PM Flux Linkage [#1488]
Diego F. Laborda, Javier G. Tiemblo, Marcos Orviz and David Reigosa
Universidad de Oviedo, Spain

12:00PM | Simple Experimental Characterization of Switching Node Parasitic in Half Bridge Module and Device [#1519]
Ashik Amin, Tahmid Ibne Mannan and Seungdeog Choi
Mississippi State University, United States

Oral Session 96 | Magnetics II - Inductors

Room 205C
Chair: Taoufik Qoria, Woongkul Lee

10:40AM | A High Power 200kW Medium Frequency Transformer With Improved Thermal Management [#691]
Zhicheng Guo, Chen Chen, Ruiyang Yu and Alex Huang
UT Austin, United States

11:00AM | DC Inductor Loss Measurement Used in DC/DC Converters Under High DC Current Conditions [#1106]
Huu Thien Le, Hiroaki Matsumori, Koushi Takano and Keiji Wada
Nagoya Institute of Technology, Japan; Tokyo Metropolitan University, Japan

11:20AM | Magnetoelectric Voltage Tunable Inductors for Power Electronics Applications [#792]
Mark Nations and Subhashish Bhattacharya
North Carolina State University, United States

11:40AM | Increasing Current Capability of Air-Core Planar Inductors Capable of Suppressing Eddy Currents [#462]
Koji Orikawa, Naoki Murakami and Satoshi Ogasawara
Hokkaido University, Japan

12:00PM | Core Energy Capacitance of EE-Type NiZn Inductor [#338]
Zhan Shen, Zhike Xu, Long Jin, Hongbin Zhang, Xiaohui Qu and Wu Chen
Southeast University, China

Monday, October 30 5:30PM – 7:10PM

Poster Session 1

Exhibit Hall B
Chairs: Minjie Chen, Dong Cao

1.1 Sustainable Energy, Energy Storage, and Power-to-X Technologies

P101 | Linear Active Disturbance Rejection Control with Deviation Differential for DC Bus Voltage in Wind Power System [#203]
Long Tao, Xiaoyong Ma, Yifeng Wang, Huaidong Shi, Wenqiang Yang and Zhongda Wang
Tianjin University, China; Tianjin University of Technology, China

P102 | A Novel Coupling Slippage Control Algorithm to Improve Post-LVRT Performance of High Power Wind Turbines [#486]
Anil Kumar Tiwari and Jishnu Kavil Kambrath
Indian Institute of Technology Roorkee, India

P103 | Detecting Power Module Thermal Resistance Change in Wind Turbine Converters Using LSTM [#647]
Yanghao Zhong, Subhash Lakshminarayana, Li Ran, Phil Mawby, Chunjiang Jia and Chong Ng
The University of Warwick, United Kingdom; Offshore Renewable Energy Catapult, United Kingdom

P105 | Offshore Wind Energy Conversion System Connected to a Floating Production Storage and Offloading Unit: Electrical Aspects [#921]
Matheus Schramm Dall Asta, Jessika Melo de Andrade, Lenon Schmitz, Francisco Viglus, Mauricio Dalla Vecchia, Leandro Benhur Klinger Fisch, Gean Jacques Maia de Sousa, Marcelo Lobo Heldwein and Lazzarin Lazzarin
Federal University of Santa Catarina, Brazil; Federal University of Technology, Brazil; Technical University of Munich, Germany

P106 | Variable DC Grid Wind Turbine Motor-Generator Grid-Connected System with Model-Based MPPT [#1086]
Dube Lucky, Kamper Maarten, Ockhuis Dillan and Garner Graham
Stellenbosch University, South Africa

P107 | DC Collection and Transmission for Offshore Wind Farms [#1206]
Jinia Roy, Hanchao Liu, Ibrahima Ndiaye and Rajib Datta
GE Research, United States

P109 | Preliminary Results and Discussion over A Novel Toolbox Supporting the Optimal Design and Management of a Resilient Islanded Microgrid [#1432]
Bharath Kumar Sugumar, Giovanna Oriti, Alexander L. Julian and Norma Anglani
University of Pavia, Italy, Italy; Naval Postgraduate School, Monterey, CA, United States

P110 | Sizing Study of a Hydrogen Electrolyzer-gas Turbine System [#1246]
Stephan Santoni, Alexandre Chailan, Alexandre Ravey, Francois Lanzetta and Fei Gao
Universite de Technologie de Belfort-Montbeliard, France; GE Gas Power, France; Universite de Franche-Comte, France

P111 | Performance Modeling of Multi-Energy System for Economic Operation [#141]
Weihao Zhao, Morten Nielsen, Martin Kjaer, Florin Iov and Stig Munk-Nielsen
Aalborg University, Denmark

P112 | Equivalent Circuit Modeling of a Wave Energy Converter via Eigenmode Analysis [#1285]
Nasim Adami, Inyong Kim, Pranav Chandran, Courtney Beringer, Ted Brekken, Solomon Yim, Brian Jonson and Yue Cao
Oregon State University, United States; University of Texas at Austin, United States

P113 | Techno-Economic-Based Design of a DC Nanogrid Using a Wave Energy Converter [#1069]
Trevor Murphy, Yue Cao, Trent Dillon, Bryson Robertson and Ean Amon
Oregon State University, United States; University of Washington, United States

P114 | Comparative study for various types of DG allocation for 24 hours load and generation profile [#1464]
Abbas Asad, TaeSuk Mun, JaeHyeong Lee, Woonki Na and Jonghoon Kim
Chungnam National University, Korea, Republic of; California State University, United States

P115 | Finite Control Set Model Predictive Control for PV System Operating as a STATCOM [#817]
Hamdan Alosaimi, Hadhlul Aladhyani, Osamah Aljumah and Subhashish Bhattacharya
North Carolina State University, United States

P116 | An Extendable High Step-Up DC-DC Converter for Renewable Energy Applications [#1553]
Saeed Habibi, Ramin Rahimi, Mehdi Ferdowsi and Pourya Shamsi
Missouri University of Science and Technology, United States

P117 | Four-Port Converter Interfacing Two PV Panels, Load, and Bidirectional Battery [#572]
Abdullah Alhatlani, Sumana Ghosh, Fahad Alaql and Issa Batarseh
Imam Mohammad ibn Saud Islamic University, Saudi Arabia; Power Application Engineer Wolfspeed Inc., United States; University of Central Florida, United States

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P224 | The Effects of Relative Humidity on DC Series Arc Generation and Detection [#241]
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The University of Nottingham, United Kingdom

P225 | Monolithic Bidirectional Power Transistors: Opening New Horizons in Power Electronics [#1665, Post Journal]
Jonas Huber and Johann Walter Kolar
ETH Zurich, Switzerland

P226 | Reset-Less Rogowski Current Sensor: A Novel Approach for High-Bandwidth, Non-Intrusive Switch Current Measurement [#1707, Post Journal]
Hossein Niakan, Ali Parsa Sirat and Babak Parkhideh
University of North Carolina at Charlotte, United States

P227 | Experimental Evaluation of Power Losses in High-Power Transformer [#1291]
Hongmei Wan, Hanqing Nie, Tom Farkas, Mark Ventura and Chad Eckhardt
GridBridge Inc., United States

P246 | Rethinking Basic Assumptions for Modeling Parasitic Capacitance in Inductors [#1595, Post Journal]
Hongbo Zhao and Shen Zhan
Aalborg University, Denmark; Southeastern University, China

1.8 Applied Research and Emerging Technologies

P229 | IGCT-based Solid-State Circuit Breaker Coordination using Delay Compensation for DC Protection [#1230]
Abhinav Patni, Chunmeng Xu, Govind Chavan, Steven Englebretson and Pietro Cairoli
ABB, United States

P230 | Testing Methodology for Wide Bandgap High Power Converter with Limited Lab Resources [#1419]
Zibo Chen, Chen Chen and Alex Q. Huang
The University of Texas at Austin, United States

P231 | Digital twin-based energy management for home microgrid: A quantification of redundant supply capacity [#1536]
Junyan Shao, Baoze Wei, Yajuan Guan, Bazmohammadi Najmeh, C. Vasquez Juan and M. Guerrero Josep
Aalborg university, Denmark

P232 | In situ SOH Monitoring and Estimation Through Ultrasonic Detecting Techniques [#464]
Yi Shen, Bingchen Zou, Maoshu Xu, Sheng Wang, Haomiao Li, Kangli Wang and Kai Jiang
Huazhong University of Science and Technology, China

P233 | Theoretical and Experimental Investigation of Phase shift control strategies of Bi-directional Energy Harvesters Interface (BEHI) for Battery Energy Storage System (BESS) [#1525]
Ramesh Palanisamy, Swetha .C, Aji .U S, Sreeranjini .S V, Aby Joseph and Renji V Chacko
Power Electronics Group, CDAC, India

P234 | Model Predictive Control for Scalable Power Converters with Reconfigurable Architecture [#1546]
Liwei Zhou, Youssef Fahmy, Matthew Jahnes and Matthias Preindl
Columbia University, United States

P235 | Power Quality Improvement of Irradiance-Dependent Photovoltaic Microgrid by Three-Level Space Vector Modulation [#1571]
Sukanta Roy, Milad Behnamfar, Anjan Debnath, Mohd Tariq and Arif Sarwat
Florida International University, United States

P238 | Hybrid Direct-Injection Power Flow and Control Circuit for Low-Voltage Grids [#651]
Mowei Lu, Mengjie Qin and Stefan Goetz
University of Cambridge, Great Britain; Xi an Jiaotong University, China

P239 | A Novel Multiport Bidirectional AC-DC Interlinking Converter with Galvanic Isolation for Hybrid Microgrid Applications [#676]
Asad Hameed and Gerry Moschopoulos
The University of Western Ontario, Canada

P240 | A Converter-Based Hardware Testbed Hybrid Microgrid Emulator of a Flexible Manufacturing Plant [#354]
Mohamed Al Sager, Dingrui Li, Leon Tolbert, Fred Wang and Hua Bai
University of Tennessee, United States

P241 | A 99.977% Efficient, 20 kV, 50 A, T-Type Modular Dc Circuit Breaker with SiC Based Full Bridge Modules [#410]
Yizhou Cong, Yue Zhang, Xiao Li, Dihao Ma, Zhining Zhang, Peiwen Jiang, Faisal Alsaif, Pengyu Fu, Jin Wang, Baljit Riar, Hailing Wu and Jeffrey Ewanchuk
The Ohio State University, United States; RTX Technology Research Center, United States

P242 | Evaluation and Experimental Comparison of Overvoltage Suppression Methods for DC Circuit Breakers [#901]
Zhi Jin Zhang, Yang Liu, Lukas Graber and Maryam Saeedifard
Georgia Institute of Technology, United States

P243 | Medium Voltage DC Transformer with Series-Connected Power Devices Based on Active Clamping Circuit [#481]
Tong Wu, Shuai Shao, Xingyu Pei, Xin Wang, Wentao Cui and Junming Zhang
Zhejiang University, China; Guangdong Power Grid Co., Ltd, China

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Poster Session 2

Exhibit Hall B
Chairs: Luca Zarri, Lei Gu

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Syed Imam Hasan, Alper Uzum, MD Ehsanul Haque, Arifur Rahman, Ashraf Siddiquee, Mithat John Kisacikoglu and Yilmaz Sozer
University of Akron, United States; National Renewable Energy Lab, United States

P302 | Ultra-Efficient 100kW SiC-based battery charger design and validation [#213]
Amaia Lopez-de-Heredia, Endika Bilbao, Itsasne Landaburu and Irma Villar
IKERLAN, Spain

P303 | Four Quadrants Operation Control of High-voltage Transformerless BESS System [#347]
Xiqi Wu, Rui Li and Xu Cai
Shanghai Jiaotong University, China

P304 | Parameter Variations of Equivalent Circuit Model of Lithium-ion Capacitor [#660]
Mohammad Al-Smadi and Jaber Abu Qahouq
The University of Alabama (UA), United States

P305 | Modeling and Parameter Identification of a 400 kW Grid-Connected Supercapacitor Energy Storage System using the Inherent Impedance Spectroscopy Capability of its DCDC Converter [#570]
Michael Hetzel, Daniel Diaz Ocampo, Giovanni De Carne and Marc Hiller
Karlsruhe Institute of Technology (KIT), Germany

P306 | A DRL-based Optimized Pulse Heating Strategy for Low-Temperature Lithium-ion Batteries [#1139]
Nan Wang, Ziqiang Jia, Qiqi Ren and Alian Chen
Shandong University, China

P307 | A Novel Method of Battery State-of-health Estimation for Energy Storage Station Based on Inconsistency and Dual Time-scale Extended Kalman Filtering [#1517]
Jiahao Zhang, Xianmin Mu, Zhaoyuan Huang, Fanpeng Zeng, Jing Liu and Guanlin Li
Dalian University of Technology, China; Jiangsu Linyang Energy, China

P308 | Adaptive Power Management Control Demonstrated in Hybrid Li-Ion Battery/Li-Ion Supercapacitor Power System [#271]
Raymond Sepe, Kyle Waterman and Andrew Vose
Electro Standards Laboratories, United States

P309 | A Fast Computational Model of Arbitrary Battery Network Topology with Time-varying Working Conditions [#1314]
Congjia Zhang, Chao Gao, Yue Chen, Ende Lin, Feng Yang, Yanglin Zhou, Song Ci and Chongqing Kang
Tsinghua University, China; China Three Gorges Co., LTD., China; Ibattery Cloud Technology Co., LTD., China

P310 | A Real-Time Degradation Estimation Approach for Batteries in PV and Battery Hybrid Plant Operation [#1272]
Shumeng Wang, Mahshid Amirabadi and Brad Lehman
Northeastern University, United States

P311 | Feature Extraction and Signal Processing with Battery Operating Data for Classification of Environment Conditions within Battery [#1466]
Miyoung Lee, Dongho Han, Faiz Majeed, Na Woonki and Jonghoon Kim
Chungnam National University, Korea, Republic of; California State University, Korea, Republic of

P312 | Comparative Study of Li-ion Battery Degradation Enhancement and Charging Time Reduction Using Optimal Charging Protocol [#1467]
Abeeb Agbolagade Adejare, Sangwoo Cho, Hyeongjun Choi, Woonki Na and Jonghoon Kim
Chungnam National University, Korea, Republic of; California State University, United States

P313 | PV-Virtual Bus Topology with Series Capacitor for DPP Converters [#579]
Yousef Mahmoud
Kennesaw State University, United States

P314 | Sweep Frequency Response Analysis to Monitor and Identify Changes in the Impedance of a Photovoltaic Panel Measured Online using a Power Optimizer [#1359]
Jeet Panchal, Bo Wen and Rolando Burgos
Virginia Tech, United States; Milan Power Electronics Laboratory (MPEL), United States

P315 | A LLC Step-up PV Micro-converter With An Integrated High-Frequency AC Inter-Connected Energy Storage Unidirdectional Power Interface [#812]
Maria Beshara, Sanjida Moury, Kajanan Kanathipan and John Lam
York University, Canada; Lakehead University, Canada

P316 | Bidirectional Multiport Converter for Hybrid Solar-Battery Systems [#1326]
Di Wu and King Man Siu
University of North Texas, United States

P317 | Power Hardware-in-the-Loop Interfaces for Inverter-Based Microgrid Experiments Including Transitions [#155]
Annabelle Pratt, Kumaraguru Prabakar, Subhankar Ganguly and Soumya Tiwari
National Renewable Energy Laboratory, United States

P319 | Improving AGC Performance with Hybrid Energy Storage Systems for Enhanced Utilization of Renewable Energy [#837]
Abhishek Saxena, Omar Al Zaabi, Ravi Shankar, Khaled Al Jaafari, Khalifa Al Hosani and Utkal Ranjan Muduli
NIT Patna, India; Khalifa University, United Arab Emirates

ISOP Multimode Flyback Based Auxiliary Power Module with Ultra-wide Input Voltage Range [#789]
Qishan Pan, Dongdong Shu, Chuhan Peng, Hengzhao Yang and Haoyu Wang
ShanghaiTech University, China

2.2 Grid Modernization and Smart Grid

P320 | Detection of False Data Injection and Series Arc Faults in DC Microgrids Based on Unknown Input Observers [#1256]
Ge Yang, Luis Herrera and Xiu Yao
University at Buffalo, United States

P321 | Distributed Control Strategy Based on Line Impedance Identification for Reactive Power Sharing in Microgrid [#969]
Yuxin Cheng, Hua Han, Hongfei Wang, Shujin Chen, Yao Sun and Linxiang Fei
Central South University, China

P322 | Sizing Optimization of Power Generation and Energy Storage for Lunar Microgrids [#1232]
Yuzhou Yao, Nihanth Adina, Zhining Zhang, Varsha Sunkara and Jin Wang
The Ohio State University, United States

P323 | Comparison of NPC and T-Type Single-Phase String Inverters Using WBG Devices for Grid-Connected PV Systems [#733]
Wenjie Ma, Hui Li, Shan Yin, Xiaohu Pang and Honglang Zhang
UESTC, China

P324 | NPC Converter-Based Grid Current Quality Improvement through Adaptive Phase-Shift at Single-Phase AC Ports [#1487]
Gleisson Balen, Cristian Blanco, Angel Navarro Rodriguez and Pablo Garcia Fernandez
University of Oviedo, Spain

P325 | Robust Stability Analysis of the Simplified Virtual Synchronous Compensator for Grid Services and Grid Support [#854]
Vincenzo Mallemaci, Sante Pugliese, Fabio Mandrile, Enrico Carpaneto, Radu Bojoi and Marco Liserre
Politecnico di Torino, Italy; Kiel University, Germany

P326 | Design and Construction of 60kVA Prototype of High-Frequency Transformer for Dual-Active-Bridge Converters Devoted to DC Distribution Networks Applications [#591]
Stefano Menicanti, Marco di Benedetto and Fabio Crescimbini
Mesar, Italy; Roma Tre University, Italy

P327 | Operating Mode Analysis and Controller Design for Medium Voltage Asynchronous Microgrid Power Conditioning System [#1459]
Nithin Kolli, Harshit Nath, Sanket Parashar, Raj Kumar Kokkonda, Subhashish Bhattacharya and Victor Veliadis
North Carolina State University, United States

P328 | EV Adoption Impacts on Residential, Commercial and Urban-Commercial Feeders [#598]
Abhijith Ravi, Linquan Bai, Grant Wollam and Johan Enslin
UNC Charlotte, United States; Clemson University, United States

P329 | Analysis of Building Model Forecasts using Autonomous HVAC Optimization System for Residential Neighborhood [#383]
Viswadeep Lebakula, Helia Zandi, Christopher Winstead, Eve Tsybina, Teja Kuruganti and Justin Hill
Oak Ridge National Laboratory, United States; Radio Systems Corporation, United States; Southern Company, United States

P330 | Optimal Inertia Emulation via Adaptive Grid-forming Inverter Selection in Active Distribution Networks [#1004]
Alireza Zare, Silvanus Dsilva, Mohammad B. Shadmand and Sudip Mazumder
University of Illinois Chicago, United States

2.3 Transportation Electrification Applications

P331 | Hybrid Energy Storage System with Power Surge Capabilities Utilizing Six-Port Converter for Cell Management [#568]
Ilya Zeltser, Michael Evzelman, Daniel Beniaminson and Mor Peretz
Rafael Advanced Defense Systems Ltd., Israel; Ben-Gurion University of the Negev, Israel

P332 | Non-Linear Bipolar Pulse Characterisation of Lithium-ion Batteries [#684]
Alan Gen Li and Matthias Preindl
Columbia University, United States

P333 | A Scalable Multi-input Hybrid Converter for Energy Management Control in Hybrid Energy Systems Empowering Electric Mobility [#698]
Xueshen Zhang, Moon-young Kim, Jeong-Il Kang and Yeonho Jeong
University of Rhode Island, United States; Samsung Electronics, Korea (South)

P334 | Controller Hardware-in-the-loop Modeling and Operation of a High-power DC Charging Hub [#747]
Emin Ucer, Alastair Thurlbeck, Ed Watt, Md Shafquat Ullah Khan, Mithat John Kisacikoglu and Andrew Meintz
NREL, United States

P335 | A Wireless Power Transfer System with Full Duplex Data Communication for 24V DC Industrial Proximity Sensor. [#761]
Matthew Schraa, Jonathan Letwin, Cameron Ball, Jack Birkett, Sanjida Moury and Farhan Ghaffar
Lakehead University, Canada

P338 | GaN Based Modified Integrated On-Board Charger Configuration Using Minimum Additional Active and Passive Components [#809]
Shohei Funatsu, Hiroaki Matsumori, Takashi Kosaka, Nobuyuki Matsui, Keisuke Nakamura, Mitsuru Takahashi, Shin Taguchi and Saha Subrata
Nagoya Institute of Technology, Japan; Aisin corporation, Japan

P339 | A Two-stage Power Conversion Structure for E-VTOL Aircraft with both Fuel cell and Battery Energy Sources [#835]
Wang Zhichun and Fang Peng
University of Minnesota, Duluth, United States

