PROGRAM

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<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECCE 2016 Supporters and Partners</td>
<td>2</td>
</tr>
<tr>
<td>Welcome Letters</td>
<td>3</td>
</tr>
<tr>
<td>ECCE 2016 Leadership</td>
<td>6</td>
</tr>
<tr>
<td>Downtown Milwaukee Map</td>
<td>10</td>
</tr>
<tr>
<td>Convention Center Floor Plans</td>
<td>11</td>
</tr>
<tr>
<td>Schedule-at-a-Glance</td>
<td>12</td>
</tr>
<tr>
<td>Conference Highlights</td>
<td>15</td>
</tr>
<tr>
<td>Detailed Schedule</td>
<td>16</td>
</tr>
<tr>
<td>Event Services</td>
<td>26</td>
</tr>
<tr>
<td>General Information</td>
<td>27</td>
</tr>
<tr>
<td>Milwaukee 101</td>
<td>28</td>
</tr>
<tr>
<td>Committee Meetings</td>
<td>29</td>
</tr>
<tr>
<td>Special Events</td>
<td>32</td>
</tr>
<tr>
<td>Presenter Information</td>
<td>36</td>
</tr>
<tr>
<td>Plenary Session</td>
<td>37</td>
</tr>
<tr>
<td>Town Hall Meetings</td>
<td>38</td>
</tr>
<tr>
<td>Special Sessions</td>
<td>40</td>
</tr>
<tr>
<td>Tutorials</td>
<td>42</td>
</tr>
<tr>
<td>TECHNICAL PROGRAM SCHEDULE</td>
<td>46</td>
</tr>
<tr>
<td>Oral Sessions</td>
<td>46</td>
</tr>
<tr>
<td>Poster Sessions</td>
<td>79</td>
</tr>
<tr>
<td>EXPOSITION</td>
<td>92</td>
</tr>
<tr>
<td>Exhibit Hall Floor Plan</td>
<td>92</td>
</tr>
<tr>
<td>Exhibitor Listing</td>
<td>93</td>
</tr>
<tr>
<td>Exhibitor Directory</td>
<td>94</td>
</tr>
<tr>
<td>Product and Services Sessions</td>
<td>100</td>
</tr>
<tr>
<td>Student Demonstrations</td>
<td>102</td>
</tr>
<tr>
<td>ECCE 2017 INFORMATION</td>
<td>104</td>
</tr>
<tr>
<td>Call for Papers</td>
<td>104</td>
</tr>
<tr>
<td>Call for Tutorials</td>
<td>105</td>
</tr>
<tr>
<td>Call for Special Session Organizers</td>
<td>107</td>
</tr>
</tbody>
</table>
ECCE 2016 would like to express our gratitude for the generous support received from the following:

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It is my pleasure to welcome you to the 8th Annual IEEE Energy Conversion Congress & Exposition (ECCE 2016), sponsored by the IEEE Power Electronics Society (PELS) and the IEEE Industry Applications Society (IAS), in Milwaukee, the heartland of North America’s electric drive and electrical equipment industry.

As the world’s leading technical conference and exposition for energy conversion solutions, ECCE provides a unique opportunity to engineers, researchers, students, and other professionals from the broad spectrum of energy conversion for exchange of technical knowledge, networking, and exposure to the latest technology trends. ECCE is unique in our emphasis on integrated systems, presenting the best in contemporary energy conversion research alongside innovations from more traditional component topics.

ECCE 2016 features keynote speeches from Prof. Arun Majumdar from Stanford University and former Director of ARPA-E; Mr. Blake Moret, CEO of Rockwell Automation; Prof. Massoud Amin from University of Minnesota; Mr. Michael Regelski, CTO/Electrical Sector of Eaton Corporation; and Dr. Guangfu Tang, Vice President, Global Energy Interconnection Research Institute of China. We are extremely fortunate to have these distinguished leaders from industry and academia to share their visions and wisdoms with us on the opening day of the conference.

ECCE 2016 features 925 technical presentations which are selected from an all-time record high 1717 digests submitted from across the globe, organized in 16 parallel oral sessions and 3 consecutive poster dialog sessions. In addition, 7 special sessions are organized by the field experts on timely and practical topics including “Cyber Security of the Grid”, “Modeling and Simulation”, “SiC Devices”, “Electricity and Water Nexus”, and “Advanced Electrical Machines”. Our Town Hall Meetings this year include two moderated debates on “Industrial Internet of Things: Why Do We Care?” and “Close to the Edge: The New Frontier of the Grid” on Tuesday. On Sunday, we have 12 tutorials offering an in-depth discussion of important and complex technical topics which combine practical application with theory.

We are very pleased to acknowledge the support of Wolong Electric (Platinum), ABB (Gold), Danfoss (Gold), Eaton Corporation (Gold), General Motors (Gold), Rockwell Automation (Gold), Delta (Silver), Halla Mechatronics (Silver), and Keysight Technologies (Silver). Their support and participation has created a very strong industrial relationship and relevance. We will have 60 exhibitors in the Exhibition Hall on Monday and Tuesday. The exhibitors will showcase their state-of-the-art technologies, products, and solutions, creating a highly interactive networking environment when mixing with the poster sessions and student demonstrations on the same floor.

Milwaukee offers a unique experience to millions of visitors each year, ranging from its German heritage to its famous beers to Harley Davidson motorcycles to the beautiful lake shore. We will make ECCE 2016 not only a successful technical forum but also a memorable social event for the attendees. On Sunday, we will host our Welcome Reception in the Milwaukee Art Museum, with its landmark modern architecture, and a great view of Lake Michigan. On Wednesday evening, we expect to see you all at the ECCE 2016 Oktoberfest Night to enjoy German folk music and dance, and special Milwaukee brewed Oktoberfest beers. We will also have a special Award Luncheon on Thursday to celebrate the great achievement of some of our colleagues. Technical and city walking tours are also organized during the week.

For many of our attendees, the ECCE conference is like a homecoming event where you can catch up with old friends and meet new ones. ECCE 2016 provides two free-to-use lounges in the convention center. The IAS/PELS Community Lounge can be reserved for exclusive use for group events (school or company reunion, or a quick project review meeting, etc.) on a first-come-first-serve basis. The Creative Digressions Lounge does not need reservation and provides a place for colleagues and friends to hang out and perhaps brainstorm on a few ideas generated during the conference. Complimentary coffee and refreshments will be served in both rooms through the day. For our first time ECCE attendees, we extend you a special welcome by inviting you to a first timer session just before the Sunday Welcome Reception event.

I would like to express my utmost gratitude to the members of the organizing committee, the technical program committee, the steering committee, and Courtesy Associates, who with hard work and selfless dedication have made possible this event. I would like to thank PELS and IAS for their sponsorship and stewardship, and the generous support of our Platinum, Gold, and Silver corporate partners. I would like to thank each and every one of you as a presenter, an attendee, an exhibitor, a volunteer, or any combined role of the above for your contribution and participation.

Once again I welcome you to ECCE 2016. Together we help deliver a more sustainable future.

John Shen
General Chair
Welcome from Technical Program Chairs

Whether it is power converters, motor/motor drives, renewable energy, devices, controls, LED lighting, smart grid or the countless other technical sub-fields related to electrical energy conversion – we are in a period of immense opportunity for our industry. Since the start of the ECCE conference series, there has been a tremendous growth in the numbers of technical papers submitted and attendees to the conference. We are pleased that you consider ECCE to be a flagship conference and worthy of your time as an author and attendee.

This year we have received 1715 digests — more than a 10% increase over the previous record set in 2015. We are able to accept 925 papers into 16 parallel oral sessions and 3 poster sessions. This represents a very competitive 53.9% acceptance rate. In addition, several presentation-only special sessions are scheduled throughout the week.

All submitted digests underwent a rigorous and fair peer review process by subject domain experts. Each paper received a minimum of three (3) reviews with the average of approximately 4.2 reviews per digest. The review process is managed by the Technical Program Committee (TPC), which is comprised of the Chairs, Vice Chairs, and Topic Chairs. Each Reviewer made his/her recommendation to the Topic Chair responsible for that technical sub-track, which then made a recommendation to the Vice Chair responsible for the track, which in-turn made a recommendation to the TPC Chairs. This means that each digest was read by a minimum of: 3 Reviewers + 1 Topic Chair + 1 Vice Chair = 5 members of the technical community. In most cases, this number ranges from 6 to 8.