P340 | Investigation of Electro-mechanical Interaction and Active Protection in More Electric Aircrafts [#836]
Jishnu Kavil Kambrath and Xiong Liu
IIT ROORKEE, India; Jinan University, China

P341 | Module Development of a High-Power-Density High-Efficiency Cryogenic Solid State Circuit Breaker for Electrified Aircraft Propulsion [#879]
Shimul K. Dam, Ching-Hsiang Yang, Zhou Dong, Dehao Qin, Ruirui Chen, Fred Wang, Hua Bai and Zheyu Zhang
University of Tennessee, Knoxville, United States; ABB US Research Center, Raleigh, United States; Clemson University, United States

P342 | A Novel Control Method for Single-Phase 25kV Solid-State Transformer for High-speed Railway Vehicle [#885]
Kim Dong-Uk, Lee Jaehong, Lee Seung-Hwan, Lee Junho and Kim Sungmin
Hanyang University, Korea (South); University of Seoul, Korea (South); Inter-Mobility, Korea (South)

2.4 Power Converter Topologies

P343 | Design Aspects of Resonant and Non-Resonant Capacitive-Coupled DC/DC Converters [#641]
Thiago Pereira, Hannes Bruckner and Marco Liserre
Kiel University, Germany

P344 | A High Boost DC-DC Converter with Less Input Current Ripple: Derivation, Analysis and Implementation [#1038]
Qingyu Deng, Ping Wang, Feng Jiang, Ze Cheng, Xiaochen Ma and Long Tao
Tianjin University, China

P346 | A Novel DC-DC Boost Converter with High Voltage Conversion Ratio and Zero Current Ripple for Fuel Cell Application [#1039]
Feng Jiang, Ping Wang, Qingyu Deng, Ze Cheng, Long Tao and Xiaochen Ma
Tianjin University, China

P347 | Trapezoidal Current Modulation based Zero Voltage Switching of Interleaved Converters [#1377]
Vihan Shahu, Vinod John and Utsab Kundu
Indian Institute of Science Bangalore, India

P348 | Model Predictive Control of a New Five-Level Inverter for Medium Voltage Applications [#89]
Hoang Le, Apparao Dekka and Deepak Ronanki
Lakehead University, Canada; Indian Institute of Technology, Madras, India

P349 | Analog Digital Mixed Synchronous Rectifier Gate Signal Generation for LLC Resonant DC/DC Converter [#138]
Xiaozhou Wang, Zheng Zhang, Rui Bai, Xiangdong Yu, Lijian Ding and Shuang Zhao
Hefei University of Technology, China

P350 | Design and Implementation of CLLLC Bidirectional Converter with Wide Voltage Range on Low Side [#120]
Jie Li, Wen-Hsuan Lee, Jiann-Fuh Chen and Tsorng-Juu Liang
National Cheng Kung University, Taiwan

Novel Inverter Topology for Electric Vehicle Inductive Wireless Power Transfer Charging [#1539]
Mohammad Ali Hosseinzadeh, Maryam Sarebanzadeh, Ralph Kennel, Ebrahim Babaei, Cristian Garcia, Jose Rodriguez
Technical University of Munich, Germany, University of Tabriz, Iran, Universidad de Talca, Curico, Chile, Universidad San Sebastian, Santiago, Chile

2.5 Control, Modeling, and Optimization of Power Converters

P352 | A Sub-harmonic Oscillation Elimination Method with PI Modulation in PSR Flyback Converter [#169]
Xinyu Wei, Chong Wang, Daying Sun and Wenhua Gu
Nanjing University of Science& Technology, China

P354 | A Simple Control Strategy for Three-Phase Vienna Rectifier via Input Impedance Regulation [#20]
Jiawei Chen, Guangyu Jia and Xinke Zhu
Chongqing University, China

P355 | A Constant Current Digital Control Method for Primary-Side Regulation Half-Bridge LLC Resonant Converter [#396]
Daying Sun, Lihui Cong, Yu Yao, Mian Dai, Chong Wang and Wenhhua Gu
Nanjing University of Science& Technology, China

P356 | Effects of Circulating Current Controllers on MMC-based System Stability [#627]
Semih Isik, Vasishta Burugula and Subhashish Bhattacharya
North Carolina State University, United States

P357 | Event-triggered Online MPC Model Calibration for Photovoltaic Power Optimizers [#924]
Nabila Elbeheiry, Morcos Metry and Robert S. Balog
Texas A&M University, United States; Texas A&M University, Qatar

P358 | Gray-Box Modeling for Distribution Systems with Inverter-Based Resources [#1228]
Junhui Zhang, Yuxi Men, Lizhi Ding, Xiaonan Lu and Wei Du
Purdue University, United States; Pacific Northwest National Laboratory, United States

P359 | Dynamic Modeling of a Hybrid Microgrid and Stability Analysis Considering Communication Delays [#666]
Hadi Akbari and Adel Nasiri
University of Wisconsin-Milwaukee, United States; University of South Carolina, United States

P360 | The CVRC Based Grid-Forming Inverter State Feedback Optimal Control Design [#966]
Zhanqi Zhang, Xiangjun Quan, Zaijun Wu and Jian Du
Southeast University, China; State Grid Jiangsu Electric Power Co., Ltd, China

P361 | Model-based Fault Diagnostics in Cascaded H-Bridge Inverters with Level-shifted Modulation [#1328]
Uiliam Kutrolli, Pol Thoyer, Muhammed Ali Gultekin and Ali Bazzi
University of Connecticut, United States; Toulouse INP, France

P362 | Analysis and Suppression on High Dv/dt Caused Crosstalk in Driving Paths of SiC Full-bridge Inverters [#94]
Qichi Chen, Xuejun Pei, Peng Zhou and Yi Yu
Huazhong University of Science and Technology, China

P363 | A Linear Machine Learning-Based Model Predictive Control with Repetitive and PI Elements for a Three-Phase Inverter [#1395]
Jianwu Zeng and Wei Qiao
Minnesota State University, Mankato, United States; University of Nebraska-Lincoln, United States

P364 | Reduction of Current Harmonics in Single Phase Uninterruptable Power Supply Using Phase Based Comb Filter [#1428]
Jung-yong Lee, Dongmin Choi, TaeHoon Chin, SungMin Lee and YoungHoon Cho
Konkuk university, Korea (South)

P365 | Comprehensive Analysis and Efficiency-Optimized Modulation of Resonant Dual Active Bridge DC-DC Converters with T-Type Impedance Network [#1535]
Jun Huang, Yu Wang, Pengchong Huo and Xuguo He
Hebei University of Technology, China

P783 | A Novel Online Open-Circuit Fault Diagnostics Strategy for Asymmetrical Six-Phase Induction Motor Drives [#469]
Khaled Laadjal, Joao Serra, Fernando Bento and Antonio J. Marques Cardoso
CISE - University of Beira Interior, Portugal

A Simplified Online Stability Monitoring Method for Grid-connected Systems [#142]
Yihan Zhou, Jinjun Liu, Zipeng Liu and Tong Wu
Xi'an Jiaotong University, China

Development of Novel Conductive Grease to Mitigate PWM Inverter-Induced Bearing Currents [#124]
Madeline Stephens, Hellen Chen, Annette von Jouanne, Emmanuel Agamloh and Alex Yokochi
Baylor University, United States

A Novel Model-Less Method for the Emulation of PMSM in Power-Hardware-in-the-Loop [#226]
Nicolas Basquera, Marco di Benedetto, Luca Bigarelli, Alessandro Lidozzi and Luca Solero
Roma Tre University, Italy; Avio SpA, Italy

Hybrid Modulation for Three-level Boost Converter with ZVS near Double Gain [#118]
He Zhou, Ding Hongfa, Zhang Ziqi, Chen Zibo, Yao Zhigang, Jiang Yongbin, Deng Fei and Tang Yi
SEEE, Huazhong University of Sci. & Tech., China; University of Texas at Austin, United States; SEE, Southwest Jiaotong University, China; EEE, Nanyang Technological University, Singapore; ERI, Nanyang Technological University, Singapore

A High Precision Observer Using a Full-Range Harmonics Suppression Schme for High-Speed Permanent Magnet Synchronous Motor [#390]
Yifeng Liu, Jinhua Du, Yutong Song, Yao Wang, Qidong Wen and Mengjie Qin
Xi'an Jiaotong University, China

2.6 Electrical Machines and Electric Drives

P366 | Research on A High Torque Density Axial-Radial Flux Permanent Magnet Machine to Avoid Stator Axial Movement [#1030]
Yuhang Long, Zhanfeng Song and Zan Zhang
Tianjin University, China; Xuchang University, China

P367 | Optimization of MW-Class Dual Three-Phase Permanent Magnet Synchronous Machines for Electric Propulsion Vessels Considering Mutual Effects Based on the Neural Network [#987]
DoHyun Jang, Tae-Hyuk Ji, Young-Ho Hwang, Hwe-Won Yang, Chae-Won Seo and Sang-Yong Jung
Sungkyunkwan University, Korea, Republic of

P368 | Concept Design and Optimization Methodology of a Wound Field Synchronous Motor for Commercial Vehicle Applications [#357]
Hooshang Mirahki, Leon Rodrigues, Thomas Cawkwell and Kais Atallah
University of Sheffield, United Kingdom; Arrival Ltd, United Kingdom

P369 | Space-Vector Dynamic Model of Dual-Three Phase PMSMs and related Identification Technique [#983]
Angelo Accetta, Marco Di Benedetto, Alessandro Lidozzi, Massimiliano Luna, Marcello Pucci, Antonino Sferlazza and Luca Solero
INM-CNR, Italy; University ROMATRE, Italy; University of Palermo, Italy

P370 | Magnet Pole Design Improvement of Novel Hybrid-Pole Variable Flux Memory Machine [#1425]
Rui Tu, Hui Yang, Heyun Lin, Hanlin Zhan and Chaohui Liu
Southeast University, China; Harbin Institute of Technology, Shenzhen, China; National New Energy Vehicle Tech. Inno. Center, China

P371 | An Inquiry into the Winding Phase-Shifting Technique on the Electromagnetic Performance of Wound-Field Flux Modulation Machines [#1405]
Udochukwu B. Akuru and Karen S. Garner
Tshwane University of Technology, South Africa; Stellenbosch University, South Africa

P372 | Airgapless PMSM with Diamond Like Carbon Coating Technology [#194]
Hyungkwan Jang, Woongpyo Hong, Taegyu Lee and Byungho Min
Hyundai Motor Company, Korea, Republic of

P373 | Multi-Disciplinary Optimization of an Electrically Excited Synchronous Motor [#278]
Hiroyuki Sano, Katsuyuki Narita, Kazuki Semba, Yusaku Suzuki and Takashi Yamada
JSOL Corporation, Japan

P374 | Ultra-Light Reaction Wheel with Dual-layer rotor and Single-side Halbach Magnet Array for CubeSat [#1389]
Nai-Wen Liu, Kuo-Yuan Hung, Bo-Ting Lyu and Shih-Chin Yang
National Taiwan University, Taiwan

P375 | Rotor Optimization and Electromagnetic Performance Comparison of the 10- and 14-pole Wound-Field Flux Switching Machines [#1398]
Udochukwu B. Akuru, Lesedi Masisi and Mbika Muteba
Tshwane University of Technology, South Africa; Witwatersrand University, South Africa; University of Johannesburg, South Africa

P376 | A Novel High Torque Density E-Core Hexane-Type Stator Permanent Magnet Flux Switching Machine [#152]
Wasiq Ullah, Faisal Khan, Udochukwu Bola Akuru, Shahid Hussain, Salar Ahmad Khalil and Mwana Wa Kalaga Mbukani
COMSATS University Islamabad, Abbottabad Campus, Pakistan; Tshwane University of Technology Pretoria Campus, South Africa; Tallinn University of Technology, Estonia; National University of Science and Technology, Pakistan; University of Pretoria Pretoria, South Africa

P377 | Analysis of a Mechanically Doubly Salient Electric Machine using FE and Lumped Parameter Magnetic Circuit Models [#539]
Chandra Sekhar Goli, Somasundaram Essakiappan, Madhav Manjrekar, Dan M Ionel and James Gafford
University of North Carolina at Charlotte, United States; QM Power Inc, United States; University of Kentucky, United States

P378 | Dual Model Predictive Torque Control Scheme for Online Torque Ripple Reduction in Switched Reluctance Machines [#739]
Kun Hu, He Yang and Jin Ye
University of Georgia, United States

P379 | Torque Ripple Reduction of Switched Reluctance Motor by Implementing a New Converter based on DITC Method [#871]
Reza Shahbazi and Amir Rashidi
The Pennsylvania State University, United States; Isfahan University of Technology, Iran

P380 | Design Consideration for E-core Outer-rotor Flux Switching Permanent Magnet Machines from the Perspective of the Stator-poles and Rotor-teeth Combinations [#157]
Zhiyuan Xu, Ming Cheng and Minghao Tong
Southeast University, China; Nanjing University of Science and Technology, China

P381 | Dynamics Condition in 6/10 Switched Reluctance Motor with Noise Reduction by Selective Radial Force Harmonics Reduction [#1073]
Candra Adi Wiguna, Yifei Cai, Kyohei Kiyota and Akira Chiba
Nanyang Technological University, Singapore; Tokyo Institute of Technology, Japan

P382 | Multi-objective Optimization of the Control Parameters of SRMs Incorporating Accurate Core Loss Estimation [#1411]
Muntasir Islam, Md Khalid Mahmud Bin Azam, Ashraf Siddiquee and Yilmaz Sozer
University of Akron, United States

P383 | Design Trandeoff between Flux Regulation Capability and DC Winding Induced Voltage in Hybrid Excitation Switched Flux Machine [#927]
Wentao Zhang, Zhongze Wu, Wei Hua, Ying Fan, Zhiyuan Xu and Ming Cheng
Southeast University, China

P384 | Performance Evaluation of a Slotless Permanent Magent Synchronous Machine with NdFeB/Ferrite Halbach Array under PWM Excitation [#370]
Junyeong Jung, Ritvik Chattopadhyay and Iqbal Husain
NC State University, United States

P385 | An Improved PWM-Induced Losses Prediction Method in IPM Synchronous Machines for Traction Applications [#1496]
Cong Ma, Wei Wang, Hongyu Wang, Mojtaba Bahrami Kouhshahi and Jeff Carter
BorgWarner Inc., United States

P386 | Analysis of Two Design Topologies for Variable Flux Permanent Magnet Motors [#256]
Bassam Abdel-Mageed, Akrem Aljehaimi and Pragasen Pillay
Concordia University, Canada

P387 | Experimental Tests of Fractional-Slot SPM Motor with Star-Delta Windings [#1048]
Nicola Bianchi, Luca Cinti, Chiara Conto and Ludovico Ortombina
University of Padova, Italy

P388 | Overview of Post-Fault Operation Strategies for Open-End Winding Machines Considering ZSC [#986]
Abd Alrahman Dawara and Annette Muetze
Graz University of Technology, Austria

P389 | Adaptive Disturbance Input Decoupling for Galvo Motor based on Resonance Frequency Estimation [#770]
Yi-Jen Lin, Po-Huan Chou and Shih-Chin Yang
National Taiwan University, Taiwan; Industrial Technology Research Institute, Taiwan

P390 | Comprehensive Study of DVDT Filter for Motor Drive System with Long Cable Lead [#176]
Haider Mohomad and Manish Saraf
Hammond Power Solutions, Canada

P391 | A High-efficiency Resonant Driver and Soft Decoder Interface with Fast-dynamics PLL-Type Angle and Speed Tracking Observer for Resolvers [#223]
Alex Musetti, Panciroli Enrico, Hossein Sadegh Lafmejani and Alessandro Soldati
University of Parma, Italy

P392 | Characterization and Analysis of Bearing Currents in SiC Inverter Driven PM Machines [#667]
Benjamin Sirizzotti, Hellen Chen, Annette von Jouanne, Emmanuel Agamloh, Jimi Adegbohun and Alex Yokochi
Baylor University, United States

P393 | Real-Time Evaluation of New Position Estimator Based on Speed Information of EV [#93]
Myeong-Won Kim, Issac Kim and Jung-Wook Park
Yonsei Univ., Korea, Republic of

P394 | Diagnosing IGBT Module Degradation by Frequency-domain Heat Flow Analysis [#697]
Mengqi Xu, Tianle Cai, Ke Ma, Dangsheng Zhou, Sufei Wang and Tianhao Wu
Shanghai Jiaotong University, China; Shenzhen Hopewind Electric Co., Ltd., China

P395 | An Online Monitoring Technique for Partial Demagnetization Monitoring of Permanent Magnet Machines Based on Intermittent Short-circuit [#310]
Tianze Meng, Geye Lu and Pinjia Zhang
Tsinghua University, China

P396 | Control and Monitoring of Induction Machines using Hall-Effect Sensors [#1499]
Daniel Fenandez, Maria Martinez, Michael Saur, Juan Guerrero and Fernando Briz
University of Oviedo, Spain; Mercedes-Benz AG, Germany

P417 | Torque Modulation Improves the Efficiency of Electric Motors [#377]
Siyu Leng, Zakirul Islam, Ben Wolk, Matthew Younkins, Mark Wilcutts and Paul Carvell
Tula Technology, Inc., United States

P782 | Field Oriented Control with Variable Switching Frequency for Symmetrical Six-Phase Induction Machines [#1518]
Joao Serra and Antonio J. Marques Cardoso
CISE, University of Beira Interior, Portugal, Portugal

P336 | On-Demand Battery Reconfiguration for 800V DC Fast Charging in Electric Vehicles [#783]
Rashmi Prasad, Chandra Namuduri and Suresh Gopalakrishnan
General Motors, United States

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Alison Runninger and Matthew Granger
National Aeronautics and Space Administration, United States

P398 | A New Soft Charge Circuit for Diode/Thyristor Front End Variable Frequency Drives [#90]
Mahesh Swamy, Nate Carnovale and Kevin Lee
Eaton Corporation, United States

P399 | Model Predictive Control for Six-Step Operation of PMSM Based on Adapted Fast Gradient Method [#1612, Post Journal]
Jonghun Yun, Shenghui Cui and Seung-Ki Sul
Seoul National University, Korea, Republic of

P400 | Encoderless Control of PMa-SynRG Based-Stator Current Vector for Wind Generation Systems [#1642, Post Journal]
Ahmed Soliman, Mahmoud Amin, Fayez El-Sousy and Osama Mohammed
Florida International University, United States; Manhattan College, United States; Prince Sattam Bin Abdelaziz, Saudi Arabia

P401 | Accurate Analytical eGaN HEMT Parameterizable Matlab Model Based on Datasheet from Manufacturer and Its Applications in Optimal Design [#436]
Timothe Delaforge, Marco Palma and Michael De Rooij
Bern University of Applied Sciences, Switzerland; EPC-Co, Italy; EPC-Co, United States

P402 | A Behavioral Model for Short-Circuit Operation of a GaN-based Half Bridge [#628]
Simone Palazzo, Thiago Antonio Pereira, Yoann Pascal, Giovanni Busatto and Marco Liserre
University of Cassino and Southern Lazio, Italy; Christian-Albrechts Universitat zu Kiel, Germany; Fraunhofer Institute for Silicon Technology ISIT, Germany

P403 | Cryogenic Rds(on) of a GaN Power Transistor at High Currents [#466]
Jack Bruford, Daniel J Rogers and Temoc Rodriguez
University of Oxford, United Kingdom; Ricardo PLC, United Kingdom

P404 | A Switching Transient Prediction Method for Wide Band Gap Devices Considering Crosstalk and Temperature Effects [#490]
Yijie Huang, Shuangxi Zhu, Cai Chen, Yong Kang, Lei Yang, Haiyan Chen and Zhaosheng Jin
Huazhong University of Science and Technology, China; Beijing Inst. of Precision Mechatronics&Controls, China; AECC Aero Engine Control System Institute, China

P405 | Investigation on Dynamic Degradation of SiC MOSFETs after Total Ionizing Dose Radiation [#198]
Shiwei Liang, Jun Wang, Lei Shu, Yu Yang, Ziyuan Wu, Tongde Li, Liang Wang, Gaoqiang Deng, Fan Fan and Chengjie Wang
Hunan University, China; Beijing Microelectronics Technology Institute, China

P406 | Investigation of the Limit Conditions of SiC MOSFET Body Diode Reverse Recovery [#434]
Giuseppe Di Luca Cardillo, Luciano Salvo, Mario Pulvirenti, Angelo Giuseppe Sciacca, Salvatore Cascino, Santi Agatino Rizzo, Giacomo Scelba and Nunzio Salerno
STMicroelectronics, Italy; University of Catania, Italy

P407 | Thermal Control of SiC Module Based on the Feedback of Lifetime [#1130]
Jun Zhang, Xiong Du, Pengju Sun, Junjie Zhou, Xinyue Hu and Xing Ma
Hohai University, China; Chongqing University, China; State Grid Chongqing Electric Power Research Ins, China

P408 | Oxide Failures in SiC Power MOSFETs [#582]
Zachary Wehri, Van Godbold, Mikayla Schlegel and Jerry Hudgins
Deere & Company, United States; University of Nebraska-Lincoln, United States