This year, the TPC Chairs accepted all of the recommendations of the Vice Chairs without subsequent unilateral action. This was a bottom-up process driven by your subject-domain peers. Nevertheless, the TPC Chairs were actively engaged by constantly monitoring the review process and communicating with the Vice Chairs to ensure a uniform acceptance standard across all the tracks. In addition, the TPC Chairs accepted most of the recommendations of the Vice-Chairs with regard to format (oral/poster) selection and session groupings. In a limited number of cases, the TPC Chairs did make decisions subsequent to the Vice-Chair recommendations as needed to balance the overall technical program.

It is the official policy of the TPC that all accepted papers are considered to be of equal technical quality and merit, irrespective of whether selected for oral or poster session. Other than for programmatic identification, there will be no distinction made between papers presented in an oral or poster session. Papers will be uploaded to IEEE Explore Digital Library without any differentiation. Please reference this official conference policy if your institution requires conference attendance justification.

On behalf of the entire Technical Program Committee, we firmly believe that you will consider 2016 to be the best ECCE yet. We look forward to seeing you in Milwaukee. Once again, we wanted to thank all of you who have contributed to ECCE2016 as an author, reviewer, or TPC member.

Sincerely,

Robert S. Balog
Texas A&M University

Avoki Omekanda
General Motors – R&D Center

Maryam Saeedifard
Georgia Institute of Technology

ECCE 2016 Technical Program Chairs
On behalf of the IEEE Power Electronics Society and Industry Applications Society, it gives us immense pleasure to welcome you all to Milwaukee to attend the 8th Annual IEEE Energy Conversion Congress and Exposition (ECCE). Considering the growing importance of electrical energy conversion driven by the urgent need to reduce carbon emissions and save energy, the two Societies came together to establish the first ECCE in 2009. The objective was to provide a forum for the exchange of information among students, researchers and practicing professionals in the energy conversion business. ECCE 2016 organizing committee has worked diligently so we can once again bring together both users and researchers of energy conversion systems and sub systems with an emphasis on the content of technical papers and on the quality of the growing exposition.

Whether you are a first time attendee or regular attendee since 2009 or anything in between, we encourage you to enjoy the ECCE experience, create new networks and get involved in the organization of the future ECCE’s. The technical committees of the two Societies work hard in consistently delivering an excellent technical program at ECCE. The committees conduct their meetings at various times during ECCE (Please refer to the meeting calendar in the program booklet) and are open to all Society members. If you are not a Society member, please visit the Society booth at the exposition area and become a member (see the free first year membership offer at the booth). The Society volunteers will be ready to answer any questions you may have.

Many thanks to our ECCE 2016 General Chair Prof. John Shen and his dedicated organizing committee who have developed an excellent program that is rich in its technical content with plenty of socializing opportunities. Please make use of this opportunity to network with other professionals in the energy conversion area. It is our hope that all the interactions and technical programs will give you and your organization the tools to advance the field and address the challenges of the industry.

Again, on behalf of both Societies, we welcome you to Milwaukee and wish you a pleasant and productive conference!
Organizing Committee

General Chair
John Shen, Illinois Institute of Technology, USA

Technical Program Chairs
Robert Balog, Texas A&M University, USA
Avoki Omekanda, General Motors, USA
Maryam Saeedfard, Georgia Institute of Technology, USA

Finance Chair
Jin Wang, Ohio State University, USA

Industrial Partnership Chair
Bruno Lequesne, E-Motors Consulting, USA

Exhibition Chair
Navid Zargari, Rockwell Automation, Canada

Plenary Chairs
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Iqbal Husain, North Carolina State University, USA

Tutorial Chairs
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Qingchang Zhong, Illinois Institute of Technology, USA

Local Arrangement Chairs
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Rob Cuzner, University of Wisconsin Milwaukee, USA

Special Sessions and Town Hall Meetings Chair
Pete Wung, General Electric Aviation, USA

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David Morrison, How2Power, USA

Publication Chair
Ian Brown, Illinois Institute of Technology, USA

Student Activities Chairs
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Sheldon Williamson, UOIT, Canada

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Jennifer Vining, Oscilla Power, USA

Student Travel Grant Chair
Mahesh Krishnamurthy, Illinois Institute of Technology, USA

Awards Program Chair
Tom Habetler, Georgia Institute of Technology, USA

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Annie Foster, Courtesy Associates, USA
Nataki Hemmings, Courtesy Associates, USA
Michelle Brereton, Courtesy Associates, USA
John Heiser, Courtesy Associates, USA

Conference App
Scan here to check out the ECCE 2016 Conference App and get the latest conference information
Renewable and Sustainable Energy Applications
Sudip K. Mazumder (Vice Chair), University of Illinois Chicago, USA
Yilmaz Sozer (Vice Chair), University of Akron, USA
Bilal Akin, UT Dallas, USA
Francisco Canales, ABB Corporate Research, Switzerland
Jaeho Choi, Chungbuk National University, South Korea
Ahmed Elasser, GE Global Research Center, USA
Ali Elrayyah, Qatar Environment and Energy Research Institute, Qatar
Liming Liu, ABB, USA
Ke Ma, Aalborg University, Demark
Martin Ordenez, UBC, Canada
Akshay Kumar Rathore, National University of Singapore, Singapore
Tirthajyoti Sarkar, Fairchild Semiconductor, USA
Dezso Sera, Aalborg University, Denmark
Jin Wang, Ohio State University, USA

Smart Grid & Utility Applications
Adel Nasiri (Vice Chair), University of Wisconsin-Milwaukee, USA
Amirnaser Yazdani (Vice Chair), Ryerson University, Canada
Omar Abdel-baqi, Caterpillar, USA
Mahshid Amirabadi, Northeastern University, USA
Ali Davoudi, University of Texas at Arlington, USA
Kumar Dinesh, Danfoss Drives A/S, USA
Qiang Fu, Eaton, USA
Hui Li, Florida State University, USA
Xiaonian Lu, Argonne National Laboratory, USA
Goran Mandic, Eaton, USA
Ali Mehrizi-Sani, Washington State University, USA
Behrooz Mirafzal, Kansas State University, USA
Yogesh Patel, Rockwell Automation, USA
Liyan Qu, University of Nebraska Lincoln, USA
Akshay Kumar Rathore, National University of Singapore, Singapore
Tiefei Zhao, University of North Carolina-Charlotte

Transportation Electrification Applications
Bulent Sarlioglu (Vice Chair), University of Wisconsin-Madison, USA
Anand Sathyan (Vice Chair), FCA US LLC, USA
Sachin Bhide, FCA US LLC, USA
Berker Bilgin, McMaster University, Canada
Bing Cheng, Mercedes Benz R&D, USA
Hossein Dadkhah, FCA US LLC, USA
Gurunath Kedar Dongarkar, FCA US LLC, USA
Suresh Gopalakrishnan, General Motors, USA
Oliver Gross, FCA US LLC, USA
Alessandro Lidozzi, ROMA TRE University, Italy
Francesco Cupertino, Politechnico Bari, Italy

Power Converter Topologies
Ali Khajehoddin (Vice Chair), University of Alberta, Canada
Grant Pitel (Vice Chair), Magna-Power Electronics, USA
Yunwei (Ryan) Li (Vice Chair), University of Alberta, Canada
Ali Bazzi, University of Connecticut, USA
Jack Bourne, NWL, USA
Rob Cuzner, University of Wisconsin—Milwaukee, USA
Michael Harke, UTC Aerospace Systems, USA
Houshang Karimi, Polytechnique Montreal, Canada
Masoud Karimi-Ghartemani, Mississippi state university, USA
Greg Kish, University of Alberta, Canada
Ali Mehrizi-Sani, Washington State University, USA
Ali Reza Safaei, OSRAM SYLVANIA, USA
Giri Venkataramanan, University of Wisconsin-Madison, USA

Control, Modelling and Optimization of Power Converters
Luca Solero (Vice Chair), Roma Tre University, Italy
Pericle Zanchetta (Vice Chair), University of Nottingham, UK
Stefano bifaretti, University of Rome Tor Vergata, Italy
Maurizio Cirrincione, University of South Pacific, Fiji
David Diaz, University of Oviedo, Spain
Andrea Formentini, University of Nottingham, UK
Alessandro Lidozzi, ROMA TRE University, Italy
Giovanna Oriti, Naval Postgraduate School, USA
Roberto Petrella, DIEG - University of Udine, Italy
Matthias Preindl, University of Columbia, USA
Marcello Pucci, ISSIA-CNR, Italy
Jon Are Suul SINTEF, Norwegian University of Science and Technology, Norway
Lixiang Wei, Rockwell Automation, USA
Navid Zargari, Rockwell Automation, Canada

Electrical Machines
Emmanuel Agamloh (Vice Chair), Advanced Energy, USA
Akira Chiba (Vice Chair), Tokyo Institute of Technology, Japan
Luigi Alberti, Free University of Bozen-Bolzano, Italy
Ali Bazzi, University of Connecticut, USA
Nicola Bianchi, University of Padova, Italy
Andrea Cavagnino, Politecnico di Torino, Italy
Francesco Cupertino, Politecnico Bari, Italy
Program Subcommittees (continued)

Giulio De Donato, University of Rome “La Sapienza”, Italy
David Díaz Reigosa, University of Oviedo, Spain
Abraham Gebregergis, Halla Mechatronics, USA
Greg Heins, Regal Beloit, USA
Mohammad Islam, Halla Mechatronics, USA
Sang Bin Lee, Korea University, South Korea
Renato Lyra, Aerotech Inc., USA
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Wen Ouyang, ABB US Corporate Research Center, USA
Yves Perriard, EPFL, Switzerland
Rashmi Prasad, General Motors, USA
Marcello Pucci, ISSIA-CNR, Italy
Ronghai Qu, Huazhong University of Science and Technology, China
Khwaja Rahman, General Motors, USA
Manoj Shah, GE - Global Research, USA
Thomas Wu, University of Central Florida, USA
Wei Xu, Huazhong University of Science and Technology, USA
Shih-Chin Yang, National Taiwan University, Taiwan
Julia Zhang, Oregon State University, USA

Electric Drives
Fabio Giulii Capponi (Vice Chair), University of Roma “La Sapienza”, Italy
Mahesh Swamy (Vice Chair), Yaskawa America, Inc., USA
Davide Barater, University of Parma, Italy
Ali Bazzi, University of Connecticut, USA
Nicola Bianchi, University of Padova, Italy
Wenping Cao, Aston University, UK
Mazharul Chowdhury, Halla Mechatronics, USA
Uday Deshpande, Ingersoll Rand, USA
David Díaz Reigosa, University of Oviedo, Spain
Rukmi Dutta, UNSW, Australia
Marko Hinkkanen, Aalto University, Finland
Rakib Islam, Nexteer Automotive, USA
Dong Jiang, Huazhong University of Science and Technology, China
Antonio J. Marques Cardoso, University of Beira Interior, Portugal
Di Pan, GE Global Research, USA
Gianmario Pellegrino, Politecnico di Torino, Italy
Roberto Petrella, DIEG - University of Udine, Italy
Prerit Pramod, Nexteer Automotive Corporation, USA
Rashmi Prasad, General Motors, USA
Ramakrishnan Raja, Halla Mechatronics, USA
Giacomo Scelba, University of Catania, Italy
Stefan Schroeder, GE Global Research, USA
Jul-Ki Seok, Yeungnam University, South Korea
Takahiro Suzuki, Hitachi, Ltd., Japan
Shih-Chin Yang, National Taiwan University, Taiwan
Pinjia Zhang, Tsinghua University, China
Yue Zhao, University of Arkansas, USA

Power Semiconductor Devices, Passive Components, Packaging, Integration, and Materials
Shashank Krishnamurthy (Vice Chair), UTRC, USA
Ty McNutt (Vice Chair), Wolfspeed, a Cree Company, USA
Daniel Costinett, University of Tennessee, USA
Muhammad Nawaz, ABB Corporate Research, Sweden
Jelena Popovic, Delft University of Technology, Netherlands
Pradeep S. Shenoy, Texas Instruments, USA
Charles Sullivan, Dartmouth College, USA
Ruxi Wang, General Electric Global Research Center, USA

Energy Efficiency Systems and Applications
Dehong Xu (Vice Chair), Zhejiang University, China
Khurram Afridi (Vice Chair), University of Colorado Boulder, USA
Francisco Canales, ABB Corporate Research, Switzerland
David Perreault, Massachusetts Institute of Technology, USA

Emerging Technologies and Applications
Tsong-Ju Ju Liang (Vice Chair), National Cheng Kung University, Taiwan
Yao-Suo “Sonny” Xue (Vice Chair), Oak Ridge National Laboratory, USA
Yaow-Ming Chen, National Taiwan University, Taiwan
Huang-Jen Chiu, National Taiwan University of Science and Technology, Taiwan
Oscar Lucia, University of Zaragoza, Spain
Huai Wang, Aalborg University, Denmark
Jin Wang, Ohio State University, USA
Francisco Canales, ABB Corporate Research, Switzerland
David Perreault, Massachusetts Institute of Technology, USA

Datacenters and Telecommunication Applications
Robert Pilawa-Podgurski (Vice Chair), University of Illinois Urbana-Champaign, USA
Alexis Kwasinski (Vice Chair), University of Pittsburgh, USA
Milwaukee Fun Facts

- Largest city in the state of Wisconsin with a population of 2.2 million
- There are 17 museums in downtown Milwaukee and 25 including the surrounding counties
- There are 150 restaurants in downtown Milwaukee
- Home to 12 major colleges and universities
- Home to over 150 state and country parks
- Nicknamed Cream City because of its distinctive cream-colored brick and Brew City because of its rich brewing history
- 7 Fortune 500 Companies in the City including Johnson Controls, Rockwell Automation and Harley-Davidson
**Saturday, September 17th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:00PM – 7:00PM</td>
<td>Registration</td>
</tr>
</tbody>
</table>

**Sunday, September 18th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00AM – 7:00PM</td>
<td>Registration</td>
</tr>
</tbody>
</table>

**AM Tutorials • 8:00AM – 12:00PM**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>101B</td>
<td>T1-1: Mechanical, Solid State and Hybrid Circuit Breakers for Protection of DC and AC Grids</td>
</tr>
<tr>
<td>101CD</td>
<td>T1-2: Principles and Applications of Modular Multilevel Converters</td>
</tr>
<tr>
<td>102B</td>
<td>T1-3: Linearized Modeling and Stability Analysis of AC Power Electronic Based Power Systems</td>
</tr>
<tr>
<td>102C</td>
<td>T1-4: The Origin of Converters</td>
</tr>
<tr>
<td>102D</td>
<td>T1-5: Advanced High-Power Industrial Drives</td>
</tr>
<tr>
<td>103C</td>
<td>T1-6: Power Semiconductors for Vehicle Traction Inverters: From Discretes to Power Modules, from Silicon to Wide Band Gap Devices</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00PM – 1:00PM</td>
<td>Lunch on Your Own</td>
</tr>
</tbody>
</table>

**PM Tutorials • 1:00PM – 5:00PM**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>101B</td>
<td>T2-1: Electric Machine Design for Automotive Applications</td>
</tr>
<tr>
<td>101CD</td>
<td>T2-2: High Power Si &amp; SiC Module Technology &amp; Application Considerations</td>
</tr>
<tr>
<td>102B</td>
<td>T2-3: Shipboard DC Microgrids</td>
</tr>
<tr>
<td>102C</td>
<td>T2-4: Renewables, Energy Storage and Power Electronics as Enabling Technologies for the Smart Grid</td>
</tr>
<tr>
<td>102D</td>
<td>T2-5: Modeling and Control of Grid Inverters</td>
</tr>
<tr>
<td>103C</td>
<td>T2-6: Predictive Control - A Simple and Powerful Method of Control Power Converters and Drives</td>
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<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>5:30PM – 7:30PM</td>
<td>Opening Reception</td>
</tr>
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</table>

**Monday, September 19th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00AM – 7:00PM</td>
<td>Registration</td>
</tr>
<tr>
<td>8:30AM – 12:00PM</td>
<td>Plenary Session</td>
</tr>
<tr>
<td>10:30AM – 10:50AM</td>
<td>AM Break</td>
</tr>
<tr>
<td>12:30PM – 1:30PM</td>
<td>Lunch on Your Own</td>
</tr>
<tr>
<td>12:30PM – 4:00PM</td>
<td>Exhibitor Products and Services Sessions</td>
</tr>
</tbody>
</table>