P409 | Static Characterization of Discrete MOSFETs after Rotational Stress Testing [#174]
Jeremiah Vannest, Zachary Adamson, Kevin Wolf, Anthony Luscher, Julia Zhang, Shengyi Liu and Lijun Gao
The Ohio State University, United States; The Boeing Company, United States

P410 | Calorimetric Measurement Methodology for Comprehensive Soft and Hard Switching Loss Characterisation [#244]
Szymon Beczkowski, Mike Zach, Faheem Ahmad, Thore Stig Aunsborg and Stig Munk-Nielsen
Aalborg University, Denmark

P411 | Design and Testing of a 6.5 kV Submodule Based on a 10 kV SiC Power Module [#585]
Min Lin, Ruirui Chen, Dingrui Li, Leon Tolbert, Fred Wang and Hua Bai
University of Tennessee, United States

P412 | A Cooling Method and Investigation on Process of Interconnection for High-temperature SiC Applications [#22]
Cheng Zizhen, Yang Fengtao, Xu Wenjie, Kong Hang, Zhang Hong and Wang Laili
Xi'an Jiaotong University, China

P413 | A New Low-cost Test Bench for the Characterization of SiC Power Devices under Active Short-circuits [#1408]
Tommaso Scimone, Antonia Lanzafame, Luigi Danilo Tornello, Benedetto Amata, Giacomo Scelba and Mario Cacciato
University of Catania, Italy; STMicrolectronics, Italy

P414 | Threshold Voltage Extraction Method for LowVoltage SiC MOSFETs at High-Temperature [#424]
Abu Shahir Md Khalid Hasan, Md. Zahidul Islam, Nicolaus Vail, John Venker, Md Maksudul Hossain and H. Alan Mantooth
University of Arkansas, United States

P415 | Parallel Connection of Silicon Carbide MOSFETs - Challenges, Mechanism, and Solutions [#1662, Post Journal]
Shuang Zhao, Helong Li and Alan Mantooth
Hefei University of Technology, China; University of Arkansas, United States

P416 | Design of high-current converters with Inter-cell Transformers [#1188]
Mohammad Wasiq, Cristina Terlizzi, Stefano Bifaretti and Alessandro Lampasi
University of Rome Tor Vergata, Italy; ENEA and DTT S.C. a r.l., Italy

A High Power High Isolation Medium Frequency Transformer With A Planar Matrix Structure [#999]
Zhicheng Guo, Chen Chen, Zibo Chen and Alex Huang
UT Austin, United States

P614 | Dynamic Current Sharing Optimization of Asymmetric SiC Power Module [#1274]
Pawel Piotr Kubulus, Janus Meinert, Szymon Michal Beczkowski, Stig Munk-Nielsen and Asger Bjorn Jorgensen
Aalborg University, Denmark

2.8 Applied Research and Emerging Technologies

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Yuetao Hou, Qing Ji, Dheeraj Etta, Meera Garud, Thomas Schenkel, Amit Lal and Khurram Afridi
Cornell University, United States; Lawrence Berkeley National Laboratory, United States

P419 | A Power Hardware-In-The-Loop Emulation of a Brushless DC Motor [#77]
Kalonji Gael Tshamala, Mathews Boby and Pragasen Pillay
Concordia University, Canada

P420 | Reduction of Transversal Vibrations Excited by Load Impacts on Mining Belt Conveyors [#1153]
Constanza Ahumada, Papini Luca, Tarisciotti Luca and Bolognesi Paolo
University of Chile, Chile; University of Pisa, Italy; University Andres Bello, Chile

P421 | Performance Comparison of dSPACE and DSP MPC Implementation in PV Power Optimizer [#1400]
Morcos Metry, Naki Guler, Rohouma Wesam and Robert S. Balog
Texas A&M University, Qatar; Gazi University, Turkey; University of Doha for Science and Technology, Qatar; Texas A&M University, United States

P422 | Participation Factor-Based Shaping Method of Controller for Grid Forming Converter [#1224]
Yong Yang, Zichao Zhou, Liang Zhao and Xiongfei Wang
Aalborg university, Denmark; KTH Royal Institute of Technology, Denmark; KTH Royal Institute of Technology, Sweden

P423 | An Inductorless Direct-injection Power Control Circuit for the Distribution Grid [#648]
Mowei Lu, Yejing Fan, Chunxu Zhang and Stefan Goetz
University of Cambridge, Great Britain; University of Leeds, Great Britain; Harbin Institute of Technology, China

P424 | Development of Communication to Control Photovoltaic System in a Microgrid by Using Programmable Automation Controller, Raspberry-Pi and Open-source Software [#1530]
Alyston Nascimento, Hercules Oliveira, Jose Gomes, Luiz Ribeiro and Orlando da Silva Santos
Federal University of Maranhao, Brazil; Equatorial Energy, Brazil

P425 | Three-Phase Inverter Dynamics Predictions Using GNN-based Regression Model [#772]
Ahmed Khamis and Mohammed Agamy
University at Albany SUNY, United States

P426 | Hybrid Cyber-attack Detection in Photovoltaic Farms [#992]
Jinan Zhang, Jin Ye, Wenzhan Song, Jianming Lian, Dongbo Zhao and He Yang
Eaton Research Lab, United States; University of Gerogia, United States; University of Georgia, United States; Oak Ridge National Laboratory, United States

P427 | A Robust Method to Secure Multi Inverter Grid Tied PV and Battery Energy Storage Systems Against Cyber Intrusions [#1259]
Hasan Ibrahim, Jaewon Kim, Shaozhe Wang and Prasad Enjeti
Texas A&M University, United States

P428 | Quantum Annealing-Based Machine Learning for Battery Health Monitoring Robust to Adversarial Attacks [#1275]
Alve Akash, Ameya Khot and Taesic Kim
Texas A&M University-Kingsville, United States

P429 | Experimental Analysis of Measurement Time Reduction in Electrochemical Impedance Spectroscopy using the Distribution of Relaxation Times [#484]
Min Jae Jung, Young-Nam Lee, Juhyun Song, Sang-Gug Lee and Kyung-Sik Choi
KAIST, Korea (South); KENTECH, Korea (South); ETH Zurich, Switzerland

P430 | An Online High-Frequency Resonant Current Digitalization Method for CLLC Converters [#1162]
Liyang Du, Xia Du, Hui Cao, Haodong Yang and Alan Mantooth
University of Arkansas, United States; university of Arkansas, United States

P431 | Machine Learning-Enabled Power Converter Optimization for Next-Generation Data Centers: A Review [#1380]
Syed Owais Athar and Muhammad Naveed Aman
University of Nebraska-Lincoln, United States

P432 | Mechanism Segmentation Transient Model of SiC MOSFETs for Multi-rate Electro-thermal Simulation [#303]
Jialin Zheng, Yangbin Zeng, Weicheng Liu, Haoyu Wang, Han Xu, Di Mou and Zhengming Zhao
Tsinghua University, China; Columbia University in the City of New York, United States

P433 | Electric Machine Inverse Design with Variational Auto-Encoder (VAE) [#262]
Yihao Xu, Bingnan Wang, Yusuke Sakamoto, Tatsuya Yamamoto, Yuki Nishimura, Toshiaki Koike-Akino and Ye Wang
Mitsubishi Electric Research Laboratories, United States; Mitsubishi Electric Corporation, Japan

P434 | Flying Capacitor Optimization Design for a Novel Hybrid Switched-Capacitor Converter [#83]
Shihang Sun, Wenjie Chen, Haowei Dang, Yun Wang, Ding Su and Mengjie Qin
Xi'an Jiaotong University, China

P435 | Exact Analysis and Design of Voltage Multipliers Based on Output Voltage Ripple [#1365]
Sukeerti Chauhan, Utsab Kundu and Vinod John
Indian Institute of Science (IISc), Bangalore, India

P436 | Switching-Ripple Current Evaluation of Bidirectional Chopper with Single Auxiliary Full-Bridge Converter [#69]
Ghiffari Aby Malik Nasution, Masaki Matsumoto and Makoto Hagiwara
Tokyo Institute of Technology, Japan

P437 | A Dual Power Path DC-DC Step Up/Down Partial Power Converter for Electric Vehicle Fast Charging [#1355]
Sai Bhargava Althurthi, Kaushik Rajashekara and Vinay Rathore
University of Houston, United States; General Motors, United States

P438 | An Isolated Voltage Injection Based Hybrid Circuit Breaker for MVDC Applications [#1645, Post Journal]
Abdul Basit Mirza, Yalda Azadeh, Hongwu Peng, Yang Li, John Kaplun and Fang Luo
Stony Brook University, United States; University of Connecticut, United States

P439 | Analysis of the Capacitor-Less D-STATCOM for Voltage Profile Improvement in Distribution Network With High PV Penetration [#1671, Post Journal]
Morcos Metry, Wesam Rohouma, Robert S. Balog, Aaqib Ahmad Peerzada, Miroslav M. Begovic and Dao Zhou
Texas A&M University, Qatar; University of Doha for Science and Technology, Qatar; Texas A&M University, United States; Aalborg University, Denmark

P440 | Auto-Bias Electrical Variable Capacitor of Reduced Active Component Count and Voltage Stress for 13.56 MHz RF Plasma Process [#1651, Post Journal]
Heewon Choi and Yongsug Suh
Jeonbuk National University, Korea, Republic of

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Poster Session 3

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3.1 Grid Modernization and Smart Grid

P525 | Stability Enhanced Design of EV Chargers for Weak Grid Connection [#202]
Lu Wang, Zian Qin, Yang Wu and Pavol Bauer
Delft University of Technology, Netherlands

P530 | Distribution Substation Dynamic Reconfiguration and Reinforcement - Digital Twin Model [#551]
Robert Brown, Zunaib Ali, Komal Saleem, Sandra Dudley and Dilshan Wickramarachchi
London South Bank University, United Kingdom

P531 | Demand Profiling Oriented Nuisance Tripping Forecasting for Residential Power Network [#903]
Weisong Tian, Chengwei Lei and Zhongzhe Liu
Widener University, United States; California State University Bakersfield, United States

P532 | Grid-Induced Telluric Currents for Non-Contact Load Monitoring and Fault Detection [#682]
Abigail Farris, Charles Van Neste, Robert Craven, Christopher Johnson and William Stump
Tennessee Technological University, United States

P533 | A Novel Online Grid Impedance Measurement Method Based on Injecting Third Harmonic Voltage [#1278]
Yanqi Cheng, Weimin Wu, Mohamed Orabi, Koutroulis Eftychios, Henry Chung and Frede Blaabjerg
Shanghai Maritime University, China; Aswan University, Egypt; Technical University of Crete, Greece; CityU of Hongkong, Hong Kong; Aalborg University, Denmark

P534 | Quasi-Static Virtual Admittance for Sequence Decomposed Grid-Forming Control [#805]
Ma Awal, Siye Cen, Md Rifat Kaisar Rachi and Iqbal Husain
North Carolina State University, United States

P535 | Evaluating Recursive Blind Forecast Against API and Baseline: A Puerto Rican Case Study on Solar Irradiance for Normal and Extreme Weather [#273]
Aditya Sundararajan, Mohammed Olama, Maximiliano Ferrari, Ben Ollis, Arturo Massol, Guodong Liu and Yang Chen
Oak Ridge National Laboratory, United States; Department of Biology, UPRM; Casa Pueblo, PR, United States; NC Agricultural and Technical State University, United States

P536 | Digital Twins for Moving Target Defense Validation in AC Microgrids [#918]
Suman Rath, Subham Sahoo and Shamik Sengupta
University of Nevada, Reno, United States; Aalborg University, Denmark

P537 | Factorization Machine Learning for Disaggregation of Transmission Load Profiles with High Penetration of Behind-the-Meter Solar [#953]
Zhenyu Zhao, Daniel Moscovitz, Liang Du and Xiaoyuan Fan
Temple University, United States; PJM Interconnection, United States; Pacific Northwest National Laboratory, United States

P552 | Three-Phase Unified Power Quality Conditioner in Open Delta With Shared Legs [#1330]
Jean Torelli Cardoso, Alan Santana Felinto, Cursino Brandao Jacobina, Mauricio Beltrao Rossiter Correa and Arthur De Queiroz Tavares Borges Mesquita
Federal University of Campina Grande, Brazil

P553 | A Modular Multilevel Converter Submodule Based on Series-connected Power Devices for Medium Voltage Distribution Grid Applications [#480]
Yineng Shi, Shuai Shao, Zhi Gao, Ying Huang, Junming Zhang and Kuang Sheng
Zhejiang University, China

P554 | Two-Stage Piezoelectric Resonator / Switched Capacitor DC-DC Converter [#618]
Babuabel Wanyeki, Jessica Boles, Jeffery Lang and David Perreault
Massachusetts Institute of Technology, United States; University of California, Berkeley, United States

P555 | The Matrix Autotransformer Switched Capacitor DC-DC Converter with Partial Power Processing Regulator for Datacenter Application [#926]
Maohang Qiu, Mengxuan Wei, Xiaoyan Liu, Haoran Meng and Dong Cao
University of Dayton, United States

P556 | Three-Phase Four-Wire Transformerless Unified Power Quality Conditioner Based on Single-phase and Three-Phase Cells [#1332]
Jean Torelli Cardoso, Cursino Brandao Jacobina, Alan Santana Felinto, Ademar Alves dos Santos Jr and Alexandre Cunha Oliveira
Federal University of Campina Grande, Brazil

P564 | Unified Power Quality Conditioner (UPQC) Based on Two Three-leg Convertes with Standby Operation Mode and Improved Voltage Swell Compensation. [#705]
Gilielson Paz, Cursino Jacobina, Isaac Freitas, Jean Cardoso and Arthur Mesquita
Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil

P570 | A Novel High-Bandwidth Control Scheme for Current-Source Solid-State Transformers [#720]
Decheng Yan, Ruomu Hao, Brad Houska, Joseph Benzaquen and Deepak Divan
Georgia Institute of Technology, United States

P571 | Voltage Sensor-less and PLL-less Inner-Loop Control Method for Grid-tied Inverter-Based Resources [#1356]
Bokang Zhou, Yuchen He, Yuntao Zou, Yuan Li and Fang Peng
Florida State University, United States; Cee-group, China

P572 | Active Damping of DC Transformer with ISOP Structure Based on Impedance Reshaping [#511]
Yangfan Chen and Yu Zhang
Huazhong University of Science and Technology, China

P573 | Utilizing a Micro-Fluxgate Magnetometer in Dual-Path Configuration for Fast Switch-Current Sensing [#743]
Ali Parsa Sirat, Hossein Niakan and Babak Parkhideh
University of North Carolina at Charlotte, United States

P574 | Adaptive Hybrid Filtering & Damping Control for Grid-Following MMC [#1375]
Pengxiang Huang and Luigi Vanfretti
Rensselaer Polytechnic Institute, United States

P575 | Resonant Current Impacts on the Lifetime of LCL Filter in PV Systems [#220]
Jiacheng Sun, Xinyue Zhang, Tamas Kerekes, Wenli Yao, Xiaobin Zhang and Dao Zhou
Northwestern Polytechnical University, China; Aalborg University, Denmark

P636 | A Quad-Active-Bridge Series Resonant-Based Converter with Automatic Voltage-Balancing for Bipolar DC Grids [#43]
Emmanuel Seun Oluwasogo, Honnyong Cha and Seunghoon Lee
Carinthia University of Applied Sciences, Austria; Kyungpook National University, Korea (South)

Addressing Initial Power Undershoots in Grid-Forming Converters: The Role of RHP Zero [#1234]
Jianyu Zhou, Fangzhou Zhao, Heng Wu and Xiongfei Wang
Aalborg University, Denmark; KTH Royal Institute of Technology, Sweden

Neural-Predictor-based Data-Driven Control for 100kVA, 4.16/0.48 kV Solid-State Transformer for Smart Distribution Grids [#1426]
Paul Gistain Ipoum Ngome, Daniel Legrand Mon-Nzongo, Tang Jinquan Tang, Lai Chunyan, Rodriguez Jose and Jin Tao
Pearl Electric Co, Ltd, China, China; Concordia University, Canada; Pearl Electric Co, Ltd, CHina, China; Universidad San Sebastian, Chile; Fuzhou university, China

3.2 Transportation Electrification Applications

P517 | Coordinate Power Control for Wind-Solar Hydrogen Production System [#108]
Pei Cheng, Jiawei Chen, Pengfei Wang and Mi Tan
Chongqing University, China

P518 | A Cyber-physical Model Based on Multi-Agent and Controlled Hybrid Petri Net for Energy Routers [#1135]
Yanjie Cui, Zilong Wang and Alian Chen
Shandong University, China

P519 | A Hybrid Si/SiC MV Power Conditioning system for Ultra-Fast Electric Vehicle Charging Stations [#1418]
Ahmed Rahouma, David Porras, Zhuxuan Ma, Ahmad Al-Hamoud, Hui Cao, Juan Balda, Yue Zhao and Ram Adapa
University of Arkansas, United States; Electrical Power Research Institute, United States

P520 | Individual Module-power Control With Minimum Power Loss for Solid-state Transformer-based Extreme Fast Charging Stations [#1298]
Dong-ho Choi, Jin-Hyuk Park and June-Seok Lee
Dankook university, Korea (South); Korea Railroad Research Institute, Korea (South)

P521 | A Soft-switching Universal-input Solid State Transformer [#28]
Haoyuan Weng, Yongshan Jiang, Haihong Long, Xin Wu, Yujie Jiang and Dehong Xu
Zhejiang University, China

P522 | Operation of a New Fault-Tolerant Dual Active Bridge Converter [#387]
Somnath Meikap, Hitesh Malviya and Chandan Kumar
Indian Institute of Technology Guwahati, India

P523 | Medium Voltage Electric Spring with Dedicated Non-Critical Load Output Based on LLC Converter [#1098]
Jiayang Wu, Huawei Yuan, Hin Sang Lam, Siew-Chong Tan, Josep Pou and Shu-Yuen Ron Hui
The University of Hong Kong, Hong Kong; Nanyang Technological University, Singapore

P524 | Medium-Voltage Electric Spring Based on Modular Multilevel Cascade Converter with Multiple-Outputs [#422]
Hin Sang Lam, Gaowen Liang, Huawei Yuan, Josep Pou and Shu Yuen Ron Hui
Nanyang Technological University, Singapore

P538 | High-current Density Electric Motor: System Integration and Design Space Exploration [#922]
Abbas Alahyari, Joseph Turney, Kimberly Saviers and Jagadeesh Tangudu
Raytheon Technologies, United States

P539 | Traction Inverter Reliability Analysis for e-Truck [#941]
Mohamad Saad Mohamad Khalid Shaikh and Yue Cao
Oregon State University, United States

P540 | Design and Analysis of PM Machines for Personal Mobility Applications Considering Safety Regulations [#968]
Gwan-Hui Jang, Mingyu Choi and Gilsu Choi
Inha University, Korea, Republic of

P547 | Stand-Alone Battery Charger for Low-Power EV Based on IPT and Powered by a PV System [#1184]
Fernando Quiroz-Vazquez, Victor Cardenas, Juan Gonzalez-Rivera, Homero Miranda-Vidales and Ana Rivera-Rivera
Universidad Autonoma de San Luis Potosi, Mexico

P548 | A 500kW 1600V Zero-Voltage Switching Resonant Switched-Capacitor DC-DC Converter for Electric Trucks and Electric Aircraft Application [#1187]
Liu Xiaoyan, Qiu Maohang, Hobbs Kevin, Dahneem Ahmed, Meng Haoran and Cao Dong
University of Dayton, United States

P628 | Maximum Power Factor Tracking Technique for LCC-Capacitor Charging Converter Through Variable DC Link Voltage [#112]
Mengjie Qin, Wenjie Chen, Mowei Lu, Shixing Sun, Stephan Goetz and Xu Yang
Xi'an Jiaotong University, China; University of Cambridge, China; University of Cambridge, United Kingdom

P629 | Cost-Performance Pareto Analysis of DAB-based DC-DC Converter Topologies for LEV Chargers [#933]
Biswajit Sahoo, Shiladri Chakraborty and Sarangi Sarangi
IIT Bombay, India

P630 | Parallel-Input Series-Output Z-Source Converters for High Voltage DC Power Supplies [#1201]
Mehmet Akif Ozdemir, Emrullah Aydin, Bulent Dag, Bunyamin Tamyurek and Mehmet Timur Aydemir
Gazi University, Turkey; Malatya Turgut Ozal Universitesi, Turkey; Kadir Has University, Turkey

P631 | Bidirectional Asymmetric CLLLC Resonant DC-DC Converter for Onboard Electric Vehicle Chargers [#260]
Angshuman Sharma, Alvaro Cardoza, Kartikeya Jayadurga Prasad Veeramraju, Oroghene Oboreh Snapps and Jonathan W. Kimball
Missouri University of Science and Technology, United States

3.3 Control, Modeling, and Optimization of Power Converters

P501 | Introduction of a Novel Strategy Based on Dynamic Switching Frequencies to Reduce Current Distortion in Multi-level Grid Inverters with Active Neutral-point-clamping and 4-leg Topology [#222]
Matthias Klee, Jonas Steffen and Marco Jung
Fraunhofer IEE, Germany; Hochschule Bonn-Rhein-Sieg, Germany