**Oral Sessions • 1:30PM – 4:00PM**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>203DE</td>
<td>S1: Modular Multi-Level Converters</td>
</tr>
<tr>
<td>203C</td>
<td>S2: Renovable Energy I</td>
</tr>
<tr>
<td>203A</td>
<td>S3: Modeling, Analysis, and Control of Grid-Connected Converters</td>
</tr>
<tr>
<td>202D</td>
<td>S4: DC-DC Converters: Switched Capacitor</td>
</tr>
<tr>
<td>202E</td>
<td>S5: Multi-Phase Rectifiers</td>
</tr>
<tr>
<td>202AB</td>
<td>S6: Single-Phase Inverters</td>
</tr>
<tr>
<td>202C</td>
<td>S7: DC-DC Converters I</td>
</tr>
<tr>
<td>202B</td>
<td>S8: DC-DC: Dual Active Bridge</td>
</tr>
<tr>
<td>202A</td>
<td>S9: Electromagnetic Interference (EMI) in Power Converters</td>
</tr>
<tr>
<td>202D</td>
<td>S10: Modeling and Control of DC-AC Converters I</td>
</tr>
<tr>
<td>202C</td>
<td>S11: Induction Machines</td>
</tr>
<tr>
<td>201D</td>
<td>S12: Prof. S. Nandi Memorial Session: Diagnostics of Electric Machines</td>
</tr>
<tr>
<td>201B</td>
<td>S13: Control of Electric Drives</td>
</tr>
<tr>
<td>202B</td>
<td>S14: Medium Voltage Drives and High Power Drives</td>
</tr>
<tr>
<td>201C</td>
<td>S15: Power Modules</td>
</tr>
<tr>
<td>202C</td>
<td>S16: Wireless Power Transfer I</td>
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</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>4:00PM – 8:00PM</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00PM – 8:00PM</td>
<td>Expo Reception</td>
</tr>
<tr>
<td>4:10PM – 6:30PM</td>
<td>Student Demonstrations</td>
</tr>
<tr>
<td>5:30PM – 7:00PM</td>
<td>Poster Session I</td>
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</table>

**Tuesday, September 20th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>7:30AM – 5:30PM</td>
<td>Registration</td>
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**Oral Sessions • 8:30AM – 11:00AM**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>203AB</td>
<td>S17: Photovoltaic Converters</td>
</tr>
<tr>
<td>203DE</td>
<td>S18: Modular Multi-Level Converters</td>
</tr>
<tr>
<td>203C</td>
<td>S19: Renovable Energy II</td>
</tr>
<tr>
<td>203A</td>
<td>S20: Utility Applications I</td>
</tr>
<tr>
<td>202D</td>
<td>S21: Electric Machines for Transportation Electrification</td>
</tr>
<tr>
<td>202E</td>
<td>S22: Multilevel Converter Applications</td>
</tr>
<tr>
<td>202C</td>
<td>S23: Modelling and Control of DC-DC Converters I</td>
</tr>
<tr>
<td>202B</td>
<td>S24: Modulation Techniques I</td>
</tr>
<tr>
<td>202A</td>
<td>S25: Model Predictive Control of Power Converters</td>
</tr>
<tr>
<td>202D</td>
<td>S26: Reluctance Machines</td>
</tr>
<tr>
<td>202C</td>
<td>S27: Materials and Manufacturing Issues of Electric Machines</td>
</tr>
<tr>
<td>202B</td>
<td>S28: Induction Motor Drives</td>
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<tr>
<td>202A</td>
<td>S29: PM and IRM Motor Drives I</td>
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<tr>
<td>202D</td>
<td>S30: Wide Bandgap Applications: Comparative Studies</td>
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<tr>
<td>201A</td>
<td>S31: Control of Electric Drives</td>
</tr>
<tr>
<td>201D</td>
<td>S32: Wireless Power Transfer I</td>
</tr>
<tr>
<td>201B</td>
<td>S33: Simulation and Modelling</td>
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<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>11:20AM – 5:30PM</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>11:20AM – 12:30PM</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>11:10AM – 11:30AM</td>
<td>AM Break</td>
</tr>
<tr>
<td>1:00PM – 2:30PM</td>
<td>Lunch</td>
</tr>
<tr>
<td>3:00PM – 4:30PM</td>
<td>Poster Session III</td>
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<tr>
<td>4:30PM – 5:00PM</td>
<td>PM Break</td>
</tr>
<tr>
<td>5:30PM – 7:30PM</td>
<td>Town Hall I: Internet of Things: Why Do We Care?</td>
</tr>
<tr>
<td>5:30PM – 7:30PM</td>
<td>Town Hall II: Close to the Edge: The New Frontier of the Grid</td>
</tr>
</tbody>
</table>
### Wednesday, September 21st

**7:30AM – 5:30PM**  
Registration

**Main Lobby Foyer – 1st Floor Wisconsin Center**

#### Oral Sessions • 8:30AM – 10:10AM

|-------|------|------|------|-------|------|------|------|------|------|------|-------|------|------|------|------|

**10:10AM – 10:30AM**  
AM Break

#### Oral Sessions • 10:30AM – 12:10PM

|-------|------|------|------|-------|------|------|------|------|------|------|-------|------|------|------|------|

**12:10PM – 2:00PM**  
Lunch on Your Own

#### Oral Sessions • 1:30PM – 3:10PM

|------|------|------|------|-------|------|------|------|------|------|------|-------|------|------|------|------|

**3:10PM – 3:30PM**  
PM Break

#### Oral Sessions • 3:30PM – 5:10PM

|-------|------|------|------|-------|------|------|------|------|------|------|-------|------|------|------|------|

**7:00PM – 9:30PM**  
ECCE Oktoberfest Banquet
Thursday, September 22nd

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30AM – 12:00PM</td>
<td><strong>Registration</strong></td>
<td>Main Lobby Foyer — 1st Floor Wisconsin Center</td>
</tr>
<tr>
<td>10:10AM – 10:30AM</td>
<td><strong>AM Break</strong></td>
<td>100/200 Foyers</td>
</tr>
<tr>
<td>12:10PM – 2:00PM</td>
<td><strong>Awards Luncheon</strong></td>
<td>Ballroom ABCD</td>
</tr>
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### Oral Sessions • 8:30AM – 10:10AM

<table>
<thead>
<tr>
<th>Session Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>203AB</td>
<td>597: Converter</td>
</tr>
<tr>
<td>203C</td>
<td>598: Energy Storage Systems</td>
</tr>
<tr>
<td>101B</td>
<td>599: Power Quality I</td>
</tr>
<tr>
<td>203DE</td>
<td>600: AC Microgrids I</td>
</tr>
<tr>
<td>102D</td>
<td>601: Battery Management for Transportation Electrification I</td>
</tr>
<tr>
<td>202A</td>
<td>602: Grid</td>
</tr>
<tr>
<td>202B</td>
<td>603: D Modular</td>
</tr>
<tr>
<td>202C</td>
<td>604: DC-DC Isolated: LLC</td>
</tr>
<tr>
<td>202D</td>
<td>605: Modeling and Control of Grid</td>
</tr>
<tr>
<td>202E</td>
<td>606: Fault Propensity for Power Devices</td>
</tr>
<tr>
<td>101A</td>
<td>607: Thermal Analyses of Electric Machines</td>
</tr>
<tr>
<td>101CD</td>
<td>608: Control of Electric Drives II</td>
</tr>
<tr>
<td>202C</td>
<td>609: Control of Power Devices</td>
</tr>
<tr>
<td>102A</td>
<td>610: Power Magnetics I</td>
</tr>
<tr>
<td>102E</td>
<td>611: Grid Synchronization</td>
</tr>
<tr>
<td>103C</td>
<td>612: Advanced Electrical Machines</td>
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### Oral Sessions • 10:30AM – 12:10PM