P502 | Interleaved CLLC Converters with Dual Phase-Shift Modulation [#841]
Farhad Abbasi Aghdam Meinagh, Jun Min and Martin Ordonez
Mr., Canada; Dr., Canada

P504 | An Input-series-Output-Parallel connected Four-Switch Buck-Boost-Integrated CLLC DC transformer with Bidirectional Natural Power-Sharing Property [#734]
Ruizhi Wei, Xuesong Wu, Rui Liu, Li Ding, Wenze Li and Yunwei Li
University of Alberta, Canada

P505 | A Reduced Switch Multiport AC-DC Converter with Galvanically Isolated Auxiliary DC Port [#674]
Asad Hameed and Gerry Moschopoulos
The University of Western Ontario, Canada

P506 | A Novel Method for Predicting the Leakage Inductance of the High-frequency Transformer in a DAB Converter Considering Parasitic Capacitance [#785]
Jae-sub Ko, Jae-hyeon So, Cheol-woong Choi, Woong-kul Lee and Dae-kyong Kim
Sunchon National University, Korea, Republic of; Michigan State University, United States

P507 | A Nonlinear Inductor-Based MPC Technique for DC Cascaded System Including Constant Power Loads [#1127]
Hongjian Lin, Shuhung Henry Chung and Ruihua Shen
City university of Hong Kong, China

P508 | Evaluation and Comparison of Multilevel LLC Resonant DC-DC Converters for Solid-Sate Transformer [#1096]
Samuel Soares Queiroz and Levy Ferreira Costa
Eindhoven University of Technology, Netherlands

P509 | Harmonic State Space Modeling for the MLCL-Type Grid-Connected Inverter with Nonlinear Inductors [#87]
Zhang Jiansong, Yang Xu, Zhou Hongwei, Lu Dapeng and Cao Jianbo
Xi'an Jiaotong University, China; TBEA Xi'an Electric Technology Company, Ltd., China

P510 | Research on Multi-envelope Mode and Its Hybrid Mode of Resonant Soft-switching Inverter [#520]
Yajing Zhang, Xuecong Wei, Jianguo Li, Jiuhe Wang and Hong Li
Beijing Information Science and Technology Unive, China; Beijing Jiaotong University, China

P511 | An AC-DC Converter with Maximum Power Tracking for Multi-input Electromagentic Energy Harvester [#497]
Xianchao Liu, Han Peng and Tolbert Leon M
University of tennessee,Knoxville, United States; Huazhong University of Science and Technology, China

P512 | A Hydrokinetic Energy Conversion System using Underwater LLC-type Resonant Converter [#626]
Hang Dai, Sayan Acharya, David Torrey, Xuan Yi, David Jasinski, Robert Thomas, Maja Harfman Todorovic and Vandana Rallabandi
GE Research, United States; Menlo Micro, United States; Oak Ridge National Laboratory, United States

P513 | A Fast Dynamic Response Control Method for the Hybrid SRC-PSFB Converter with Partial Power Processing Property [#727]
Ruizhi Wei, Nie Hou, Li Ding, Wenze Li and Yunwei Li
University of Alberta, Canada

P514 | A Space Vector Modulation Technique for H8 Transformerless Three-Phase Photovoltaic Inverter [#624]
Michael Araujo Santos Teixeira de Jesus, Filipe Antonio da Costa Bahia, Fabiano Fragoso Costa, Andre Pires Nobrega Tahim and Jose Renes Pinheiro
Federal University of Bahia, Brazil

P515 | A 1.6 kW GaN PV Microinverter with two MPPT Ports [#1336]
Mojtaba Heydari, Vishal Kumar Meena, Qingyun Huang, Ruiyang Yu and Alex Q. Huang
University of Texas at Austin, United States; University of Missouri, United States

P516 | A Decentralized Control for a Triple Active Bridge Converter Integrating PV and ESS [#768]
Osamah Aljumah, Shrivatsal Sharma, Shubham Dhiman, Hamdan Alosaimi and Subhashish Bhattacharya
North Carolina State University, United States

P526 | A 9x Matrix Autotransformer Switched-Capacitor DC-DC Converter for Data Center Application [#1312]
Meng Haoran, Qiu Maohang, Sun Zhongshu, Liu Xiaoyan and Cao Dong
University of Dayton, United States

P527 | Comparative Performance Analysis of Regulated Hybrid Switched-Capacitor Topologies for Direct 48 V to Point-of-Load Conversion [#407]
Yicheng Zhu, Nathan Ellis and Robert Pilawa-Podgurski
University of California, Berkeley, United States

P528 | A Non-isolated Fixed-ratio DC-DC Converter Using Switched Auto-transformer (SATx) for Data Center Applications [#1538]
Xufu Ren, Jinfeng Zhang, Pengcheng Xu and Teng Long
University of Cambridge, United Kingdom; EPIC Technology, China

P529 | Buck-Boost PFC Converter with Active Power Decoupling Capability Using Time-sharing Control [#672]
Yuki Miyada, Keita Ohata, Koki Yamanokuchi, Hiroki Watanabe and Jun-ichi Itoh
Nagaoka University of Technology, Japan

P557 | A Novel Space Vector Modulation Strategy for Three-Level Simplified Neutral Point Clamped Inverter [#329]
Shuangxi Zhu, Xinyue Guo, Menghu Liu, Cai Chen, Yong Kang, Haiyan Chen, Zhaosheng Jin and Lei Yang
SEEE,Huazhong University of Science & Technology, China; AECC Aero Engine Control System Institute, China; Beijing Inst. of Precision Mechatronics&Controls, China

P558 | An Iterative-Based Dead-Time Compensation Method for Integrated Interleaved Boost-LLC Converter [#483]
Jin Wen, Jiajia Guan, Zongheng Wu, Wenzhe Xu, Haiyan Chen, Zhaosheng Jin, Lei Yang, Cai Chen and Yong Kang
Huazhong University of Science and Technology, China; AECC Aero Engine Control System Institute, China; Beijing Inst. of Precision Mechatronics&Controls, China

P559 | An Improved One-Dimensional Space Vector Modulation for Three-Phase Five-Level Cascaded H-Bridge Inverters [#675]
Jiale Zhou, Xiuhu Sun, Tiefu Zhao, Qiang Mu and Xiaoqiang Guo
University of North Carolina at Charlotte, United States; Yanshan University, China

P560 | Design of a Small-Scale SiC-based Modular Multilevel Converter for Experimental Verification of Back-to-back Network Studies [#1104]
Haodong Yang, Liyang Du, Mojtaba Ahanch, Alan Mantooth and Roy McCann
University of Arkansas, United States

P563 | A Five-level Hybrid Modular Multilevel Converter with High Efficiency and Power Density [#529]
Jian Liu and Dong Dong
virginia Tech, United States

P565 | Self-Healing Power Converters Architecture with Highly Reliable Operation [#1547]
Liwei Zhou, Youssef Fahmy, Matthew Jahnes and Matthias Preindl
Columbia University, United States

P578 | Comparison and Performance Evaluation of the Mid-point Voltage Balance Modulation Schemes for a Three-phase 2L-3L DAB [#1348]
Apoorv Agarwal, Shrivatsal Sharma and Subhashish Bhattacharya
North Carolina State University, United States

P633 | Peak Current Optimization of Hybrid NPC-DAB Converter Ensuring Soft Switching of All the Switches [#1154]
Nikhil Patil and Anshuman Shukla
Indian Institute of Technology Bombay, India

P634 | PFM-PSM Hybrid Controlled CLLC Resonant Converter for Electric Vehicles [#92]
Issac Kim, Won-Yong Jang, Myeong-Won Kim and Jung-Wook Park
Yonsei University, Korea, Republic of

P635 | Power Loss Minimization of CLLC Resonant Converters via Time Domain Analysis [#448]
Ziheng Xiao, Zhou He, Fei Deng and Yi Tang
Nanyang Technological University, Singapore

A Power-Balance Modulation Strategy with Low Switching Frequency Based on Carrier Reconstruction [#1093]
Zihao Lu, Jinwu Gong, Zisen Lin, Kemin Dai, Chang Xu and Xiaoming Zha
Wuhan University, China; Wuhan university, China

Primary-Side-Controlled AC-DC Single-Stage Active Clamp Flyback Converter [#868]
Fu-Zhi Lin, Tsorng-Juu Liang, Kai-Hui Chen and Kuo-Fu Liao
National Cheng Kung University, Taiwan

A Fast Method for Predicting the Quasi-Peak Radiated EMI Spectrum of Power Converters [#300]
Yi Yu, Xuejun Pei, Qichi Chen, Peng Zhou and Dingkun Zhao
Huazhong University of Science and Technology, China

3.4 Electrical Machines and Electric Drives

P542 | Multiphysics Verification of an In-Wheel Traction Motor [#1006]
John Wanjiku, Bert Van Genechten, Mark Lamping, Sebastian Ciceo and Giancarlo Conti
Siemens Digital Industries Software, Canada; Siemens Digital Industries Software, Belgium; Siemens Digital Industries Software, United States; Siemens Digital Industries Software, Italy

P576 | Generalized Dynamic Model and Digital-Twin-Based Open-Switch Fault Classification of Multi-Phase Inverters [#512]
Bijen Mali and Dong-Choon Lee
Yeungnam University, Korea (South)

P577 | Combined Feedforward Duty Cycle Predictive and Feedback Power Control for Electrosurgical Generator [#514]
Zhiyu Jin and Ling Gu
Nanjing University of Science and Technology, China

P579 | Gear Fault Diagnosis and Evaluation Based on MCSA in Gear Phase-domain [#200]
Zhiyuan Wang, Juntao Wang and Pinjia Zhang
Tsinghua University, China

P580 | Radial Force Control in Switched Reluctance Motors by using Strain gauges [#749]
Jianhui Xiang, Yifei Cai, Fares S. El-Faouri and Akira Chiba
Tokyo Institute of Technology, Japan

P581 | FEA-based NVH Performance Analysis for a Dual Three-Phase Permanent Magnet Machine [#1441]
Md Khalid Mahmud Bin Azam, Afsana Dristy, Aquib Ahmed, Anik Chowdhury and Yilmaz Sozer
University of Akron, United States

P582 | Magnetostriction Effect on Vibration in Switched Reluctance Motors [#382]
Yifei Cai, El-Faouri Fares S., Naoki Saikawa, Akira Chiba and Yoshizaki Souichiro
Tokyo Institute of Technology, Japan; JFE Steel Corporation, Japan

P583 | Application of New Shield Structure for Shaft Voltage Reduction in IPMSM [#113]
Jun-Hyeok Heo, Jun-Kyu Kang, Jun-Hyuk Im and Jin Hur
Incheon National University, Korea (South); Daegu Mechatronics & Materials Institute, Korea (South)

P584 | Acoustic Noise Reduction and Radial-Force Sum Flattening of Switched Reluctance Motors by Analytical Force Shaping [#304]
Fares S. El-Faouri, Yifei Cai, Akira Chiba and Yusuke Fujii
Tokyo Institute of Technology, Japan

P585 | A Novel Variable Impedance PM Machines with Separated Fault Tolerant Ring [#48]
Runyu Wang, Xinggang Fan, Dawei Li, Ronghai Qu, Yongtao Peng and Xiaopeng Zhao
Huazhong University of Science and Technology, China; National Key Laboratory of Science and Technolog, China

P586 | Mitigating High-Frequency Overvoltage on Motor Windings: An Adaptive Approach [#910]
Milad Sadoughi, Arya Sadasivan, Alex Howard, Fariba Fateh, JiangBiao He and Behrooz Mirafzal
Kansas State University, United States; University of Kentucky, United States

P587 | Detection and Classification of Stator Inter-Turn Fault Severity Levels using Prominence-Based Features and Neural Networks [#1394]
Rahul R Kumar, Priynka Sharma, Ali Mohammadi, Giansalvo Cirrincione and Maurizio Cirrincione
The University of the South Pacific, Fiji; University of Picardie Jules Verne, France; University of Picardie Jules, Fiji

P588 | Research on Electromagnetic Noise Suppression Method through Master-Slave Windings Motor Driving Scheme [#325]
Zhao WeiTao, Yang QiChou, Hu SiDeng, Wu Xu and Song Zhihao
ZheJiang University, China; Zhejiang University, China

P589 | Static Eccentric Fault Diagnosis of IPMSM Using Thermocouple Sensor [#114]
Jun-Kyu Kang and Jin Hur
Incheon National University, Korea (South)

P590 | IPMSM Fault Diagnosis Method Using VR Resolver's Transformation Ratio [#115]
Sung-Won Lee, Jun-Kyu Kang and Jin Hur
Incheon National University, Korea (South); Daegu Mechatronics & Materials Institute, Korea (South)

P591 | Analytical Calculation of Electromagnetic Force of VSPS Considering Harmonic supply in Rotor Converters [#519]
Zhonghua Gui, Weifu Lu, Bo Zhao, Chenbo Wang, Guorui Xu and Haisen Zhao
State Grid Xinyuan Company LTD, China; North China Electirc Power University, China

P592 | Second Order Radial Force Suppression Method to Superimpose Harmonic Current on Redundant DoF of Double-Star PMSM [#825]
Takumi Soeda and Hitoshi Haga
Nagaoka University of Technology, Japan; Shizuoka University, Japan

P593 | Study on the Dependency of Soft Magnetic Material Properties on the Magnetization Angle for Electric Machine Design [#1442]
Gereon Goldbeck, Daniel Woeckinger, Christoph Dobler and Gerd Bramerdorfer
Johannes Kepler University Linz, Austria

P594 | Novel Blade-Shaped Rotor Hub Design for Electric Machine Cooling [#913]
Leyue Zhang, Justin Paddock, Gregory Nellis and Bulent Sarlioglu
University of Wisconsin-Madison, United States

P595 | Thermal Analysis of Liquid and Air Cooling of High-Power Density Integrated Motor Drives [#764]
Ken Chen, Wenda Feng, Feida Chen, Lee Sangwhee, Justin Paddock, Thomas Jahns and Bulent Sarlioglu
WEMPEC, United States

P596 | Visual Observing of the Cutting Effects in 0.35 mm FeSi sheets [#1484]
Andrea Cavagnino, Emir Poskovic, Fausto Franchini, Silvio Vaschetto, Luca Ferraris and Zbigniew Gmyrek
Politecnico di Torino, Italy; Lodz University of Technology, Poland

P597 | Thermal Modeling and Drive-cycle Critical Temperatures Estimation of Electrically Excited Synchronous Machine for Automotive Traction [#1567]
Luca Boscaglia, Daniele Chiappini, Nimananda Sharma, Yujing Liu, Junfei Tang and Bowen Jiang
Chalmers University of Technology, Sweden; Niccolo Cusano, Italy

P598 | Motorette Thermal Performance Testing and Modeling for an Electric Motor with Additively Manufactured Hollow Conductors with Integrated Heat Pipes [#886]
Towhid Chowdhury, Salar Koushan, Sina Vahid, Ayman El-Refaie, Xuhui Feng, Emily Cousineau and Bidzina Kekelia
Marquette University, United States; NREL, United States

P599 | Semi-Stranded and Shaped-Profile Hollow Additively Manufactured Coils with Integrated Heat Pipes for All-Electric Aircraft Motors [#1406]
Ali Al-Qarni and Ayman El-Refaie
Marquette University, United States

P600 | Direct Winding Thermal Management Schemes Enabled by Additive Manufacturing [#1195]
Nick Simpson, Harry Felton, Priya Munagala and Phil Mellor
University of Bristol, United Kingdom

P601 | A 2-in-1 Switched-Capacitor Inverter for Next-Generation Modular Motors [#562]
Zhiheng Luo, Hai-Nam Vu, Ratul Das and Hanh-Phuc Le
University of California San Diego, United States

P602 | Comprehensive Efficiency Analysis of Seven-Switch Current-Source Inverter Based on Voltage-Boost Function and Genetic Algorithm [#1327]
Feida Chen, Sangwhee Lee, Thomas Jahns and Bulent Sarlioglu
University of Wisconsin-Madison, United States

P603 | Modeling and Mitigation of dv/dt and Transmission Line Effect for Motor Drive System in Electric Aircraft Propulsion [#1586]
Bo Liu, Xin Wu, Alex Leary, Kushan Choksi, Yuxuan Wu and Fang Luo
RTX Technologies Research Center, United States; Pratt & Whitney, RTX, United States; NASA Glenn Research Center, United States; Stonybrook University, United States

P604 | General Open-Phase Fault-Tolerant Online Current-Reference Generation for Maximum Torque Range and Minimum Copper Loss With Phase-Current-Peak Limitation for n-Phase PMSMs With Nonsinusoidal Back-EMF [#846]
Alejandro G. Yepes, Wessam Abdel-Azim, Abdullah Shawier, Ayman Abdel-Khalik, Mostafa Hamad, Shehab Ahmed and Jesus Doval-Gandoy
University of Vigo, Spain; Alexandria University, Egypt; AASTMT, Egypt; KAUST, Saudi Arabia

P605 | General Decoupling Transformation for Simplification of Analysis and Control of Multi-stator Winding Synchronous Reluctance Motor Drives Drives [#1526]
Musayyibi Shuaibu and Olorunfemi Ojo
Tennessee Tech University, United States

P606 | A Hybrid PWM Strategy for Common-mode Voltage Reduction and Voltage Linearity Retainment in Adjustable Speed Drives [#107]
Zhe Zhang and Kevin Lee
Eaton Corporation, United States

P607 | Torque Ripple Minimization Control Strategy in Synchronous Reluctance Machines [#1714, Post Journal]
Anant Singh, Ramakrishnan Raja, Tomy Sebastian and Kaushik Rajashekara
Halla Mechatronics, United States; Halla Mecahtronics, United States; University of Hosuton, United States

A Robust Dual-Vector Model Predictive Current Control Scheme for Open-Winding Permanent Magnet Synchronous Motor Drives with Sliding Mode Observer [#132]
Yuelin Dong, Shuo Zhang, Chengning Zhang, Xueping Li and Mingwei Zhao
Beijing institute of technology, China

Design of a Current Limiting Solid State Circuit Breaker (CL-SSCB) for DC Microgrids [#1352]
Muhammad Foyazur Rahman, Tiancan Pang, Madhav Manjrekar
The University of North Carolina at Charlotte

P760 | A Unified Circuit View of Multiphysics Finite Element Analysis via Discrete Exterior Calculus Part I: 2D Static Fields [#413]
Baoyun Ge
University of Florida, United States

3.5 Power Semiconductor Devices, Passive Components, and Packaging

P549 | Optimal Design of the Nonlinear Inductor for MLCL-Filtered Grid-Connected PV Inverter [#79]
Zhang Jiansong, Yang Xu, Zhou Hongwei, Lu Dapeng and Cai Wenlong
Xi'an Jiaotong University, China; TBEA Xi'an Electric Technology Company, Ltd., China; TBEA Xi'an Electric Technology Company, Ltd,, China

P550 | Design of A 50-kW Medium Frequency Medium Voltage Transformer for 10-kV SiC-Based Dual Active Bridge Converter [#408]
Zihan Gao, Dingrui Li, Ruirui Chen, Hua Bai, Leon Tolbert and Fred Wang
the University of Tennessee, Knoxville, United States

P551 | Design Optimization of a Rotary Transformer Converter for the Excitation of Electric Machines [#839]
Lihong Xie, Xibo Yuan, Jun Wang and Phil Mellor
Nanjing Univ. of Aeronautics and Astronautics, China; University of Bristol, United Kingdom

P561 | Design and Optimization of High-frequency Transformer for Isolated Single-Stage Three-Phase AC/DC Converter using Bidirectional Switches [#1345]
Isaac Wong, Ramandeep Narwal, Subhashish Bhattacharya, B. Jayant Baliga and Douglas C. Hopkins
North Carolina State University, United States

P562 | Variable Turns-Ratio Matrix Transformer based LLC Converter for Two-Stage Electric Vehicle Auxiliary Power Module Applications [#404]
Zhengming Hou, Shengcheng Kao, Dong Jiao and Jih-Sheng Lai
Virginia Tech, United States

P566 | Design Guidelines for Shield-Less PCB-Based Rogowski Coil Sensors With Passive Offset Compensation for Switching Current Measurement [#714]
Ali Parsa Sirat, Hossein Niakan, James Gafford and Babak Parkhideh
University of North Carolina at Charlotte, United States

P568 | Ripple Current and Temperature Distribution in Ceramic Capacitors for DC Link Applications [#183]
Jacob Mueller, Jonathan Bock, Luciano Garcia Rodriguez and Felipe Palacios
Sandia National Laboratories, United States

P569 | Diagnosis of IGBT Module Bond Wire Independent of Temperature Based on BP Neural Network [#508]
Yanyong Yang, Xiaofeng Ding, Zhenyu Shan and Pinjia Zhang
Beihang University, China; Tsinghua University, China

P608 | A Double-sided Flip chip SiC Power Module with a Novel Flip Chip Method On DBC By PTFE Coating [#193]
Liangjun Ma, Hong Zhang, Lei Li, Dingkun Ma, Tianshu Yuan, Yilong Yao, Kai Gao and Laili Wang
Xi an Jiaotong University, China; State Grid Shanghai Electric Power Research Inst, China

P609 | Thermal Performance Comparisons of Different Spacer Structures in Double-Sided Cooling Power Modules [#478]
Yan Yiyang, Liu Baihan, Zhang Yifan, Liu Jiaxin, Chen Cai, Kang Yong, Chen Haiyan, Jin Zhaosheng and Yang Lei
Huazhong University of Science and Technology, China; AECC Aero Engine Control System Institute, China; Beijing Inst. of Precision Mechatronics&Controls, China

P610 | Fabrication Process Optimization of A High- Power Double-Sided Cooled SiC Power Module [#277]
Yuxiang Chen, Liyang Du, Xia Du, Murtadha Alher, Ange Iradukunda, David Huitink, Zhong Chen and Alan Mantooth
University of Arkansas, United States

P611 | Ultra-Fast Power Module Inductance Estimation using Convolutional Neural Networks [#620]
Pawel Piotr Kubulus, Szymon Michal Beczkowski, Stig Munk-Nielsen and Asger Bjorn Jorgensen
Aalborg University, Denmark

P612 | Achieving Low Thermal Stress in a PCB/AMB Hybrid SiC Power Module Using Fluidic Connections Based on Liquid Metal [#1252]
Wei Mu, Ameer Janabi, Borong Hu, Luke Shillaber, Zhongxiu Xiao and Teng Long
Cambridge University, United Kingdom; EPFL, Switzerland

P613 | Design and Surface Flashover Test of 10 kV SiC Power Module for DC Shipboard Application [#1253]
Xiaoling Li, Yang Liu, Skyler Schwartz, Ning Guo, Ebrahim Karimi, H. Alan Mantooth, Lukas Graber and Robert Cuzner
University of Arkansas, United States; Georgia Institute of Technology, United States; University of Wisconsin Milwaukee, United States

P615 | Power Electronic Substrates for Space Restricted Application [#1333]
Shajjad Chowdhury and Burak Ozpineci
Oak ridge national lab, United States; Oak Ridge National Lab, United States

P616 | Effects of Encapsulant Properties on the Thermo-Mechanical Reliability of Double-Side Cooled Power Modules for Traction Inverters [#1087]
Filip Boshkovski, Carl Nicholas, Zichen Zhang, Paul Paret, Khai Ngo and Guo-Quan Lu
Virginia Tech University, United States; National Renewable Energy Laboratory (NREL), United States

P617 | Analytical Model of Fast-Switching GaN HEMTs in Bridge-Leg Considering Nonlinear Characteristics [#1288]
Xiao Li, Zhuofan Xiong, Jianyu Cao and Yushan Liu
Beihang University, China

P618 | Selective Gate Driver Encoded with a Single Digital Signal for the SiC Inverter [#640]
Luowei Wen, Wensong Yu, John Geiger and Iqbal Husain
North Carolina State University, United States; Texas Instruments, United States

P638 | Characterization and Modeling of Ceramic Capacitor Losses Under Large Signal Operating Conditions [#1726, Post Journal]
Samantha Coday and Robert Pilawa
Graduate Student Member, United States; Associate Professor, United States

A Stacked SiC Half-Bridge Power Module with Comprehensive Optimization of Parasitic Capacitance and Parasitic Inductance [#479]
Yifan Zhang, Xie Yue, Yan Yiyang, Baihan Liu, Chenhang Zeng, Sijia Liu, Liu Jiaxin, Cai Chen, Yong Kang, Lei Yang, Chen Haiyan and Jin Zhaosheng
Huazhong University of Science and Technology, China; Beijing Inst. of Precision Mechatronics&Controls, China; AECC Aero Engine Control System Institute, China

Online Gate-Oxide Degradation Monitoring of SiC MOSFETs Based on Parasitic Capacitance Aging Characteristics [#1070]
Shengxu Yu, Zhiqiang Wang, Da Zhou, Yimin Zhou, Yanqiu Li and Xiaojie Shi
Huazhong University of Science and Technology, China

TCAD Modeling of Temperature-Dependent Reverse Recovery Characteristics of 1.2-kV SiC MOSFETs' Body Diode [#1506]
Zhe Xue, Mengyu Zhu, Hongchang Cui, Fengtao Yang, Yunqing Pei and Laili Wang
Xi'an Jiaotong University, China

Modeling of SiC MOSFETs Switching Oscillation for Dynamic Optimization with RC Snubber in the Half-bridge Circuit [#688]
Yujie Ding, Saijun Mao, Hongyao Liu, Qiuyang Tan, Shuhao Yang and Pan Liu
Fudan University, China; UniSiC Technology (Shanghai) Co.,Ltd., China

3.6 Applied Research and Emerging Technologies

P541 | Experimental Investigation of the Eddy-Current and Dielectric Loss of Underwater IPT System [#975]
Yao Wang, Amr Mostafa, Zilong Zheng, Hua Zhang, Chong Zhu and Fei Lu
Drexel University, United States; Rowan University, United States; Shanghai Jiao Tong University, China; Drexel Universdity, United States

P543 | Maximum-Tilt Control of Electromagnetic Micromirrors with Embedded Piezoresistive Sensor [#1102]
Kahyun Lee and Chang-Hyeon Ji
Ewha Womans University, Korea (South)

P544 | Frequency Regulation Scheme for Double-Sided LCC Compensated Inductive Power Transfer Systems With Quasi-Load-Independent Outputs [#1124]
Kaiyuan Wang, Yun Yang, Heshou Wang and Eric Cheng
Nanyang Technological University, Singapore; The Hong Kong Polytechnic University, Hong Kong

P545 | Fuel-Cell Power System Preliminary Design Optimization for Ferry Application [#1160]
Gianmarco Saponaro, Davide D'Amato, Michele Stefanizzi, Emanuele Franchini, Ottar L. Osen, Agus I. Hasan, Sergio Mario Camporeale and Vito Giuseppe Monopoli
Polytechnic University of Bari, Italy; Isotta Fraschini Motori SpA, Italy; Norges Teknisk-Naturvitenskapelige Universitet, Norway

P546 | Sensorless Maximum Efficiency Point Tracking Control of A Series-Series Tuned, 11 kVA, 85 kHz Inductive Power Transfer System [#1164]
Woonjung Hong, Sangmin Lee and Seung-Hwan Lee
University of Seoul, Korea, Republic of

P567 | Hierarchical Failure Mode Effect Analysis for the Protection Design of a MV AC-DC Solid State Transformer based EV Extreme Fast Charging Station [#1349]
Md Rashed Hassan Bipu, Oscar Montes, Srdjan Lukic and Iqbal Husain
North Carolina State University, United States

P619 | Lifetime Extension for Solid-State Circuit Breakers in Motor Control Center Applications [#1317]
Jiale Zhou, Tiefu Zhao and Yao Wang
University of North Carolina at Charlotte, United States; Hebei University of Technology, China

P620 | Miniaturized Pulsed Power Supply for Magnetic Resonance Imaging (MRI) Application [#1319]
Gaureej Gauttam, Harish S Krishnamoorthy, Anup Deka and Steven Chen
University of Houston, United States

P621 | A Substrate Cooling Method for Metal Oxide Varistors in Solid State Circuit Breakers [#1413]
Chunmeng Xu, Govind Chavan, Abhinav Patni and Pietro Cairoli
ABB Inc, United States

P622 | Discontinuous PWM Modulation for Active Power Filters Operating in Disturbed Environments [#930]
Alessandro Roveri, Fabio Mandrile, Vincenzo Mallemaci and Radu Bojoi
Prima Electro S.p.A, Italy; Politecnico di Torino, Italy

P623 | Clustering Algorithm for the Screening of SiC MOSFETs Connected in Parallel [#700]
Fang Lv, Saijun Mao, Qiuyang Tan, Guangyin Lei, Shuhao Yang and Yujie Ding
Fudan University, China; UniSiC Technology (Shanghai) Co., Ltd, China

P624 | Multi-rate Discrete Domain Modeling of Power Hardware-in-the-Loop Setups [#1715, Post Journal]
Fargah Ashrafidehkordi
Karlsruhe Institute of Technology, Germany

P625 | Fixed Frequency Operation in Critical Conduction Mode with Voltage-Controlled Variable Inductor [#405]
Sihoon Choi, Jong-Won Shin, Jun Imaoka and Masayoshi Yamamoto
Nagoya University, Japan; Chung-Ang University, Korea (South)

P626 | Generalized FOM for Multiphase Converters with Inductors [#51]
Alexandr Ikriannikov and Brad Xiao
Analog Devices, United States; Analog Devices, China

P627 | Hybrid-Switched-Capacitor VRM with Multifunction Components [#502]
Yenan Chen, Huaqiao Liu and Shuyu Zhang
Zhejiang University, China; Stanford University, United States

P632 | Analysis, Design and Verifications on Receiver-side Pulse-Width-Modulation Load-Independent ZVS Class-E2 Wireless Power Transfer [#985]
Tomokazu Mishima, Shoma Shimizu, Tianyu Yang and Ching-Ming Lai
Kobe University, Japan; National Chung Hsing University, Taiwan

P637 | Fast Frequency Support Through LED Street Lighting in Small Non-Synchronous Power Systems [#1719, Post Journal]
Sergio Bruno
Politecnico di Bari, Italy

Design of a Current Limiting Solid State Circuit Breaker (CL-SSCB) for DC Microgrids [#1352
Muhammad Foyazur Rahman, Tiancan Pang, Madhav Manjreka
The University of North Carolina at Charlotte

3.7 Power Converter Topologies

Design of a High Efficiency and High Power-Density GaN-Based Microinverter [#468]
Wenzhe Xu, Shuangxi Zhu, Zhiyi Hu, Teng Liu, Mengyao Du, Jin Wen, Cai Chen, Yong Kang, Chen Haiyan, Jin Zhaosheng and Yang Lei
Huazhong University of Science and Technology, China; AECC Aero Engine Control System Institute, China; Beijing Inst. of Precision Mechatronics&Controls, China

Efficiency Improvement of DAB Converters with Enhanced Inductor Current Classification [#293]
Ziheng Xiao, Lei Zhang, Zhixing He and Yi Tang
Nanyang Technological University, Singapore; Hunan Univerisity, China

3:00PM | An Improved Modulation Method for Series Capacitor Buck Converter in Discontinuous Conduction Mode [#1116]
Zhao Lingling, Sun Min, Pan Siming, Hu Weihao and Frede Blaabjerg
University of Electronic Science and Technology, China; Aalborg University, Denmark

3.8 Sustainable Energy, Energy Storage, and Power-to-X Technologies

Development of Flexible Polymer Composites Films for the Study of Charge Storage Ability [#139]
Chandan Kumar Raul, Somnath Meikap, Monalisa Halder, Amit Kumar Das and Ajit Kumar Meikap
National Institute of Technology Durgapur, India; Indian Institute of Technology Guwahati, India; Abacus Institute of Engineering and Management, India

Thursday, November 2 2:00PM-3:40PM

Poster Session 4

Ballroom Prefunction - Floor 4
Chairs: Zhicheng Guo, Heng Wu

4.1 Latest Research Briefs

P701 | Photovoltaic Characterization based on Light Intensity Modulation Impedance Spectroscopy [#1654]
Desmon Simatupang, Biswan Kallol, Sifat Iram, Agrios Alexander, Ayers John and Sung-Yeul Park
University of Connecticut, United States

P702 | Towards Digital Twining of Lithium-ion Battery Management Systems: An Extended Kalman Filter for State-of-Charge Estimation in Cloud-platform [#1664]
Karnehm Dominic, Anekal Latha, Samanta Akash, Neve Antje and Williamson Sheldon
Universitaet der Bundeswehr Muenchen, Germany; Ontario Tech University, Canada; Ontario Tech University, Germany

P703 | A New 8x Matrix Autotransformer Switched Capacitor DC-DC Converter for Datacenter Application [#1672]
Maohang Qiu, Xiaoyan Liu and Cao Dong
University of Dayton, United States

P704 | New 600V GaN Single-Stage Isolated Bidirectional 400V Input Three-Phase PFC Rectifier [#1675]
David Menzi, Johann W. Kolar, Hector Sarnago, Oscar Lucia and Jonas E. Huber
ETH Zurich, Switzerland; University of Zaragoza, Spain

P705 | Core-as-a-Sensor: Ferrite DC-Resistance-Based Core Temperature Measurement of Magnetics [#1677]
David Menzi, Edvaldsson Gardar, Jonas E. Huber and Johann W. Kolar
ETH Zurich, Switzerland

P706 | Motor Power Pulsation Buffer for Single-to-Three-Phase Current-Source-Converter Drives [#1678]
Michael Haider, Johann Walter Kolar and Jonas Huber
ETH Zurich, Switzerland

P707 | Regenerative Braking Torque Ripple Minimization of a Brushless DC Machine Using Fuzzy-PI Controller [#1680]
Jiyaad Lai, Lesedi Masisi and Udochukwu Bola Akuru
University of the Witwatersrand, South Africa; Tshwane University of Technology, South Africa

P708 | Strengthening Cybersecurity for Industrial Control Systems: Innovations in Protecting PLC-Based Infrastructure [#1685]
Peng-Hao Huang, Hasan Ibrahim, Jaewon Kim, Prasad Enjeti, P. R. Kumar and J. V. Rajendran
Texas A&M University, United States

P709 | Power Decoupling Method for Grid Inertial Support Provided by Ultra-Fast Bidirectional Chargers [#1686]
Alessandro Roveri, Vincenzo Mallemaci, Fabio Mandrile and Radu Bojoi
Prima Electro S.p.A, Italy; Politecnico di Torino, Italy

P710 | Impact of Immersion Cooling on Balancing Semiconductor Thermal Distribution in NPC Multilevel Converters for Transportation Propulsion [#1688]
Reza Ilka, Yiju Wang, Jiangbiao He, Ning Ren, Z.George Zhang, Gefei Wu and Roger England
University of Kentucky, United States; Valvoline Global Operations, United States

P711 | An Intelligent Metasurface-Based Wireless Power Transfer System [#1691]
Emrullah Aydin, Ali Riza Ekti, Shajjad Chowdhury, Omer C. Onar and Elizabeth Piersall
Oak Ridge National Laboratory, United States

P712 | PCB Busbar Optimization for Distributed DC Link Capacitors and Parallel Discrete SiC MOSFETs [#1692]
Hemanth Varun Betha, Milijana Odavic and Kais Atallah
University of Sheffield, United Kingdom

P713 | EMI Mitigation for SiC MOSFET Power Modules Using Integrated Common-Mode Screen [#1696]
Taha Moaz, Narayanan Rajagopal, Christina DiMarino and Michael Fish
Virginia Polytechnic Institute and State Univers, United States; Army Research Lab, United States

P714 | Real-Time Industrial Medium-Voltage Synchronous Motor Drive Controller-Hardware-in-the-Loop [#1699]
John Buczek, Alexander Uzochukwu, Guilherme Salvador, Hamid Khan, A. Mamianja Rakotozafy and Sami Siala
GE Power Conversion, United States; GE Power Conversion, Brazil; GE Power Conversion, France; GE Power Conversion, Madagascar

P715 | Torque Analysis in an Alternating Flux-Barrier Permanent Magnet Vernier Machine [#1700]
John Mushenya and Azeem Khan
University of Cape Town, South Africa

P716 | A Stacked Dual-Active-Half-Bridge DC/DC Differential Power Converter [#1701]
Matthew Jahnes and Matthias Preindl
Columbia University, United States

P717 | Development of a Quasi-Impedance-Source-Based Multilevel Converter Topology for Renewable Energy Systems [#1702]
Akinola Ayodeji Ajayi-Obe, Azeem Khan, Paul Stanley Barendse and Sampath Jayalath
University of Cape Town, South Africa

P718 | Time-Step-Adaptive-Bilinear (TSAB) Second-Order Digital Filter Design for Variable Sampling Frequency Control of Power Converter [#1704]
Inhwi Hwang, Jaekeun Lee and Shenghui Cui
Seoul National University, Korea, Republic of

P719 | New Interlinking PV Converter Modules with Individual MPPT and Integrated Power Balance Units [#1705]
Kajanan Kanathipan and John Lam
York University, Canada

P720 | A Bridgless Stacked-switches Based AC-DC Converter with Reduced Storage Capacitances and Low-Frequency Voltage Ripple for HV EV Systems [#1709]
Siamak Derakhshan and John Lam
York University, Canada

P721 | Distributed Hierarchial Sensing and Analytics for Grid-Edge Behind the Meter Visibility and Grid Resilience [#1710]
Mehrnaz Madadi, Subhashish Bhattacharya, Paul Ohodnicki, Yang-Duan Su, Dolendra Karki, Meredith Miller, Emma Stewart, Ganapathi Subramania, Honggang Wang, Todd Monson, Richard Beddingfield and Arvind Tiwari
North Carolina State University, United States; University of Pittsburgh, United States; National Rural Electric Cooperative Association, United States; Sandia National Laboratory, United States; General Electric Global Research, United States

P722 | The Topology Automatic Search Algorithm of the Isolated DC-DC Converters [#1711]
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P834 | A Mission Profile based Stress Emulation Method for Capacitors in High-power Converter Systems [#1238]
Bo Yao, Xing Wei, Yichi Zhang, Shuai Zhao and Huai Wang
Aalborg University, Denmark; Aalborg university, Denmark

4.8 Sustainable Energy, Energy Storage, and Power-to-X Technologies

High Voltage Wind Turbine Conversion System with Dual DC Converter for MVDC Grids [#272]
Ghazaleh Sarfi and Omid Beik
Colorado School of Mines, United States

P108 | Comparison of Multiphase Active and Passive Rectifier in Wind Turbines [#1276]
Mahzad Gholamian and Omid Beik
Colorado School of Mines, United States

P318 | Two-Mode H-bridge Based DC Electric Spring For DC-Bus Voltage Stabilization [#541]
Awais Karni and Omid Beik
North Dakota State University, United States

P104 | Reactive Power Control in an All-DC Wind Generation System [#670]
Mahzad Gholamian and Omid Beik
Colorado School of Mines, United States

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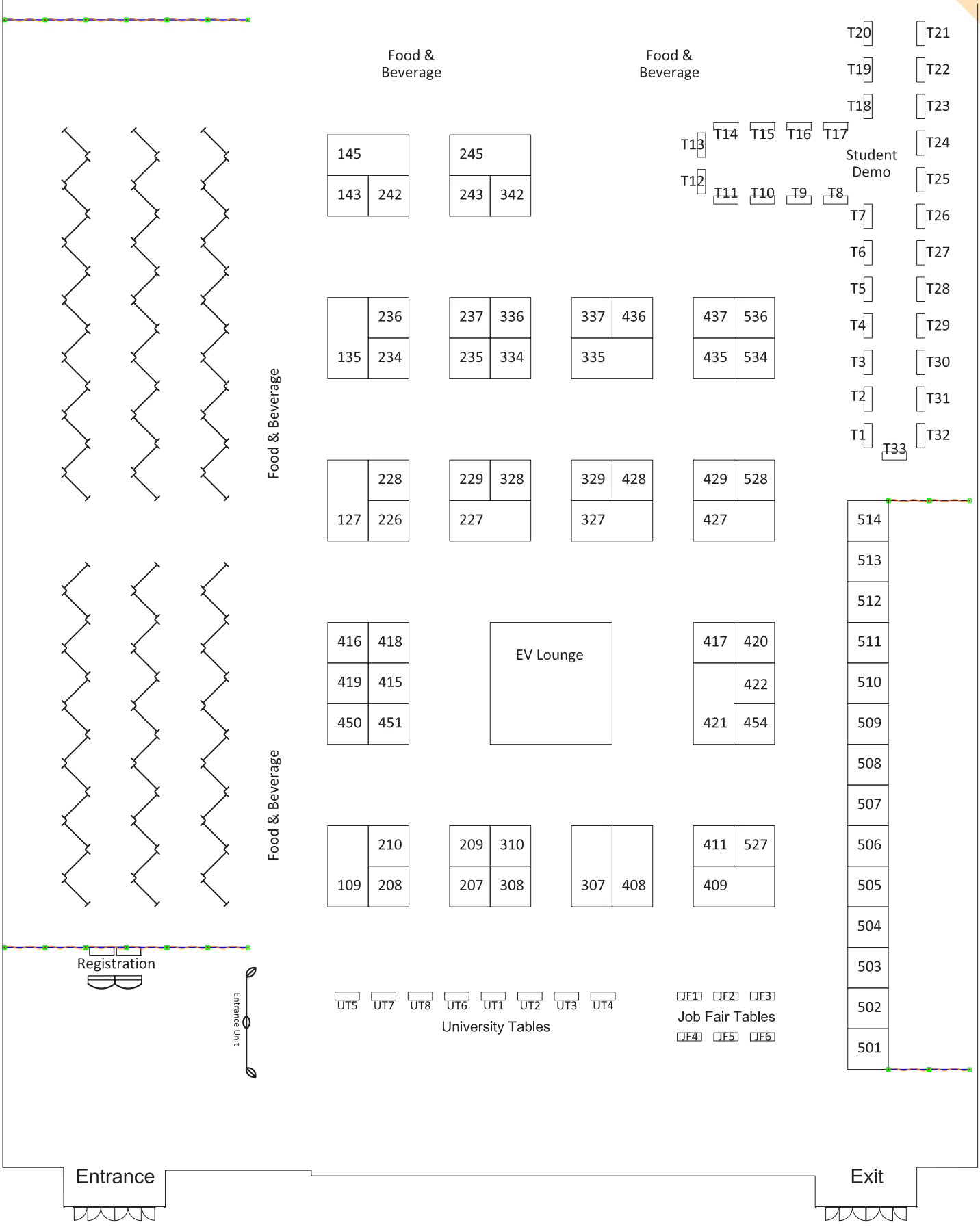