<table>
<thead>
<tr>
<th>Session Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>203AB</td>
<td>1103: Electric</td>
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<tr>
<td>203C</td>
<td>1114: Converter Topologies for Energy Storage Systems</td>
</tr>
<tr>
<td>203DE</td>
<td>1115: AC Microgrids II: Sharing and Coordination</td>
</tr>
<tr>
<td>102D</td>
<td>1116: Batteries and Battery Management for Transportation Electrification II</td>
</tr>
<tr>
<td>102A</td>
<td>1117: Multi-Phase Inverter</td>
</tr>
<tr>
<td>202A</td>
<td>1118: AC-AC Converters I</td>
</tr>
<tr>
<td>202B</td>
<td>1119: Modular Multilevel Converters (MMC) II</td>
</tr>
<tr>
<td>202C</td>
<td>1120: DC-DC Resonant</td>
</tr>
<tr>
<td>102D</td>
<td>1121: Modeling and Control of Grid Conected Convert-er II</td>
</tr>
<tr>
<td>101B</td>
<td>1122: Power Quality II</td>
</tr>
<tr>
<td>102A</td>
<td>1123: Stability in Power Converters I</td>
</tr>
<tr>
<td>102E</td>
<td>1124: Non-Conventional Machine Configurations I</td>
</tr>
<tr>
<td>101A</td>
<td>1125: Noise and Vibration Issues in Electric Machines</td>
</tr>
<tr>
<td>101CD</td>
<td>1126: Electrical Drives for Aerospace and Traction Applications</td>
</tr>
<tr>
<td>102A</td>
<td>1127: Magneticics II</td>
</tr>
<tr>
<td>102C</td>
<td>1128: Device Short Circuit Capability</td>
</tr>
<tr>
<td>103C</td>
<td>1129: Advanced Electrical Machines II</td>
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</table>

### Oral Sessions • 2:00PM – 3:40PM

<table>
<thead>
<tr>
<th>Session Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>203AB</td>
<td>1229: DFIG Based Wind Power Systems</td>
</tr>
<tr>
<td>203C</td>
<td>1230: Utility Scale Battery Systems</td>
</tr>
<tr>
<td>203DE</td>
<td>1231: AC Microgrids III: Operation, Control and Energy Management</td>
</tr>
<tr>
<td>202D</td>
<td>1232: Battery Charging for Transportation Electrification</td>
</tr>
<tr>
<td>202A</td>
<td>1233: Three-Phase Inverter PVM</td>
</tr>
<tr>
<td>202E</td>
<td>1234: AC-AC Converters II</td>
</tr>
<tr>
<td>202B</td>
<td>1235: Modular Multilevel Converters (MMC) III</td>
</tr>
<tr>
<td>202D</td>
<td>1236: DC-DC Isolated: Converters</td>
</tr>
<tr>
<td>101B</td>
<td>1237: Modeling and Control of DC-AC Converters II</td>
</tr>
<tr>
<td>202C</td>
<td>1238: Stability in Power Converters II</td>
</tr>
<tr>
<td>101A</td>
<td>1239: Design Optimization of Power Converters,</td>
</tr>
<tr>
<td>102B</td>
<td>1240: Active Power Filters</td>
</tr>
<tr>
<td>101CD</td>
<td>1241: Non-Conventional Machine Configurations II</td>
</tr>
<tr>
<td>102A</td>
<td>1242: Magnetic Gears</td>
</tr>
<tr>
<td>103C</td>
<td>1243: High Speed and Direct Drives</td>
</tr>
<tr>
<td>S144</td>
<td>1244: Power Assemblies</td>
</tr>
</tbody>
</table>
Plenary Session
The plenary session features keynote speeches from Prof. Arun Majumdar from Stanford University and former Director of ARPA-E; Mr. Blake Moret, CEO of Rockwell Automation; Prof. Massoud Amin from University of Minnesota; Mr. Michael Regelski, CTO/Electrical Sector of Eaton Corporation; and Dr. Guangfu Tang, Vice President, Global Energy Interconnection Research Institute of China on a wide range of topics related to energy and sustainability. We are extremely fortunate to have these distinguished leaders from industry and academia to share their visions and wisdoms with us on the opening day of the conference.

Oral Sessions
The Technical Program Committee organized a rigorous peer review process and has carefully picked over 600 papers making up 16 parallel Oral Sessions. The technical program includes papers of broad appeal scheduled for oral presentation from Monday afternoon through Thursday morning. The various technical venues cover all areas of technical interest to the practicing power electronics professional. The papers are sure to give you many new design ideas that you can apply to your work immediately.

Poster Sessions
ECCE’s poster sessions gives our attendees a unique opportunity to engage in discussions with 300 or so presenters in a way more interactive and more in depth way than possible in oral sessions. Each of our 3 poster presentation sessions will allow nearly 100 ideas to be viewed by our ECCE community. Our poster presenters will have an hour and a half to present their topics over the course of Monday evening and throughout the day on Tuesday. A broad range of topics and ideas will be covered during these interactive dialogues.

Town Hall Meetings
Town Halls serve as a public forum during the conference to discuss topics that are state of the art, controversial, forward looking, and motivate creative and innovative thinking. Town Halls create interaction between a panel of experts and attendees. It could become a massive debate with opportunities for a lot of back and forth. The panel will give their opinions and thought on the topic while also fielding dissenting opinions and questions. Beer and chips will be provided. Join us on Tuesday from 5:30 – 7:30 PM for moderated discussion on the following topics:

- Industrial Internet of Things: Why Do We Care?
- Close to the Edge: The New Frontier of the Grid

Special Sessions
We are pleased to offer 7 special sessions this year presented by a field of experts Tuesday through Thursday. These presentation-only sessions are focused on timely and practical topics in the field.

Exhibitor Products and Services Sessions
ECCE is the ideal place for companies to exhibit and promote their products and services for and by savvy engineers, industry veterans and fresh startups alike to stay abreast of the research. These half-hour, industry-driven sessions, provide an in-depth look off the show floor from our exhibitors, showcasing their innovative products and services. The sessions will occur Monday afternoon in Room 103C.

Exhibit Hall Opening Reception
Join us for the opening of the ECCE 2016 Exhibit Hall! Enjoy a drink and hor d’oeuvres 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. The Hall opens Monday, September 19th – 4:00 PM to 8:00 PM in the Wisconsin Center Exhibit Hall A.

Student Demonstrations
Since 2011, ECCE has introduced the hardware demo event for students to showcase their research outcomes and interact with academia and industry. This year’s selected students were chosen from an impressive group of applicants. Visit the Student Demonstration Lounge in the Exhibit Hall A and support the social network among students from different universities and countries as they demonstrate their research on emerging technology. The Student Demonstration Lounge is open during Exhibit Hall hours.

Social Events
Social events provide an opportunity for attendees to network in a social setting and to further indulge in conversation around the conference or to simply catch up with an old friend or colleague! Special events also allow attendees the chance to relax and unwind and become acquainted with the conference city. This year’s conference includes some of the following special events: Opening Reception at the Milwaukee Art Museum, ECCE’s Banquet Oktoberfest, and an Award Luncheon to recognize and honor outstanding folks in the industry. You will need tickets for admission into these events.

Sunday Welcome Reception
The conference will host a Sunday Reception in the Milwaukee Art Museum, with its landmark modern architecture, and a great view of Lake Michigan. The museum is only 15 minute walk from the convention center. Bus service is available for those who wish to use. 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. For the first time ECCE attendees, you will have a unique opportunity to get through the museum door 30 minutes before everyone else and enjoy a special orientation session. Join us on Sunday from 5:30 – 7:30 PM (Bus leaves Convention Center 5:00-5:30, and returns 7:00-8:00)

Wednesday Oktoberfest Banquet
Milwaukee is proud of its German heritage and its beer brewing history. There is no better way to celebrate our conference than a true Oktoberfest themed banquet. Milwaukee brewed special Oktoberfest beers and non-alcohol drinks will be served in our own ECCE beer steins that are for you to take home as souvenirs. Folk music and dance performance will make you forget about these technical topics for a moment or two. Join us on Wednesday from 7:00 – 9:30 PM in Ballroom ABCD.

Thursday IEEE Award Luncheon
We will gather to celebrate the great achievement of some of our colleagues at our traditional IEEE Award Luncheon event. Join us on Thursday from 12:10 – 2:00 PM in Ballroom ABCD.

Newcomer’s Orientation
ECCE has grown into a very large conference, the amount of parallel activities is staggering. This session is our service to our first time attendees, serving as the introductory session for our colleagues who have not been to our conference before. We will cover everything that you need to know about the conference, the schedules, all of the program offerings, some behind the curtain tricks and tidbits to help the first time attendee to get comfortable and be able to confidently navigate this conference week.

The ECCE Steering Committee members will be presenting and answering your questions regarding any issues that you may have regarding the conference.
### Detailed Schedule

#### Saturday, September 17th

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>10:00 AM</td>
<td>Opening Reception</td>
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#### Sunday, September 18th

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 AM</td>
<td>Registration</td>
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#### Tutorials Group 1 • 8:00 AM – 12:00 PM

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
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<tbody>
<tr>
<td>101B</td>
<td>T1-1: Mechanical, Solid State and Hybrid Circuit Breakers for Protection of DC and AC Grids</td>
</tr>
<tr>
<td>102C</td>
<td>T2-2: High Power Si &amp; SC Module Technology &amp; Application Considerations</td>
</tr>
<tr>
<td>103B</td>
<td>T3-3: Shipboard DC Microgrids</td>
</tr>
<tr>
<td>104C</td>
<td>T4-4: Renewables, Energy Storage and Power Electronics as Enabling Technologies for the Smart Grid</td>
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<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>10:00 AM</td>
<td>Registration</td>
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#### Oral Sessions • 1:30 PM – 12:30 PM

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
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<tbody>
<tr>
<td>201B</td>
<td>S1: Modular Multi-Level Converters, HV DC, and DC Grids</td>
</tr>
<tr>
<td>202A</td>
<td>S2: Renewable Energy I</td>
</tr>
<tr>
<td>203B</td>
<td>S3: DC-DC Converters: Switched Capacitor</td>
</tr>
<tr>
<td>204B</td>
<td>S4: Analytical, Analysis, and Control of Grid-Connected Converters</td>
</tr>
<tr>
<td>205B</td>
<td>S5: Multi-Phase Rectifiers</td>
</tr>
<tr>
<td>206A</td>
<td>S6: Single-Phase Inverters</td>
</tr>
<tr>
<td>207B</td>
<td>S7: DC-DC Converters: Multi-Phase Rectifiers</td>
</tr>
<tr>
<td>208B</td>
<td>S8: Dual Active Bridge</td>
</tr>
<tr>
<td>209B</td>
<td>S9: Electromagnetic Interference (EMI) in Power Converters</td>
</tr>
<tr>
<td>210B</td>
<td>S10: Modeling and Control of DC–AC Converters I</td>
</tr>
<tr>
<td>211B</td>
<td>S11: Induction Machines</td>
</tr>
<tr>
<td>212B</td>
<td>S12: Prof. S. Sand’s Memorial Session: Diagnostics of Electric Machines</td>
</tr>
<tr>
<td>213B</td>
<td>S13: Control of Electric Drives I</td>
</tr>
<tr>
<td>214B</td>
<td>S14: Medium Voltage Drives and High Power Drives</td>
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<tr>
<td>215B</td>
<td>S15: Power Modules</td>
</tr>
<tr>
<td>216B</td>
<td>S16: Wireless Power Transfer I</td>
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#### Lunch on Your Own

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<thead>
<tr>
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<tbody>
<tr>
<td>12:00 PM</td>
<td>Lunch on Your Own</td>
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#### Monday, September 19th

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>8:00 AM</td>
<td>Registration</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>AM Break</td>
</tr>
<tr>
<td>12:00 PM</td>
<td>Lunch on Your Own</td>
</tr>
<tr>
<td>12:30 PM</td>
<td>Exhibitor Products and Services Sessions</td>
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### Detailed Schedule

**Monday, September 19th (continued)**

<table>
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<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td><strong>Oral Sessions • 120PM – 4:00PM (continued)</strong></td>
<td></td>
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<tr>
<td>2:00PM – 2:45PM</td>
<td>S1: Modular Multi-Level Converters, HVDC, and DC Grids I</td>
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<tr>
<td></td>
<td>S2: Renewable Energy I</td>
</tr>
<tr>
<td></td>
<td>S3: Modelling, Analysis, and Control of Grid-Connected Converters</td>
</tr>
<tr>
<td></td>
<td>S4: DC-DC Converters: Switched Capacitor</td>
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<td>S5: Multi-Phase Rectifiers</td>
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<td></td>
<td>S6: Single-Phase Converters</td>
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<td></td>
<td>S7: DC-DC Dual Active Bridge</td>
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<td></td>
<td>S8: Electro-magnetic Interference (EMI) in Power Converters</td>
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<td></td>
<td>S9: Modelling and Control of DC-AC Converters</td>
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<td>S10: Induction Machines</td>
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<td></td>
<td>S11: High Voltage and High Power Drives</td>
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<td></td>
<td>S12: Control of Electrical Drives I</td>
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<td></td>
<td>S13: DC-DC Dual Active Bridge</td>
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<td></td>
<td>S14: Renewable Energy I</td>
</tr>
<tr>
<td></td>
<td>S15: Wireless Power Transm. II</td>
</tr>
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</table>

| 2:45PM – 3:10PM | S10: Renewable Energy I                                               |
| 3:10PM – 3:35PM | S11: Medium Voltage Drives and High Power Drives                      |
| 3:35PM – 4:00PM | S12: Control of Electrical Drives I                                   |
| 4:00PM – 8:00PM | D1: Wireless Power Transm. II                                        |
| 8:00PM – 8:30PM | Student Demonstrations                                                |
| 8:30PM – 9:00PM | 2016 IEEE ENERGY CONVERSION CONGRESS & EXPOSITION®                   |

**Exhibit Hall A**

- **4:00PM – 8:00PM**: Exhibit Hall Open
- **4:00PM – 8:00PM**: Expo Reception
- **5:00PM – 7:00PM**: Poster Session I
- **4:00PM – 8:00PM**: Exhibit Hall A
- **4:00PM – 8:00PM**: Exhibit Hall A
### Detailed Schedule

#### Tuesday, September 20th

**8:30 AM – 8:55 AM**
- Low Power Factor Operation of the Interconnection with Power Decoupling Function

**8:55 AM – 9:20 AM**
- Stand-Alone Photovoltaic Asynchronous Generator

**9:20 AM – 9:45 AM**
- Several Small Scale Load Centers Supplying a DC Power Cable Between Multi-Grounded Grids

**9:45 AM – 10:10 AM**
- A Novel Two-Stage DC-DC Converter for Solar Photovoltaic Arrays with Active and Passive Decoupling

**10:10 AM – 10:35 AM**
- Low Line Current Transformer Three-Phase Photovoltaic Inverters

**10:35 AM – 11:00 AM**
- Operation of Dual Input Current Transformer Photovoltaic Inverters for Unbalanced and Grid Voltage Condition

**11:00 AM – 11:25 AM**
- Exhibit Hall Open

**11:25 AM – 11:30 AM**
- Lunch

**11:30 AM – 12:00 PM**
- AM Break

**12:00 PM – 2:30 PM**
- Oral Sessions • 8:30AM – 11:00AM

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
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<tbody>
<tr>
<td>203AB</td>
<td>The Impact of Small Signal Conductances on the Stability of AC/DC Converters in MMC-HVDC Terminal Case Studies</td>
</tr>
<tr>
<td>203D</td>
<td>Integration of Photovoltaic Arrays in the Grid</td>
</tr>
<tr>
<td>203C</td>
<td>High Power Electronics for Photovoltaic and Wind Applications</td>
</tr>
<tr>
<td>202A</td>
<td>Renewable Energy for Centralized Power Systems</td>
</tr>
<tr>
<td>102D</td>
<td>Electric Machines for Renewable Energy Applications</td>
</tr>
<tr>
<td>102E</td>
<td>Multilevel Inverter Applications for Renewable Energy Systems</td>
</tr>
<tr>
<td>102C</td>
<td>Modeling and Control of DC/DC Converters</td>
</tr>
<tr>
<td>102B</td>
<td>Reliability of Electric Machines</td>
</tr>
<tr>
<td>102A</td>
<td>Induction Motor Drives</td>
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<tr>
<td>101A</td>
<td>Induction Motor Drives</td>
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<tr>
<td>101B</td>
<td>PM and IPM Motor Drives</td>
</tr>
<tr>
<td>101CD</td>
<td>Wide Bandgap Control Comparative Studies</td>
</tr>
<tr>
<td>202C</td>
<td>Gate Drive Techniques</td>
</tr>
<tr>
<td>102A</td>
<td>Wireless Power Transfer II</td>
</tr>
<tr>
<td>202B</td>
<td>Simulation and Modelling</td>
</tr>
</tbody>
</table>

#### Tuesday, September 20th (continued)

**11:40 AM – 11:55 AM**
- Exhibition Hall Open

**11:55 AM – 1:00 PM**
- Poster Session II

**1:00 PM – 1:15 PM**
- Lunch

**1:15 PM – 2:00 PM**
- Poster Session III

**2:00 PM – 2:15 PM**
- Town Hall I: Internet of Things

**2:15 PM – 3:00 PM**
- Town Hall II: Close to the Edge: The New Frontier of the Grid
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00AM – 5:30PM</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00AM – 5:30PM</td>
<td>Oral Sessions * 8:30AM – 10:10AM</td>
</tr>
<tr>
<td>10:10AM – 10:30AM</td>
<td>AM Break</td>
</tr>
</tbody>
</table>