MUSIC CITY CENTER **FLOOR PLAN**

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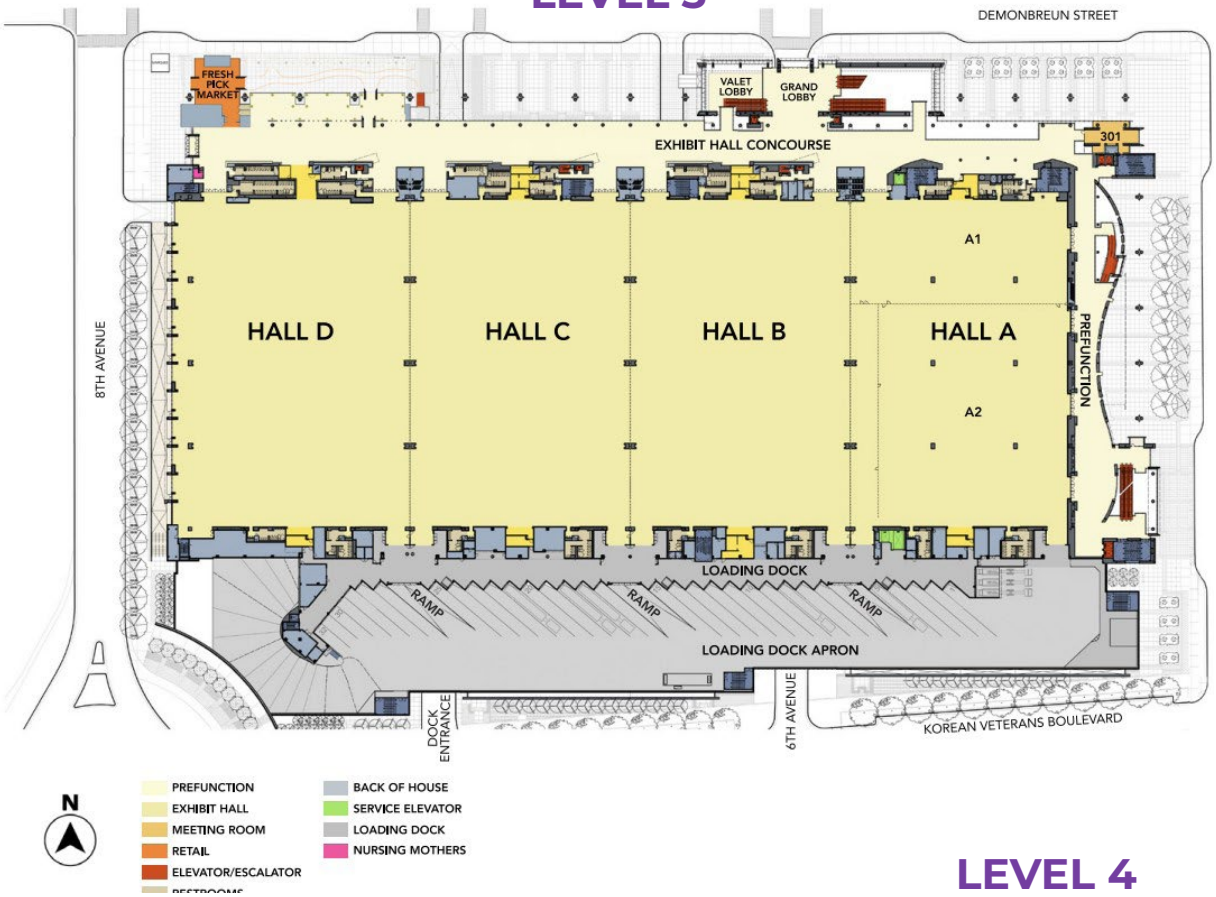
LEVEL 2

LEVEL 3



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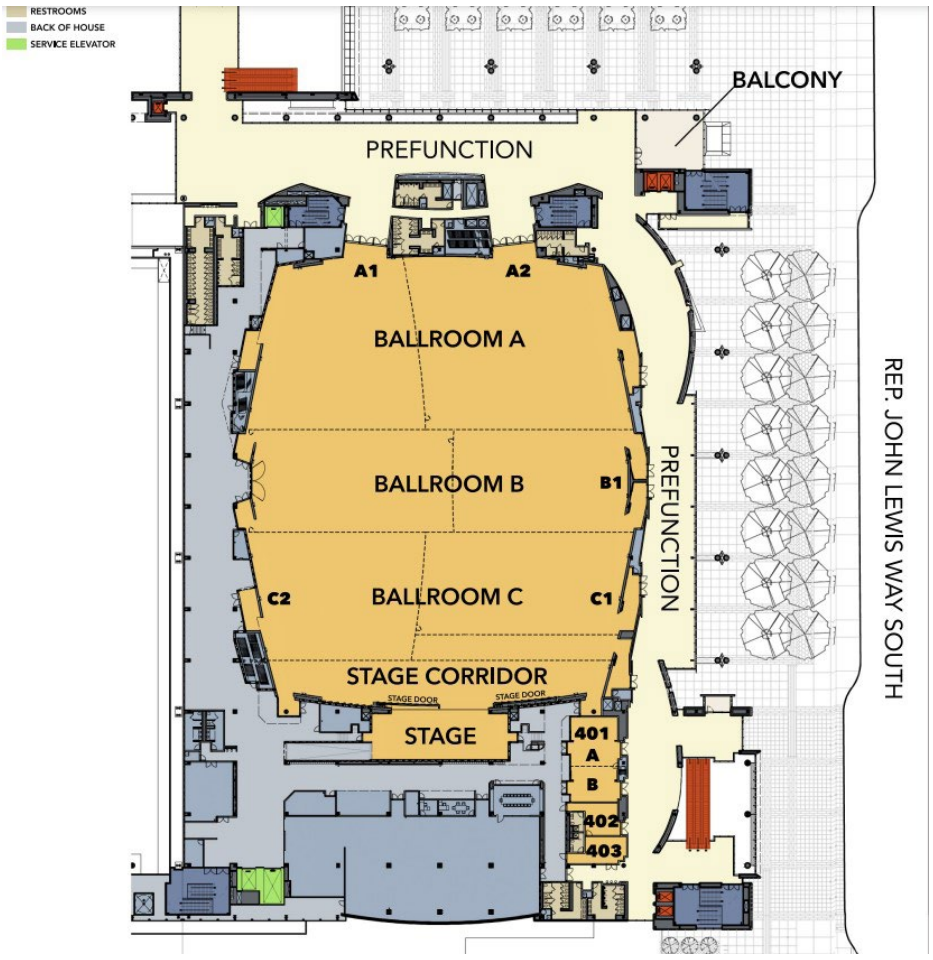

STUDENT **DEMONSTRATIONS**

Open – Monday, October 30 **5:00PM – 7:30PM**
Judging – Tuesday, October 31 **1:30PM – 5:00PM**

Exhibit Hall B

Student Demonstrations provide an opportunity for students from various universities and countries to showcase their emerging technology research outcomes and interact with academia and industry.

Table 1 | UAV Autonomous Wireless Charging Demonstration

Demonstrators: Stephen Paul, Muhammad Abdelraziq, Ujjwal Pratik
North Carolina State University

Table 2 | Fiber-optic-less Isolated Gate Driver with Power-signal Integrated Transmission for 10-kV SiC MOSFETs

Demonstrator: Zhehui Guo
Florida State University

Table 3 | Power Converter with Immersion Cooling for Transportation Applications

Demonstrators: Reza Ilka, Yiju Wang, Majid T. Fard
University of Kentucky

Table 4 | Rare-Earth and Heavy Rare-Earth Free EV Traction Motors

Demonstrators: Ritvik Chattopadhyay, Sodiq
North Carolina State University

Table 5 | High Power-Density Single-Stage 48/1.8V Converter with Easy-to-Design Discrete Magnetics

Demonstrator: Xin Lou
Virginia Tech

Table 6 | EMI Filter Integration for GaN Power Modules Using Air-Cured Magnetic Composite

Demonstrators: Niu Jia, Xingyue Tian
University of Tennessee Knoxville

Table 7 | A Transformer Design with PCB Litz Wire Concept for Solid State Transformer

Demonstrators: Zheqing Li, Feng Jin
Virginia Polytechnic Institute and State University

Table 8 | Modular Multilevel GaN Based Ultra-high Power Density Electric Power Conversion on the Lunar Surface

Demonstrator: Yuzhou Yao
The Ohio State University

Table 9 | Liquid Metal Cooled Ultra High Power Density Inverter with Integrated MHD Pump

Demonstrators: Junchong Fan, Siddhant Shah, Zhang
The Ohio State University

Table 10 | A Modular Switched-Capacitor Chip-Stacking Drive Platform for kV-Level Electrostatic Actuators

Demonstrators: Yanqiao Li, Bahlakoana Mabetha
Dartmouth College

Table 11 | Ultra-High Power Density 240W AC-DC Converter Based on Novel STAR Architecture and GaN

Demonstrator: Lei Wang
The University of Sydney

Table 12 | Picogrid: An Experimental Platform for Prosumer Microgrids

Demonstrator: Maitreyee Marathe
University of Wisconsin-Madison

Table 13 | A Dense and Efficient Cryogenic Power Converter

Demonstrator: Aaron Wadsworth
The University of Auckland

Table 14 | 3D Printed Heat Exchanger for Achieving High Current Density in Electric Motors

Demonstrators: Gokhan Cakal, Ahmed Hembel
University of Wisconsin-Madison

Table 16 | A Scalable Electronic-Embedded Transformer (EET), a New Concept toward Ultra-high-frequency High-Power Transformer in DC-DC Converters

Demonstrator: Yuliang Cao
Virginia Tech

Table 17 | A Non-isolated Fixed-ratio DC-DC Converter Using Switched Autotransformer (SATx) for Data Center Applications

Demonstrator: Xufu Ren
University of Cambridge

Table 18 | Design and Integration of SiC Gate Drivers Inside Commercial SiC Power Modules

Demonstrator: Asif Faruque
University of Arkansas

Table 19 | A Novel Hybrid Core Structure for 100kW Medium Frequency Transformers

Demonstrator: Chen Chen
The University of Texas at Austin

Table 20 | An Isolated Bidirectional DC-DC Converter with High Voltage Conversion Ratio and Reduced Output Current Ripple

Demonstrators: Zhining Zhang, Yue Zhang, Boxue Hu
The Ohio State University

Table 23 | Medium Voltage Current Source Inverter for High-Speed Motor Drive Applications

Demonstrators: Sneha Narasimhan
North Carolina State University

Table 23 | RazorPack Advanced Power Module Packaging

Demonstrators: Xiaoling Li, Yuxiang Chen, Hao Chen
University of Arkansas

Table 24 | Matrix Autotransformer Switched-Capacitor DC-DC Converter for Datacenter Application

Demonstrators: Haoran Meng, Maohang Qiu, Xiaoyan Liu
University of Dayton

Table 25 | Multi-objective Design Optimization for High-bandwidth Printed Circuit Board Shielded Rogowski Coils

Demonstrator: Xingyue Tian
University of Tennessee, Knoxville

Table 26 | Flexible Manufacturing Plant Controller Testing Demonstration

Demonstrators: Dingrui Li, Mohamed Al Sager
University of Tennessee

Table 27 | An Efficient and Robust Controller Design Automation Tool for Power Electronics: Enhancing Design for Manufacturing

Demonstrators: Wanrong Li, Yuhan Zhang
The University of Sydney

Table 28 | PowerBrain-An Automatic Datasheet Information Extraction Tool

Demonstrators: Fanghao Tian, Hans Wouters, Yu Zuo
KU Leuven

Table 29 | A 6.6kW On-board charger with GaN Switches and PFC+CLLC Topology

Demonstrators: Hans Wouters, Fanghao Tian, Yu Zuo
KU Leuven

Table 30 | MagNet AI: Online Neural Network Platform for Modeling and Simulation of Power Magnetic Materials

Demonstrators: Haoran Li, Shukai Wang
Princeton University

Table 31 | Enhancing Virtual Synchronous Machines: Operating Grid-Forming Inverters with Power Angle in Four Quadrant Range

Demonstrators: Armando Jose Ferreira
Federal University of Campina Grande

Table 32 | Interactive Multi-Objective Design Optimization of Power Converters

Demonstrators: Benjamin Luckett
University of Kentucky

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University Lounge

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United States
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We innovate on behalf of humanity. It doesn't matter if you've never driven a tractor, mowed a lawn, or operated a dozer. With our role in helping produce food, fiber, fuel, and infrastructure, we work for every single person on the planet.

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United States
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United States
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Silver

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United States
www.comsol.com

COMSOL provides simulation software for use in engineering, manufacturing, and research. COMSOL Multiphysics® includes functionality for creating and managing physics-based models and simulation apps.

Hitachi Energy — BOOTH 534

901 Main Campus Dr Suite 400
Raleigh, North Carolina
United States
www.hitachienergy.com

Hitachi Energy is a global technology leader that is advancing a sustainable energy future for all. We serve customers in the utility, industry and infrastructure sectors with innovative solutions and services across the value chain. Together with customers and partners, we pioneer technologies and enable the digital transformation required to accelerate the energy transition towards a carbon-neutral future. We are advancing the world's energy system to become more sustainable, flexible and secure whilst balancing social, environmental and economic value. Hitachi Energy has a proven track record and unparalleled installed base in more than 140 countries. Headquartered in Switzerland, we employ around 40,000 people in 90 countries and generate business volumes of over $10 billion USD.

How2Power.com — BOOTH 429

P.O. Box 755
Smithtown, New York
United States
www.how2power.com/index.php

A free power electronics website for engineers. Great source of practical power design information. Read in-depth technical articles on power supply design, plus power component news and more in our e-newsletter, How2Power Today. Browse our special sections on Power Magnetics, SiC & GaN technology, EMI/EMC, Space Power and other topics. Find power electronics experts in the Consultants Corner directory. Browse or search our Industry Events calendar with over 400 events listed for 2023!

MagniX

BOOTH 450

301 Seaway Blvd
Everett, Washington
United States
www.magnix.aero

MagniX is built on the cornerstones of people, passion, and possibility. Our story began on the Gold Coast of Australia in 2005, where a lean start-up focused on permanent magnet motors and superconducting technologies, developing a groundbreaking electric propulsion unit. In 2017, we arrived at a major inflection point. How could the technological discovery be translated into a product that would make a large-scale impact on customers, connecting communities sustainably and affordably? It was a turning point that saw us rebrand as magniX, and our mission turn to leading the development of propulsion for the electric aviation age.

NoMIS Power

BOOTH 418

22 Appletree Ln
Newtonville, New York
United States
nomispower.com

NoMIS Power operates as a fab-less power semiconductor device provider and design house. Combining unique expertise from the worlds of scientific research and power semiconductor manufacturing, NoMIS Power develops SiC solutions for leading power electronics groups in applications ranging from electric vehicles to Solar PV and beyond. With our unparalleled experience in the SiC supply chain and a global network of partners, NoMIS Power is the trusted choice for groups seeking to evaluate SiC technology, accelerate market entry, and develop next-generation technology.

NREL

BOOTH 409

15013 Denver West Parkway
Golden, Colorado
United States
www.nrel.gov

At the National Renewable Energy Laboratory (NREL), we focus on creative answers to today's energy challenges. From breakthroughs in fundamental science to new clean technologies to integrated energy systems that power our lives, NREL researchers are transforming the way the nation and the world use energy. NREL is a leader in the Department of Energy's effort to secure an environmentally and economically sustainable energy future and the primary laboratory for research, development, and deployment of renewable energy technologies in the US. Research Campuses: Golden and Boulder, CO

Plexim

BOOTH 226

5 Upland Road Suite 4
Cambridge, Massachusetts
United States
www.plexim.com

Plexim's PLECS software and RT Box real-time simulator are used for the design and testing of power electronic systems and their associated controls, and PLECS Coder generates embedded code for MCUs.

STMicroelectronics

BOOTH 427

200 Summit Drive Ste 405
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United States
www.st.com/content/st_com/en.html

STMicroelectronics is 50,000+ creators and makers of semiconductor technologies mastering the semiconductor supply chain. An integrated device manufacturer, we work with 200,000+ customers and partners to design and build products and ecosystems that address their challenges and opportunities, and the need to support a more sustainable world. Our sensor, power, and control solutions enable smarter mobility, more efficient power and energy management, and the wide-scale deployment of the IoT and connectivity. We are committed to becoming carbon neutral by 2027. More information: www.st.com.

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United States
www.wolfspeed.com

We're leading the transformation from silicon to Silicon Carbide (SiC) and GaN as we shape the future of semiconductor markets: the transition to electric vehicles, the move to faster 5G networks, the evolution of renewable energy and energy storage, and the advancement of industrial applications. After more than 35 years of forging new technology adoption and transformation, our Wolfspeed® power and radio frequency (RF) semiconductors are leading the industry through unrivaled expertise and capacity. What's next? We believe anything is possible through hard work, collaboration and a passion for innovation.

Virgina Tech CPES

BOOTH 109

146 Whittemore Hall 1185 Perry St
Blacksburg, Virginia
United States
cpes.vt.edu

CPES is among the most renowned academic research centers globally. We improve electrical energy processing & distribution in systems of all sizes, e.g. personal electronics, vehicles, energy grid.

University Tabletop

University of California Berkeley — UNIVERSITY TABLE 6

571 Cory Hall
Berkeley, California
United States
www.berkeley.edu

The Department of Electrical Engineering and Computer Sciences (EECS) at UC Berkeley offers one of the strongest research and instructional programs in this field anywhere in the world. Our key strength is our array of cross-disciplinary, team-driven projects. The integration of EE and CS forms the core, with strong interactions that extend into biological sciences, mechanical and civil engineering, physical sciences, chemistry, mathematics, and operations research.

FREEDM Sys Ctr NC State University — UNIVERSITY TABLE 14

Campus Box 7212
Raleigh, North Carolina
United States
www.freedm.ncsu.edu

FREEDM is the power systems and power electronics research center at NC State University. Our work covers wide bandgap devices, electric transportation, power systems analysis, and renewable energy.

Georgia Institute of Technology — UNIVERSITY TABLE 15

777 Atlantic Drive
Atlanta, Georgia
United States
cde.gatech.edu

The Center for Distributed Energy (CDE) has been established at Georgia Tech with financial support from the Georgia Research Alliance and Georgia Tech to do advanced research and to develop technologies and holistic solutions that can transform electricity delivery and utilization. Research areas include power conversion, industrial applications, energy conservation, distributed energy resources, distributed control of the grid, security and communications in energy, as well as microgrids, dc nano grids and energy access for emerging markets. CDE partners include utilities, industry, manufacturers, research organizations, start-ups, VCs and other academic institutions with interests in aligned areas. In addition to doing traditional forward-looking cutting-edge academic research, CDE is uniquely focused on accelerating and de-risking technologies so that they can see faster adoption and higher impact.

University at Buffalo — UNIVERSITY TABLE 1

230 Davis Hall
Buffalo, New York
United States
buffalo.edu

The power electronics research lab at University at Buffalo, led by Prof. Xiu Yao, investigates direct current (dc) electric power system control and protection, electrical characterization of wide-bandgap (WBG) devices, and power electronics in high power applications, spanning from device to circuit and systems level.

University of Florida — UNIVERSITY TABLE 12

P.O.Box 116200, 216 Larsen Hall
Department of Electrical and Computer Engineering
Gainesville, Florida
United States
peeprlgator.github.io/Shuo.Wang/index.html

Power Electronics and Electrical Power Research Laboratory (PEEPRL) at the University of Florida is directed under Professor Shuo Wang. The research of PEEPRL focuses on Power Electronics, Electromagnetic Interference (EMI)/Compatibility (EMC), Electrical Power, Electromagnetic Security, Cyber Security, and Hardware Security. The PEEPRL is equipped with a 3-meter semi/full anechoic chamber and all necessary EMI/EMC and power electronics equipment for conductive, near field and radiated EMI research in power electronics systems including wide bandgap (WBG) power electronics systems.

University of Kentucky — UNIVERSITY TABLE 2

453 F Paul Anderson Tower
Lexington, Kentucky
United States
sparklab.engr.uky.edu

The PEIK Institute and its affiliated labs at University of Kentucky, SPARK and AMPERE, cover research in renewable energy technologies, electric machines and power electronic drives, smart grids and homes, electric power systems, and transportation electrification.

University of Wisconsin WEMPEC — UNIVERSITY TABLE 3

1415 Engineering Dr. RM 1541-B
Madison, Wisconsin
United States
wempec.wisc.edu

Industry academia consortium developing cutting edge technology in the field of electric machines, control and power electronics.

SUNY University at Stony Brook — UNIVERSITY TABLE 4

259 Light Engineering Building
Stony Brook, New York
United States
www.stonybrook.edu

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Exhibitors

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BOOTH 421

10200 NW 110th Ave Suite #1
Miami, Florida
United States
www.amepower.com

AmePower is an award-winning company with over 20 years of specialized expertise in manufacturing and power electronics equipment. Our advanced capabilities in contract manufacturing support Power Electronics Designs with Engineering, Manufacturing, Testing, Logistics, and After Sales Technical Support. AmePower has a 44,000 sq ft. State-of-the-art facility complete with high power testing capabilities and top-of-the-line equipment for manufacturing excellence. As a Buy-America compliant manufacturer, we facilitate American-made products, and ensure the highest quality control procedures with multiple ISO certifications. AmePower is a certified DBE / MBE / SBE / WBE / WOSB organization.

Advanced Conversion

BOOTH 509

PO Box 190
South Barre, Vermont
United States
advanced-conversion.com

Advanced Power Conversion Solutions – dba Advanced Conversion was founded in 2019 by Ed Sawyer and Mike Brubaker to carry on the technology and the customer application solutions formerly provided by SBE Inc. Advanced Conversion has acquired the technology license to all patents, designs, data, products, and processes from SBE which enables us to continue to support all of the existing solutions and products used by former SBE customers. Additionally, we are ready to apply these industry-leading tools to new optimized designs for interested customers in various markets including electric vehicles, aviation, alternative energy, and pulsed power. Most of the management team of SBE and virtually all of the Production and Technical team of SBE is now part of the Advanced Conversion family. All of the same equipment and processes are used to produce products of the high quality that our customers expect. Our expert application engineering team has also been preserved and will be expanding to meet increasing demands for custom solutions. Advanced Conversion is taking this foundation of technology and industry-leading solutions to the next level by adding in-house design and manufacturing of high-performance bus bars. This allows the company to significantly decrease typical industry lead-times as well as better integrate the cap-bus design to its optimal manufactured level as a DC link solution. The result is a faster design, prototyping, and production solution to market for our customers. With manufacturing and design facilities in Vermont, Colorado, and China, Advanced Conversion can bring a global supply chain solutions at competitive prices to our customers across the globe. Our customers enjoy the best technical solution, leveraging their semiconductor strategy, and accessing competitive pricing at their production location. In March 2023, Advanced Conversion was acquired by Electro Technik Industries (ETI)

Advanced Test Corp

BOOTH 528

10401 Roselle St
San Diego, California
United States
www.atecorp.com

ATEC is a leader in test equipment rentals, sales, and service. We carry EMC, Power Supplies & Loads, RF Safety, Electrical, NDT, Environmental, Communications, and General Purpose equipment.

Centre for Development of Advanced Computing (CDAC)

BOOTH 512

Power Electronics Group
Manaveeyam Road, Vellayambalam
Thiruvananthapuram, Kerala, India
www.cdac.in

Description: Centre for Development of Advanced Computing (C-DAC) is the premier R&D organization of the Ministry of Electronics and Information Technology (MeitY) for carrying out R&D in IT, Electronics and associated areas. Different areas of C-DAC, had originated at different times, many of which came out as a result of identification of opportunities.

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BOOTH 234

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COMSOL provides simulation software for use in engineering, manufacturing, and research. COMSOL Multiphysics® includes functionality for creating and managing physics-based models and simulation apps.

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Electronic Concepts Inc

BOOTH 308

526 Industrial Way West
Eatontown, New Jersey
United States
www.ecicaps.com

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EMcoretech Co.,Ltd.

BOOTH 536

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South Korea
emcoretech.com

Active EMI Solution provider, EMCoretech, has developed the world's first IC that can detect and neutralize electromagnetic waves, and based on this technology, has developed an active EMI filter.

EMWorks

BOOTH 208

150 Montreal-Toronto Blvd Suite 120
Lachine, Quebec
Canada
www.emworks.com

EMWorks is a leading provider of electromagnetic simulation software for electrical and electronics design. EMWorks products can be used as an antenna design software, an electric field simulation, a transformer design software, a magnetic field simulation, and an electric motor design software. EMWorks' flagship products are EMS, HFWorks, MotorWizard, and EMWorks2D. All of our products are fully and seamlessly embedded in SOLIDWORKS. EMS is also embedded in Autodesk Inventor. In addition to handling frequencies from DC to millimeter wave, our products come with built-in integrated thermal, structural, and motion analyses in a hassle-free multi physics platform. Today, EMWorks products and services are widely used worldwide by both industry and academia.

Engineering for US All (e4usa)

BOOTH 506

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College Park, Maryland
United States
e4usa.org

Engineering for US All (e4usa) is a first-of-its-kind, national initiative designed to introduce engineering design principles to a new generation of high school students by democratizing and demystifying engineering. Join us to learn how you and your company or university can be a part of this important movement.

Fuji Electric

BOOTH 243

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United States
americas.fujielectric.com/products/semiconductors

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GaN Power International

BOOTH 505

3410 Lougheed Highway
Vancouver, British Columbia
Canada
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GaNPower International is developing power electronic technology based on Gallium Nitride (GaN). We believe that GaN power semiconductors have the potential to revolutionize the efficient use of electrical energy by desiging high performance GaN power devices and related ICs in various packaging forms.

GaN Systems

BOOTH 235

770 Palladium Drive
Ottawa, Ontario
Canada
gansystems.com

GaN Systems provides innovative tools and insights to support power system design engineers to create products revolutionizing some of the world's most economically essential and environmentally impactful industries.

GE Aerospace

BOOTH 209

1000 MacArthur Memorial Highway
Ronkonkoma, New York
United States
www.geaerospace.com/systems/electrical-power

GE Aerospace has been a leader in SiC technology development for nearly two decades. From chip design and component engineering to full system implementation, GE has demonstrated class-leading performance in power devices, advanced packaging and power electronics applications for aviation, defense, and industrial vehicle electrification.

GMW Associates

BOOTH 435

955 Industrial Rd
San Carlos, California
United States
www.gmw.com

GMW is at heart a company that solves customer problems, with our core expertise being in magnetics. This magnetics expertise drives our focus in non-contact current sensors, transducers and other measurement instrumentation. We are displaying: - Danisense Current Transducers in current ranges of ± 55A to 11kA, dc accuracy to 5ppm, ac accuracy of 0.01% in amplitude and 0.05 degree to 1kHz, enabling applications including efficiency measurements for power conversion. New: Danisense DW500, frequency response DC to 10MHz for use with any power analyzer. - GMW CPC Current Probe Clips with ranges of ±250A to ±2kA and frequency response of dc to 75kHz enabling Clip-On measurements over -40C to +100C in high moisture, high vibration environments. - PEM Rogowski Coil AC Current Probe with frequency response to >50MHz and currents from 30A to 500kA. - Bergoz large aperture DC/AC CTs with 1mA to 20A range and 1 uArms resolution, ideal for leakage current measurements. - Senis 3DACMT-1 AC Magnetic Field Transducer, optimized for measurements at 85kHz for mapping the field in and around wireless charging applications.

Hammond Power Solutions

BOOTH 437

595 South gate Drive
Guelph, Ontario
Canada
www.hammondpowersolutions.com

HPS is one of the largest manufacturer of dry-type transformers in North America. We engineer and manufacture a wide range of standard and custom transformers that are exported globally in electrical equipment and systems. We support solid industries such as oil and gas, mining, steel, waste and water treatment, commercial construction, data centers, microgrids, and wind power generation. We have developed a reputation as one of the most capable and broadest manufacturer of dry-type magnetics in the world. Our products can be found on every continent, every ocean and have even orbited in space. Our engineering database contains over one million designs ranging from the smallest control transformers to the largest dry-type transformers ever manufactured. Our customers have come to rely on us for support at the most critical stages of their needs. Our stability and integrity as a supplier are paramount in an industry where demands must be resolved quickly and effectively. HPS has grown to become the largest dry-type transformer manufacturer in North America.

HBK

BOOTH 310

19 Bartlett St
Marlbourough, Massachusetts
United States
www.hbkworld.com/en

HBK's Electric Power Testing solutions simplify the testing of motors and inverters by combining multiple test systems into one single source of truth.

Hitachi Energy

901 Main Campus Dr Suite 400
Raleigh, North Carolina
United States
www.hitachienergy.com

Hitachi Energy is a global technology leader that is advancing a sustainable energy future for all. We serve customers in the utility, industry and infrastructure sectors with innovative solutions and services across the value chain. Together with customers and partners, we pioneer technologies and enable the digital transformation required to accelerate the energy transition towards a carbon-neutral future. We are advancing the world's energy system to become more sustainable, flexible and secure whilst balancing social, environmental and economic value. Hitachi Energy has a proven track record and unparalleled installed base in more than 140 countries. Headquartered in Switzerland, we employ around 40,000 people in 90 countries and generate business volumes of over $10 billion USD.

HL Mechatronics

4201 Northpark Dr
Opelika, Alabama
United States
hallamechatronics.com

Halla Mechatronics is a North American subsidiary of the Halla Group established in 2013 in Bay City, MI. It is a state-of-the-art Research and Development facility committed to the design of electronics, embedded systems, and magnetics. With a multidisciplinary engineering team, our "mechatronic" know-how enables us to develop innovative design solutions for use in many precision motor-control applications.

How2Power.com

BOOTH 429

P.O. Box 755
Smithtown, New York
United States
www.how2power.com/index.php

A free power electronics website for engineers. Great source of practical power design information. Read in-depth technical articles on power supply design, plus power component news and more in our e-newsletter, How2Power Today. Browse our special sections on Power Magnetics, SiC & GaN technology, EMI/EMC, Space Power and other topics. Find power electronics experts in the Consultants Corner directory. Browse or search our Industry Events calendar with over 400 events listed for 2023!

HVR

BOOTH 210

2090 Old Union Rd
Cheektowaga, New York
United States
www.hvrapc.com

HVR Provides cost-effective, engineered solutions for difficult, high-stress resistor applications. Our resistors excel in applications that require high voltage, high energy and low inductance.

H3X Technologies

BOOTH 451

410 S Arthur Ave
Louisville, Kentucky
United States
www.h3x.tech

H3X makes the most power dense electric motors in the world to enable commercial electric aviation at scale and deep decarbonization in land, sea, and air vehicles. Our electric motors range from 40HP to 4000HP and are 3X lighter than competitors.

IEEE-IAS

BOOTH 408

445 Hoes Ln
Piscataway, New Jersey
United States
ias.ieee.org

We are a group of volunteers who are committed to the IEEE mission of fostering technological innovation and excellence for the benefit of humanity. Amongst all of the IEEE societies, the IEEE Industry Applications Society (IAS) is unique—we work at the intersection of theory and practice, supporting the advancement of the work of academics and fellow engineers, and setting the standards for the application there of

IEEE-PELS

BOOTH 307

445 Hoes Ln
Piscataway, New Jersey
United States
www.ieee-pels.org

The Power Electronics Society (PELS) is one of the fastest-growing technical societies of the Institute of Electrical and Electronics Engineers (IEEE). For over 35 years, the PELS has facilitated and guided the development and innovation in power electronics technology. This technology encompasses the effective use of electronic components, the application of circuit theory and design techniques, and the development of analytical tools for efficient conversion, control, and condition of electric power. Some of our members include distinguished award winners, practitioners, and preeminent researchers. PELS also publishes the IEEE Transactions on Power Electronics (TPEL), a top referenced journal among all IEEE publications.

IEEE- ECCE 2024 Phoenix

BOOTH 503

122 N Wheaton Ave, STE 1192
Wheaton, Illinois
United States
info@ieee-ecce.org

ECCE 2024 will be held in Phoenix, Arizona from October 19-24, 2024. Stop by to hear how you can partner with us for next year!

Imperix

BOOTH 237

Rte des Ronquoz 23 1950 Sion
Switzerland
imperix.com

Imperix develops high-end control equipment and prototyping hardware designed to accelerate the implementation of laboratory-scale power converters.

Infineon

BOOTH 337

101 N Pacific Coast Highway
El Segundo, California
United States
www.infineon.com

Infineon Technologies AG is a global semiconductor leader in power systems and IoT. Infineon drives decarbonization and digitalization with its products and solutions.

IWATSU Test Instruments Europe GmbH — BOOTH 329

Koenigsteiner Strasse 98
Bad Soden am Taunus, Hessen
Germany
www.iwatsu-europe.com

IWATSU Europe is a joint company of Heimann Industries and IWATSU founded on 27 August, 2020. IWATSU Electric Co., Ltd has provided electric measuring instruments, telecommunication system and printing system since 1938. IWATSU invented the first Japanese oscilloscope in 1954 and is a leading manufacturer for power electronic measurement solutions worldwide.

Louisiana State University — BOOTH 229

204 Thomas Boyd Hall
Baton Rouge, Louisiana
United States
www.lsu.edu

Endeavor Power Technologies is a dynamic and forward-thinking startup company at the forefront of the electrical engineering industry. Established in 2015, our core focus is to create innovative solutions that drive affordability and excellence in the field. Our primary areas of expertise include developing advanced low-cost circuits to enhance DC circuit breaker operation and pioneering cutting-edge co-simulation and Python solutions for large-scale power systems. Our Expertise: 1. Hybrid DC Circuit Breakers: At Endeavor Power Technologies, we specialize in the design and development of low-cost hybrid DC circuit breakers. Our hybrid DC circuit breaker solutions offer low cost, reliability, and safety features, making them an ideal choice for critical applications. Key Features of our Hybrid DC Circuit Breaker Enhancers: • High-speed fault interruption • Low-cost power electronics solutions for arc reduction • Robust thermal management for extended service life • Seamless integration into existing breakers 2. Co-simulation and Python Solutions: In addition to our circuit breaker expertise, we excel in developing co-simulation and Python solutions tailored to the specific needs of our clients. Our software solutions are designed to streamline the design, analysis, and optimization of complex electrical systems. Whether you require real-time simulations, system modeling, or data analysis, our team of software engineers can provide you with the tools you need to make informed decisions and improve system performance. Key Services in Co-simulation and Python Solutions: • Transmission-distribution (T&D) and ac-dc co-simulation platforms • Custom Python software development for power system analysis • Integration with existing simulation platforms such as Siemens/PSSE • User-friendly interfaces for ease of operation • Data-driven insights for system optimization

Manutech Inc. — BOOTH 502

7901 NW 67th Street
Miami, Florida
United States
manutech.us

Manutech Inc, a leading player in the Electronic Manufacturing Industry, with a strong commitment to delivering exceptional products/services to our valued customers. Services and products we provide: Standard and custom Magnetics Prototype Transformers and Inductors Electrical Engineering Electro-mechanical Engineering Printed Circuit Board Assembly Precision Tooling Injection Molding Full Product Assembly Global Procurement and Materials Management In-House Testing Worldwide Distribution and Logistics Automated Assemblies

MathWorks — BOOTH 416

3 Apple Hill Drive
Cambridge, Massachusetts
United States
www.mathworks.com

The MATLAB and Simulink product families are fundamental applied math and computational tools at the world's educational institutions. Adopted by more than 6,500 universities and colleges, MathWorks products accelerate the pace of learning, teaching, and research in engineering and science. MathWorks products also help prepare students for careers in industry worldwide, where the tools are widely used for data analysis, mathematical modeling, and algorithm development in collaborative research and new product development. Application areas include data analytics, mechatronics, communication systems, image processing, computational finance, and computational biology.

Mesago Messe Frankfurt GmbH — BOOTH 507

Rotebühlstraße 83-85
Baden-Wuerttemberg
Stuttgart
Germany
www.pcim-europe.com

International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management
Nuremberg, 11 – 13 June 2024

PCIM Europe is the international leading exhibition and conference for power electronics. It mirrors the entire value chain – from components, drives control and packaging to intelligent system.

Mitsubishi Electric US Inc — BOOTH 143

5900-A Katella Ave PO Box 6007
Cypress, California
United States
meus-semiconductors.com

Mitsubishi Electric provides highly efficient power modules for traditional and renewable energy sources, industrial and automation applications, hybrid and electric vehicles, and home appliances.

NREL

BOOTH 409

15013 Denver West Parkway
Golden, Colorado
United States
www.nrel.gov

At the National Renewable Energy Laboratory (NREL), we focus on creative answers to today's energy challenges. From breakthroughs in fundamental science to new clean technologies to integrated energy systems that power our lives, NREL researchers are transforming the way the nation and the world use energy. NREL is a leader in the Department of Energy's effort to secure an environmentally and economically sustainable energy future and the primary laboratory for research, development, and deployment of renewable energy technologies in the US. Research Campuses: Golden and Boulder, CO

NOMIS Power

BOOTH 418

22 Appletree Ln
Newtonville, New York
United States
nomispower.com

NoMIS Power operates as a fab-less power semiconductor device provider and design house. Combining unique expertise from the worlds of scientific research and power semiconductor manufacturing, NoMIS Power develops SiC solutions for leading power electronics groups in applications ranging from electric vehicles to Solar PV and beyond. With our unparalleled experience in the SiC supply chain and a global network of partners, NoMIS Power is the trusted choice for groups seeking to evaluate SiC technology, accelerate market entry, and develop next-generation technology.

Ohio State University – CHPPE

BOOTH 511

205 Dreese Labs, 2015 Neil Ave
Columbus, Ohio
United States
ece.osu.edu/center-high-performance-power-electronics

Center for High-Performance Power Electronics (CHPPE) at the Ohio State University is focused on harnessing the strengths of wide band gap (WBG) devices in a wide range of existing and emerging power electronics applications.

OMICRON Electronics GmbH

BOOTH 514

Oberes Ried 1
6833 Klaus, Quebec
Canada
www.omicron-lab.com

OMICRON Lab is a division of OMICRON electronics GmbH specialized in providing Smart Measurement Solutions® to professionals engaged in the field of electronics.

Opal-RT

BOOTH 135

1751 Rue Richardson Suite 2525
Montreal, Vorarlberg
Austria
www.opal-rt.com

OPAL-RT is a world leader in real-time simulation and Hardware-in-the-Loop (HIL) testing equipment. Since 1997, OPAL-RT has empowered engineers and researchers with accessible, cutting-edge, and customized real-time simulation technology to accelerate the development of better products and more reliable energy transmission. Real-time simulation processes let engineers quickly test and iterate their control strategies in order to decrease development costs and time to market. These processes, used by all industries, allow corrections to be made early in product development. Thus, mistakes can be corrected and optimizations can be made while it is still inexpensive to do so. Our main goal at OPAL-RT is to help you to make innovative ideas a reality--and to help our users build better products and solutions, in the hope of creating a better world.

Payton America

BOOTH 234

1805 S. Powerline Rd Suite109
Deerfield Beach, Florida
United States
www.paytongroup.com

Payton Designs and manufactures planar magnetics from 50kHz to few MHz and from few watts to over 100kWatts. Custom samples in few weeks. Full in house engineering capabilities for simple to very complex custom planar designs for transformers and inductors for all switch mode topologies

Plexim

BOOTH 226

5 Upland Road Suite 4
Cambridge, Massachusetts
United States
www.plexim.com

Plexim's PLECS software and RT Box real-time simulator are used for the design and testing of power electronic systems and their associated controls, and PLECS Coder generates embedded code for MCUs.

Power Integrations

BOOTH 127

5245 Hellyer Ave
San Jose, California
United States
www.power.com

Power Integrations, Inc. is a leading innovator in semiconductor technologies for high-voltage power conversion. The company's products are key building blocks in the clean-power ecosystem, enabling the generation of renewable energy as well as the efficient transmission and consumption of power in applications ranging from milliwatts to megawatts. For more information, please visit www.power.com.

Powersys

BOOTH 436

5465 Morehouse Dr Suite 160
San Diego, California
United States
powersys-solutions.com

Powersys revolutionizes e-design, accelerates electrification. We are a global electrical engineering software and services provider, offering fully customized solutions to accelerate the design of Power Systems. For 20 years, we have delivered our solution to more than 2500 customers in over 80 countries, enabling our clients to solve their complex electrification challenges in EV and Grid. Our solution includes electrical engineering expertise, simulation software and power computing.

PMK Mess- und Kommunikationstechnik GmbH

BOOTH 428

Koenigsteiner Strasse 98
Bad Soden am Taunus, Hessen
Germany
www.pmk.de/en/home

With over 30 years of experience, PMK develops and manufactures world-class probing solutions for the latest test and measurement challenges in electronics designs. All PMK branded probes have an universal BNC interface to ensure the re-use of our probes also when the oscilloscope vendor changes in the lab. PMK is also a well-established vendor for probes with the leading oscilloscope manufacturers worldwide.

ROHM Semiconductior

BOOTH 342

3033 Olcott Street
Santa Clara, California
United States
www.rohm.com

ROHM Semiconductor is an industry leader in system LSI, SiC, and discrete/module power products, leveraging the latest semiconductor technologies. ROHM's vertically integrated production system, in which all processes, from raw material procurement and wafer fabrication to final assembly, are performed completely in-house using proprietary production equipment, is a major factor in keeping it at the forefront of the electronic component manufacturing industry. This, coupled with highly skilled engineers well-versed in all aspects of design, development, and production, allow ROHM to offer custom solutions and provides the flexibility to respond to a wide range of application requirements in the automotive, industrial, and consumer markets along with the emerging IoT sector.