**Wednesday, September 21st**

### Oral Sessions • 8:30AM – 10:10AM

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
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<tbody>
<tr>
<td>8:00AM</td>
<td>A 5kW High Power Density Parallel-Connected PV Module Based Multistage Inverters Using Mini-Boost</td>
</tr>
<tr>
<td>8:15AM</td>
<td>A New Low-Cost Single-Phase Transformer for Low Power Photovoltaic Applications</td>
</tr>
<tr>
<td>8:30AM</td>
<td>A Novel, Zero-Voltage-Shifted Multi-Resonant DC-DC Converter with a Current-Oriented Structure</td>
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<tr>
<td>8:45AM</td>
<td>A Novel Strategy for Predictive Control of Modular Multilevel Converters with a Current-Oriented Structure</td>
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<tr>
<td>9:00AM</td>
<td>A Novel Flexibility Analysis Methodology for Modular Multilevel Converters with a Current-Oriented Structure</td>
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<tr>
<td>9:15AM</td>
<td>A Novel Flexibility Analysis Methodology for Modular Multilevel Converters with a Current-Oriented Structure</td>
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<tr>
<td>10:00AM</td>
<td>A Novel Flexibility Analysis Methodology for Modular Multilevel Converters with a Current-Oriented Structure</td>
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</tbody>
</table>

**10:10AM – 10:30AM**

AM Break
|-------|------|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|

**Wednesday, September 21st (continued)**

**Oral Sessions • 10:30AM – 12:10PM**

10:30AM – 10:55AM
- **A Variable Step Size MPPT for Single-Phase Grid-Connected Photovoltaic Systems**
- **A Novel 1-V 300W Inverter for a DC-AC Converter**: Presentation on a new inverter design focused on efficiency and power density.
- **DC/DC Converters for High-Efficiency Power Conversion**: Discussion on advanced DC/DC converter topologies and their applications in renewable energy systems.

10:55AM – 11:20AM
- **Study on the Unbalanced Current Impact on the Capability of the Neutral-Point Clamped Inverter**: Research on inverter performance under unbalanced grid conditions.
- **Photovoltaic Power Simulation Based on Individual Cell Condition**: Analysis of individual cell conditions in photovoltaic systems to improve overall system performance.

11:20AM – 11:45AM
- **Adaptive DC/Link Voltage Control Scheme for Single-Phase Inverters with Dynamic Power Dissipation**: Development of adaptive control strategies for single-phase inverters.
- **Development and Implementation of a Novel DC-Link Filter for Grid-Connected Inverters with High Power Factor**: Presentation on a new filter design for high-power-factor inverters.
- **Flexible Transformers for Distribution Grid Control**: Discussion on flexible transformer technologies for grid control applications.

11:45AM – 12:10PM
- **S64: Analysis and Power Flow Control for Three-Level and Multilevel Inverters Using a Modal-Based Impedance Spectroscopy**
- **Characterization of Silicon-Based Photovoltaic Cells Using Broadband Impedance Spectroscopy**: Analysis of photovoltaic cell performance using spectroscopy.
- **Comparative Analysis of a Modular Inverter**: Comparison of different modular inverter topologies for photovoltaic systems.

12:10PM – 2:00PM
- **Lunch on Your Own**
<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Speaker(s)</th>
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</thead>
<tbody>
<tr>
<td>1:30 PM - 3:10 PM</td>
<td>103C</td>
<td>S65: Modeling, Simulation, and Analysis of Power Applications in Connected Grids</td>
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<tr>
<td></td>
<td></td>
<td>S71: DC-DC Reliability, Modeling, and Analysis of Power Applications in Connected Grids</td>
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<tr>
<td></td>
<td></td>
<td>S72: Reliability, Diagnostics, and Analysis of Power Applications in Connected Grids</td>
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<tr>
<td>3:10 PM - 4:15 PM</td>
<td>104C</td>
<td>S78: Traction Rectifiers and Applications in Connected Grids</td>
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<tr>
<td></td>
<td></td>
<td>S80: Modeling, Simulation, and Analysis of Power Applications in Connected Grids</td>
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<tr>
<td></td>
<td></td>
<td>S81: Reliability, Diagnostics, and Analysis of Power Applications in Connected Grids</td>
</tr>
<tr>
<td>4:15 PM - 5:30 PM</td>
<td>105C</td>
<td>S82: Traction Rectifiers and Applications in Connected Grids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S83: Reliability, Diagnostics, and Analysis of Power Applications in Connected Grids</td>
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</table>
### Wednesday, September 21st (continued)

#### Oral Sessions • 3:30PM – 5:10PM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
</table>
|        | 203A A | Wind Harvesting Systems  
|        | 203A C | Utility Applications  
|        | 203A D | More Electric Aircraft  
|        | 203B | DC-DC Converters: High Frequency  
|        | 203C | More Electric Aircraft  
|        | 203D | More Electric Aircraft  
|        | 203E | Reliability and Fault Tolerance in Power Converters III  
|        | 203F | Electric Machines for Automotive Applications  
|        | 203G | Energy Efficient Motor Drives  
|        | 203H | Silicon and WBG Devices  
|        | 203I | Distribution System Utility Interface  
|        | 203J | Electricity Power Nexus  

#### 3:55PM – 4:20PM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
</table>
| 3:55PM – 4:20PM | 203A B | Short Term Forecasting of Hourly Response from a Wind Power Plant  
|        | 203A A | Modeling, Analysis and Design of An Onshore Storage System  
|        | 203A C | Field Modulation Control of an A Multi-Converter-Based Grid-Connected and Voltage-Based Power Quality  
|        | 203A D | Design and Optimization of a High Performance Isolated Three-Phase AC-DC Converter for Aircraft Applications  
|        | 203B | Mid-Frequency High Voltage Transformer for Wind Turbine Applications  
|        | 203C | New Generation of Multi-Functional Grid Connected Inverter to Improve High Current-Based and Voltage-Based Power Quality  
|        | 203D | Design and Optimization of a High Performance Isolated Three-Phase AC-DC Converter for Aircraft Applications  
|        | 203E | High Reliability and Fault Tolerance in Power Converters III  
|        | 203F | Electric Machines for Automotive Applications  
|        | 203G | Energy Efficient Motor Drives  
|        | 203H | Silicon and WBG Devices  
|        | 203I | Distribution System Utility Interface  
|        | 203J | Electricity Power Nexus  

#### 4:20PM – 4:45PM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
</table>
| 4:20PM – 4:45PM | 203A B | A 13.8KV Case Study of the Influence of PM Cost on Wind Turbine Cost of Energy  
|        | 203A A | The Joint Design of a Component Air and Wind Energy Systems for a Mechanical Spill Recovery  
|        | 203A C | Impedance Synthesis for Control of Power Converters in DC-AC Inverter Interface  
|        | 203A D | Tackling the Interactions Between the Design of a grid-connected converter and Voltage-Based Power Quality  
|        | 203B | An Improved Nonlinear Control of a High Performance Isolated Three-Phase AC-DC Converter  
|        | 203C | High Reliability and Fault Tolerance in Power Converters III  
|        | 203D | Electric Machines for Automotive Applications  
|        | 203E | Energy Efficient Motor Drives  
|        | 203F | Silicon and WBG Devices  
|        | 203G | Distribution System Utility Interface  
|        | 203H | Electricity Power Nexus  

#### 4:45PM – 5:10PM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
</table>
| 4:45PM – 5:10PM | 203A B | Direct Power Control of a Double Hall-Effect Induction Generator Wind Power System in Stand-Alone and Grid-Connected Mode with Sewage Treatment  
|        | 203A A | A Novel Power Control Scheme for a Multi-Converter-Based Wind Turbine  
|        | 203A C | A New Method for Rapid Control of a Multi-Converter-Based Wind Turbine  
|        | 203A D | A Novel Power Control Scheme for a Multi-Converter-Based Wind Turbine  
|        | 203B | Hybrid Charging for Active Front End Converter  
|        | 203C | Voltage and Current Regulation of Power Converters in Islanded Microgrids based on Online Feedback Decoupling  
|        | 203D | Control Strategy of Single Phase Full-Bridge Converter for Medium Voltage Drive under GFL Fault Conditions  
|        | 203E | A Simple Design Method for a High-Speed Surface Permanent Magnet Motor  
|        | 203F | Mechanical Design of a PM Motor  
|        | 203G | Control Strategy for Single Phase Full-Bridge Converter for Medium Voltage Drive under GFL Fault Conditions  
|        | 203H | A Simple Design Method for a High-Speed Surface Permanent Magnet Motor  
|        | 203I | A Control Strategy for Single Phase Full-Bridge Converter for Medium Voltage Drive under GFL Fault Conditions  
|        | 203J | A Simple Design Method for a High-Speed Surface Permanent Magnet Motor  