SanRex Corporation

BOOTH 454

50 Seaview Blvd.
Port Washington, New York
United States
www.sanrex.com

Description?

STMicroelectronics

BOOTH 427

200 Summit Drive Ste 405
Burlington, Massachusetts
United States
www.st.com/content/st_com/en.html

STMicroelectronics is 50,000+ creators and makers of semiconductor technologies mastering the semiconductor supply chain. An integrated device manufacturer, we work with 200,000+ customers and partners to design and build products and ecosystems that address their challenges and opportunities, and the need to support a more sustainable world. Our sensor, power, and control solutions enable smarter mobility, more efficient power and energy management, and the wide-scale deployment of the IoT and connectivity. We are committed to becoming carbon neutral by 2027. More information: www.st.com.

Taiwan Semiconductor

BOOTH 508

3040 Saturn Street Suite 200
Brea, California
United States
www.tsmc.com/english

TSMC (TWSE: 2330, NYSE: TSM) created the semiconductor Dedicated IC Foundry business model when it was founded in 1987. In 2022, TSMC served 532 customers and manufactured 12,698 products for various applications covering a variety of end markets including high performance computing, smartphones, the Internet of Things (IoT), automotive, and digital consumer electronics. Annual capacity of the manufacturing facilities managed by TSMC and its subsidiaries exceeded 15 million 12-inch equivalent wafers in 2022. These facilities include four 12-inch wafer GIGAFAB® fabs, four 8-inch wafer fabs, and one 6-inch wafer fab – all in Taiwan – as well as one 12-inch wafer fab at a wholly owned subsidiary, TSMC Nanjing Company Limited, and two 8-inch wafer fabs at wholly owned subsidiaries, WaferTech in the United States and TSMC China Company Limited. In December 2022, TSMC announced that, in addition to TSMC Arizona's first fab, which is scheduled to begin production of N4 process technology in 2024, the Company has also started the construction of a second fab which is scheduled to begin production of 3nm process technology in 2026. At the same time, the Company continues to execute its plan for a fab in Kumamoto, Japan, with production targeted for 2024.

TDK Lambda America

BOOTH 336

405 Essex Rd
Neptune, New Jersey
United States
www.us.lambda.tdk.com

TDK-Lambda Americas, Inc. is a leading manufacturer of high reliability Low/High Voltage Programmable DC and High Voltage Programmable Capacitor Charging power supplies and DC Electronic Loads.

Teledyne LeCroy

BOOTH 334

700 Chestnut Ridge
Chestnut Ridge, New York
United States
teledynelecroy.com

Teledyne LeCroy is a leading provider of oscilloscopes, probes, and software analysis solutions for power integrity, power electronics, power conversion, three-phase power and motor testing.

University of Tennessee

BOOTH 207

1520 Middle Drive
108 Min H. Kao Building
Knoxville
University of Tennessee, Knoxville
utk.edu

The University of Tennessee, Knoxville - CURENT, Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks, is a graduated National Science Foundation (NSF) Engineering Research Center. A collaboration between academia, industry, and national laboratories aiming to build a new generation of electric power and energy systems engineering leaders with global perspectives and diverse backgrounds.

WAFIOS Machinery Corporation

BOOTH 242

27 NE Industrial Road
Branford, Connecticut
United States
www.wafios.com/en

WAFIOS is one of the leading mechanical engineering companies for the wire and tube processing industry worldwide. See our team and discuss hairpin stators, busbars, axial flux motors and more.

WIN SOURCE ELECTRONICS

BOOTH 328

15A/Floor,Hangdu Bldq..Huafu Road
Shenzhen, CN20
China
www.win-source.net

The Largest electronic components distributor from Asia, - AS9120B, ISO13485,ISO28000, ISO 9001 :2008, ISO14001,ISO37001,ISO45001, ISO22301, ESDS20.20,ERAI certified, specializes in offering a wide range of obsolete and common-used electronic parts, also offers cost-effe ctive alternative solutions of electronic parts on test/measurement, healthcare, gaming, aerospace and general industry. Founded in 1999, WIN SOURCE focuses on optimizing procurement chains in the electronics industry with over 23 years of experience. With more than 3000 manufacturers and over 1 million+ SKU, WIN SOURCE provides one-stop online services, for procuring electronic components for global B2B customers through our widespread supply chains. Moreover, we are committed to guaranteeing 24-hour delivery and a 365-day warranty. Depending on our data IT service platform,WIN SOURCE is dedicated to meeting customers"demands to achieve one-stop BOM procurement, quickly acquire obsolete inventory, and continuously reduce procurement and production costs. We are known as one of the 2022 Top-class Asia international distributors awarded by SOURCETODAY, enjoying an excellent reputation in the electronic supply chain at home and abroad.

We Run So Life Can Leap Forward

Life can't evolve without innovation. That's why we're ideating to help feed the planet, build smarter, and help our farmers and growers to sustainably optimize their land.

Join our team: JohnDeere.com/Careers

JOHN DEERE

PELS Members' Townhall Meeting

Sunday, October 29
Refreshments at 4:00PM | Meeting begins 4:30PM- 6:00PM
Location: Room 101AB

IEEE Power Electronics Society President, Brad Lehman, is delighted to invite you to the upcoming PELS Membership Townhall Meeting. This Townhall meeting will provide you with an opportunity to engage with fellow PELS members, gain insights into the society's initiatives, and share ideas towards shaping the future of power electronics. We encourage all PELS members, from students to professionals, to attend this event. Let us come together to strengthen our professional network, foster collaboration, and drive innovation in power electronics.

PELS-IAS Young Professionals Reception

Monday, October 30 | 7:00PM–9:00PM
Location: Bode Nashville
401 President Ronald Reagan Wy
Nashville, TN 37201

Registration link: IAS-PELS 2023 YP Reception

You are cordially invited to attend the IAS-PELS Young Professionals (YP) reception which will take place during the IAS Annual Meeting/ ECCE in Nashville. The YP reception provides an ideal opportunity to network and socialize with fellow IAS, PELS and PSMA young professionals.

Please register as soon as possible as place is limited to the first 200 registrants. Registration is compulsory for attendance.

For any queries regarding the YP reception, please contact the IAS YP chair, Sumit Chhabria (sumit.chhabria7@gmail.com). atmosphere over food and drinks.

PELS Empowering a Billion Lives (EBL) Session: Energy Access and Off-grid Systems: Technological Advancements – Opportunities and Challenges for Providing Low-cost Energy Access

Tuesday, October 31 | 12:30PM - 3:00PM
Location: Room 101D

To contribute to the Energy Access ecosystem, we need to work with both global and local stakeholders in target contexts (national and local governments, NGOs, financial institutions etc.) to better understand the customers' needs and aspirations, purchasing power and socio-cultural contexts and towards creating economically viable and sustainable solutions. At the same time, for Energy Access solutions to scale, we need to understand the concerns of various industries. The Energy Access challenge and opportunity has spurred enormous private sector innovation, in off-grid solar, microgrids, fintech, IoT etc. Industry participants are hand-picked and invited to make presentations at the Energy Access Special Session. The session will cover the findings from that in-depth conversation regarding technological challenges and opportunities. There will also be a call for action from both academic researchers as well as innovative industry players to take part in the Energy Access challenges, solutions and address the critical issues that the session will spotlight..

Session Panelists/Speakers

Deepak Divan, *Georgia Institute of Technology, USA, Chair, Global Energy Access Forum*
Jelena Popovic, *University of Twente, Vice-Chair, Global Energy Access Forum*
Issa Batarseh, *University of Central Florida, USA, PELS TC-12 Energy Access*
Sanjib Kumar Panda, *National University of Singapore, Singapore, PELS TC-12 Energy Access - Chair*
Ali Hussain, *Enphase Energy, USA*

NOTES

CALL FOR PAPERS

ECCE 2024

IEEE ENERGY CONVERSION CONGRESS & EXPO PHOENIX, ARIZONA, USA ☼ OCT. 20-24

IMPORTANT DATES

March 8, 2024

- Digest submission deadline

May 24, 2024

- Author notification

June 7, 2024

- 2-page Late Breaking Research Briefs
- Post-Journal Paper ECCE Presentation

July 22, 2024

- Final papers submission with IEEE copyright forms

IEEE

IAS IEEE INDUSTRY APPLICATIONS SOCIETY Linking Research to Practice

pels IEEE POWER ELECTRONICS SOCIETY Powering a Sustainable Future

The Sixteenth Annual IEEE Energy Conversion Congress and Exposition (ECCE 2024) will be held in Phoenix, Arizona, USA, from October 20 – 24, 2024. ECCE is a pivotal international event on energy conversion. ECCE 2024 will feature both industry-driven and application-oriented technical sessions as well as an exposition. The conference will bring together practicing engineers, researchers and other professionals for interactive and multidisciplinary discussions on the latest advances in areas related to energy conversion, including new and emerging applications.

Technical papers are solicited on any subject pertaining to the scope of the conference including, but not limited to, the following major topics:

Energy Conversion Systems and Applications

- Renewable and alternative energy power electronics systems
- Critical power and energy storage systems
- Aerospace energy conversion systems
- Grid-forming technologies
- High power/voltage power conversion (HVDC, FACTS and multi-terminal DC systems)
- Microgrids, hybrid ac and dc grids, and dc grids
- Hydrogen systems for grid applications
- Energy Access and off-grid systems
- Energy conversion for information technology and communication systems
- Electrification for commercial, industrial and transportation applications
- Electric vehicles (EV) and charging infrastructure
- Big data and artificial intelligence in energy conversion
- Wireless power transfer
- Lighting applications and displays
- Industrial motor drives
- Medical, IoT and energy harvesting

Component, Converter & Subsystem Technologies

- Power electronic devices, gate drivers, and integrated circuits
- Passive components and materials
- Power electronic packaging integration
- Reliability, advanced fault protection systems, diagnostics, prognostics, and health management
- Thermal management and advanced cooling technologies
- Innovative magnetic materials, alternative conductor and winding insulation technologies
- Electromagnetic interference and electromagnetic compatibility
- Power conversion topologies, modulation, and control
- Electrical drive systems and topologies and their control
- Rotating/linear electromechanical devices
- Advanced manufacturing
- Digital twins, cloud design and simulation techniques for energy conversion systems
- Cyber-and-physical security for power electronics systems

Digest Submission

Prospective authors are requested to submit a single column, single spaced digest no longer than five (5) pages (including references) summarizing the proposed paper. The digest should include key equations, figures, tables, and references as appropriate, but no author names or affiliations. Digests not conforming to these requirements will be rejected without review. The digests must clearly state the objectives of the work, its significance in advancing the state of the art, and the methods and specific results in sufficient detail. All digests will go through a double-blind peer review process to ensure a confidential and fair review. The papers presented at the conference will be included in the IEEE Xplore Digital Library. Please refer to the conference website for a detailed list of technical topics and the digest submission method.

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Georgia Tech, USA

IEEE ENERGY CONVERSION CONGRESS & EXPO PHOENIX, ARIZONA, USA OCT. 20-24

IMPORTANT DATES

March 8, 2024
Tutorial proposal due

May 24, 2024
Notice of acceptance

July 22, 2024
Final Tutorials Materials Due

Call for Tutorials

The 16th Annual IEEE Energy Conversion Congress and Exposition (ECCE 2024) will be held in Phoenix, Arizona, USA, from October 20 -24, 2024 ECCE is a pivotal international event on energy conversion. It will bring together practicing engineers, researchers, and other professionals for interactive discussions on the latest advances in areas related to energy conversion.

The ECCE organizing committee invites proposals for tutorials to be presented at ECCE 2024. Each tutorial is 3 hours long, excluding break times. Each accepted tutorial will receive one conference registration together with an honorarium of $1,000.

Please note that publication of a technical paper will still require a paid full registration. All tutorial proposals should be submitted via the ECCE 2024 web portal under “Call for Tutorials”. Please follow the Tutorial Proposal Form on the website as a submission template. The proposals will be reviewed by a panel of subject matter experts.

One or more of the following elements are strongly encouraged in the tutorial proposals:

a) Industry led or co-hosted lectures
b) Interactive instructor-audience approaches, including hands-on demonstrations and practices
c) Application focused session on tools or methods for the practicing engineer
d) ECCE 2024 regionally oriented topics at the host city, e.g. smart mobility
e) Collaborative cross-disciplinary topics and tutorial teams are welcome
f) Topics that engage the audience in formats that serves to communicate with the attendees

Tutorials considered to be less attractive to the audience are:

a) Topics that are too narrowly focused
b) Lectures that are not balanced between theory and application
c) Tutorial topics or teams presented previously in immediate past ECCE or other major IAS/PELS conferences
d) Tutorials that narrowly focus on presenter’s own research works that are already publicly available
e) Solicitation of a particular product or service

Potential topic areas include but are not limited to:

Energy Conversion Systems and Applications

- Renewable energy, including under-represented ocean-wave, tidal, geothermal
- Smart grids, microgrids, nanogrids
- Electrical energy storage, including real physics or controlled virtual storage
- Energy conversion for information and communications technology
- Energy harvesting and conversion
- Smart, energy efficient buildings
- Energy efficiency for advanced manufacturing
- Big data and machine learning in energy conversion
- Digital twins for energy conversion systems
- Cybersecurity in energy conversion systems
- Transportation electrification, including aircraft and urban aerial mobility
- Battery charging technologies
- Resiliency in energy systems
- HVDC and HVDC grids

Component, Converter & Subsystem Technologies

- Power electronic devices
- Power conversion topologies
- Modeling and control of power converters
- Electric machines and drives
- Passive components, magnetics, and materials–particularly for high frequency
- Packaging, integration, and advanced manufacturing
- EMI and EMC
- Thermal management and advanced cooling technologies
- Wireless power transfer
- High voltage power conversion, including insulation technologies
- Design automation and optimization
- Reliability, diagnostics, prognostics, and health management
- Fault-tolerant converters and systems
- Protection and advanced gate drives for converters

Others

- Pedagogy for undergraduate learning or under-represented groups
- Online education technology innovations
- Entrepreneurship, technology transfer, business management
- Development and use of standards for specific applications

IEEE

IAS IEEE INDUSTRY APPLICATIONS SOCIETY Linking Research to Practice

pels IEEE POWER ELECTRONICS SOCIETY Powering a Sustainable Future

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Georgia Tech, USA

IEEE ENERGY CONVERSION CONGRESS & EXPO PHOENIX, ARIZONA, USA OCT. 20-24

IMPORTANT DATES

April 1, 2024
Special Session proposal due

May 15, 2024
Notification of acceptance

Call for Special Sessions

The 16th Annual IEEE Energy Conversion Congress and Exposition (ECCE 2024) will be held in Phoenix, Arizona, USA, from October 20 – 24, 2024. Special Sessions are solicited focusing on emerging technologies and industry-oriented topics. Industry and government organizers or speakers are of particular interest. Guest speakers will be invited on the day their session is scheduled. No written papers are required. Materials presented in the Special Sessions will not be included in the conference proceedings. Each session will be assigned either one or two 100-minute slot(s), subject to conference program scheduling.

Different session formats are solicited:

1) Formal presentations;
2) Informal talks with or without slides;
3) Full Q&A panel;
4) Debate;
5) Other creative or hybrid styles.

One or more of the following elements are strongly encouraged in the special session proposals:

a) Significant industry or government involvement;
b) Industrial application oriented;
c) ECCE 2024 regionally oriented topics;
d) Collaborative cross-disciplinary topics or teams;
e) Creative formats that engage the audience, especially industry.

Factors considered as less attractive to the audience are

a) Non-emerging topics;
b) Academic lectures;
c) Similar teams with similar topics from the immediate past ECCE;
d) Solicitation of a particular product

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Potential topic areas include but are not limited to:

Energy Conversion Systems and Applications

- Transportation electrification, including EV, trucks, aircraft, UAV, drones, trains, ships
- Energy storage systems
- Charging stations and infrastructure; vehicle to grid
- Additive manufacturing
- Renewable energy integration
- Smart grids, microgrids, nanogrids
- Resiliency in energy systems
- Smart and energy efficient buildings
- Energy conversion for information technology
- Big data and machine learning in energy conversion
- Cybersecurity in energy conversion
- Design automation and optimization
- Digital twins in energy conversion systems

Component, Converter & Subsystems

- Ultra wide-bandgap (U-WBG) semiconductor development
- Power semiconductor devices, magnetics, capacitances
- Power conversion topologies, modeling, and control
- Electric machines and drives
- Packaging, integration, and advanced manufacturing
- EMI and EMC
- Thermal management, advanced cooling technologies
- Wireless power transfer
- High voltage power conversion, including insulation systems
- Reliability, diagnostics, prognostics, and health management

Others

- Standards development
- Education and career development
- Entrepreneurship, technology transfer, business management
- Online education technology innovations

Proposal Submission and Review Process

All special session proposals must be submitted via the ECCE 2024 web portal under “Call for Special Sessions”. Please follow the Proposal Form on the website as a submission template. The proposals will be reviewed by a panel of subject matter experts.

Special Session Proposal Template

Format: Maximum 5 pages. All pages are formatted to 8.5x11” or A4 paper with margins of one inch on every side. All texts use single space, Times New Roman, and a font size of 11 or 12. A Word template will be posted on the official website under Call for Special Sessions.

Recommended Sections:

1. **Special Session Title**
2. **Proposed Session Format** (Choose from “formal presentations”, “informal talks”, “full Q&A panel”, “debate”, or create own style – see Call For Proposal. Describe the format at a high level, and note any creative activities such as software/ hardware demonstration, virtual tours, interactive audience polls, etc.)
3. **Proposed Timing** (Choose “100 minutes” or “2x100 minutes”.)
4. **Session Organizers** [List name(s), title(s), affiliation(s), and email(s).]
5. **Session Speakers/Panelists** (List names, titles, and affiliations. Clearly note each speaker’s availability: choose “confirmed” or “tentative”; failure to do so will be treated as all tentative.)
6. **Abstract** (No more than 500 words. Accepted abstract will be published through the conference website and program book.)
7. **Session Outline** (Only list the proposed topics/titles/activities. No detailed descriptions necessary. Indicate time allocation and speaker breakdown, if possible.)
8. **Organizer Biography** (No more than 200 words for each person. External website link can be included but may not be reviewed.)
9. **Speaker/Panelist Biography** (No more than 200 words for each person. External website link can be included but may not be reviewed.)

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SUBMISSION DEADLINE

June 7, 2024

Call for Papers Late Breaking Research Publications

Potential topic areas include but are not limited to:

Components & Converters

- Wide bandgap devices and their emerging applications in power electronics
- Artificial intelligence (AI) aided converter control and design
- Thermal management and advanced cooling technologies
- Reliability, diagnostics and prognostics of components and modular systems
- Electric machine design and motor drives
- Advanced technologies for power electronics such as materials, 3-D printing, magnets, magnetic devices, capacitors, switching devices EMI/EMC, etc.

Power Electronics Intensive Energy Conversion Systems

- Renewable energy systems, energy storage systems, and their integration into modern electric grids
- AC, DC, and hybrid micro-grids and nano-grids
- Power electronic based grid infrastructures: technologies, trend, and grid integration
- Resiliency enhancement and active stabilization of power electronics based power systems
- Transportation electrification, including electric vehicles, aircraft, ships, drones, etc.
- Cybersecurity in power electronic inverters and inverter dominated energy sytems

SUBMISSION GUIDELINES

Authors are requested to strictly follow the specific camera-ready, two-page paper template. References are excluded from the two-page limit. The review decision would be either to accept of reject the manuscript. No revisions or modifications allowed post-submission.

IMPORTANT DETAILS

The accepted papers will be featured as a poster presentation and made available in the conference proceedings on IEEE Xplore. All proposals should be submitted via the ECCE 2024 website under "Call for Late Breaking Research Publications."

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Call for Post Journal Presentations

Continuing with this new ECCE 2023 initiative, Post-Journal presentations will provide an opportunity to the authors of published journal papers to present their work live to the ECCE audience. This will help journal authors advocate their published ideas, while at the same time, draw attention to both the participating journals and the ECCE conference. This is "presentation only" as the published journal paper will not be included into the ECCE proceedings.

List of Journals from PELS and IAS Society

- IEEE Transaction on Power Electronics
- IEEE Power Electronics Letter
- IEEE Journal of Emerging and Selected Topics in Power Electronics
- IEEE Power Electronics Magazine
- IEEE Transactions on Industry Applications
- IEEE Industry Applications Magazine
- IEEE Open Journal of Power Electronics
- IEEE Open Journal of Industry Applications

Presentation Session Structure

For the ECCE post-journal presentation we envision having multiple sessions. The planned topics of those sessions will be consistent with the ECCE technical program scope.

www.ieee-ecce.org/2024

ECCE 2024

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savethedate

October **20-24,** 2024

Phoenix, Arizona **USA**

www.ieee-ecce.org/2024

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