#### 7:00PM – 9:30PM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
</table>
| 7:00PM – 9:30PM | 203A B | ECCE Oktoberfest Banquet  
|        | 203A A | ECCE Oktoberfest Banquet  
|        | 203A C | ECCE Oktoberfest Banquet  
|        | 203A D | ECCE Oktoberfest Banquet  
|        | 203B | ECCE Oktoberfest Banquet  
|        | 203C | ECCE Oktoberfest Banquet  
|        | 203D | ECCE Oktoberfest Banquet  
|        | 203E | ECCE Oktoberfest Banquet  
|        | 203F | ECCE Oktoberfest Banquet  
|        | 203G | ECCE Oktoberfest Banquet  
|        | 203H | ECCE Oktoberfest Banquet  
|        | 203I | ECCE Oktoberfest Banquet  
|        | 203J | ECCE Oktoberfest Banquet  

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**Ballroom ABCD**
### Thursday, September 22nd

#### Oral Sessions • 8:30AM – 10:10AM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30AM – 8:55AM</td>
<td>S97:</td>
<td>Converter Topologies for Wind Power Systems</td>
<td>The DC-DC, Next-Generation Inverter Topologies for Wind Turbine Applications: Creators, Generators, and AVS/DC/DC Hybrid Inverter Systems</td>
</tr>
<tr>
<td>8:55AM – 9:30AM</td>
<td>S98:</td>
<td>Industrial Full Boost Rectifier for Small Power Wind Energy Converters</td>
<td>Enhanced power quality and minimal fault current control in a high-voltage DC converter under unbalanced and grid faults</td>
</tr>
<tr>
<td>9:45AM – 10:10AM</td>
<td>S100:</td>
<td>Advanced Power</td>
<td>A novel method for grid-connected converters with variable duty cycle control</td>
</tr>
</tbody>
</table>

#### AM Break

### 2016 IEEE ENERGY CONVERSION CONGRESS & EXPOSITION®

**203B**

### DETAILED SCHEDULE

**203A**

**S82:**

- More Electric System and Control
- **S89:**
  - Active Islanding Response Optimization of Single-Phase Grid-Connected Inverters
- **S92:**
  - A Robust SuperJunction Active Thermal Compensation System for Single-Phase Grid-Connected Inverters

### Registration

- Main Lobby Foyer – 1st Floor Wisconsin Center
- Topology of Energy Conversion Systems for Wind Power Systems

### S89:

- Energy Storage
- Energy Management for Transportation Electrification
- Dual-Phase Active Islanding
- **S92:**
  - Advanced DC-DC Boost Rectifiers
  - A Universal Control of Grid-Connected Converters

### S95:

- Advanced Electric Machines
- Advanced Electric Machines
- Advanced Electric Machines
- Advanced Electric Machines
- Advanced Electric Machines
Thursday, September 22nd (continued)

**Oral Sessions • 10:30AM – 12:10PM**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>10:30AM – 10:55AM</td>
<td>Comparison Analysis of IM Transmissions Flows Outer Rotor Machines with without Magnetic Shunts</td>
</tr>
<tr>
<td></td>
<td>Design Considerations of an Isolated SOGI-Bidirectional DC-DC Converter</td>
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<td>Harmonic power sharing with Voltage Droop Automatic Compensation of Deep-Controlled Islanded Microgrid</td>
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<td>Accelerate Parameter Estimation with Improved Continuous Time System Identification Methods</td>
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<td>Improved Z-Source Inverter</td>
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<td></td>
<td>A Novel Highly Reliable Three-Phase Buck-Boost AC-AC Converter</td>
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<td>A Series HMC Power Tapping Using Modular Multi-Cell Converters</td>
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<td></td>
<td>Step-Down Impedance Control Scheme for Three-Phase Buck-Boost AC-AC Converter</td>
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<td>Combustion DC Voltage Control Scheme for Three-Phase Buck-Boost AC-AC Converter</td>
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<td>Realization of Quadrature Signal Generator Using Accurate Impedance Integration</td>
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<td>On Impedance Modeling of Single-Phase Voltage Source Converter</td>
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<td>A Novel Static Current HMI Machine</td>
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<td></td>
<td>Static Voltage and Acoustic Noise Analysis of FSRM for Low Noise Design</td>
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<td>Asymmetrical Transformer Reduction Generator for More Electric Machines in Aircraft</td>
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<td>High Power Density Impedance Control Network DC-DC Converter Utilizing an Integrated Magnetic Structure</td>
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<td>Robustness in Short-Circuit Mode benchmarking 600V GaN HEMT with Power SW and SiCMOS65</td>
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<tr>
<td>10:55AM – 11:20AM</td>
<td>A Generator Converter Design for Direct Drive Wind Turbines</td>
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<td>Redesigned Multilevel Phase Conversion and Energy Storage</td>
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<tr>
<td></td>
<td>Novel Active Harmonization Strategy for Multi-Phase Inverter with Distributed Cooperation Control</td>
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<td>A Real World Technology for Electric Vehicle Smart Charging Systems and PEV/BSE Interoperability</td>
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<td>High-Frequency SiC Pulse DC Link and Bidirectional Three-Phase DC-DC Converter Under Substantial Failure</td>
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<td>Soft-Switching Push-Pull DC-DC Converter</td>
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<td>Grid Voltage Sensorless Control of a Converter Under Intermediate Decoupling Capacitor</td>
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<td>A New Instantaneous Point of Wave Voltage Control of Unbalanced Three-Phase Inverter</td>
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<td>Design Consideration of SC-DC Link with Connectors in DC-Bus Networks with Multiple PI Converters</td>
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<tr>
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<td>A Novel Variable Frequency Machine with Select Hybrid Magnets</td>
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<td>Current Waveform Noise Reduction of Switched Reluctance Motor in Magnetically Isolated Condition</td>
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<td>A Novel Position Estimation of Grid-Bypass Motor for Green Traction Devices</td>
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<td>Time Domain Harmonization of Lin Proc Bundles in EV</td>
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<td></td>
<td>Investigation of the Short-Circuit Safe Operation Area of DC Motor Power Modules</td>
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<tr>
<td>11:20AM – 11:45AM</td>
<td>Gasoline Fault Diagnosis Using Vibrations and Current Information Features</td>
</tr>
<tr>
<td></td>
<td>A Novel Modular Dual Active Bidirectional Bridge (DAB) DC-DC Converter with DC Fault Ride-Through</td>
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<tr>
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<td>Capability by Battery Energy Storage System</td>
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<tr>
<td></td>
<td>An Inverter Current Method for the High-Efficiency Storage System with Helical Wound Equation</td>
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<tr>
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<td>Hybridized Observer for Modular Multilevel Inverter and Fault-Tolerance for Small Transformer</td>
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<td>Bidirectional Sensor Resistor DC-DC Converter with Fault-Tolerance and Small Transformer</td>
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<td>Voltage Quality Improvement with Minimum Phase Injection</td>
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<td>Extended Stable Fault-Tolerant Grid-Connected Inverter Based on Parallel Fault-Tolerant Control</td>
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<td></td>
<td>The Feasibility of Carbon Nanotube Wires for Electrical Machines - Case Study for a Contact-Acid R/M</td>
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<tr>
<td></td>
<td>Transformer Reduction Technique for Single DC-DC Winding</td>
</tr>
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<td>Current from Transformer Sizing Selection</td>
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<tr>
<td>11:45AM – 12:10PM</td>
<td>Bearing Fault Diagnosis of Wind-Drive-Wind Turbine Using Multi-Phase Filtering Spectrum</td>
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<tr>
<td></td>
<td>A High Current Bidirectional DC-DC Converter for Concept Demonstration of Grid-Grid SMES System</td>
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<td>Accelerated Voltage Control and Load Sharing for Inverter-Interfaced Microgrid with Resilient Lines</td>
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<tr>
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<td>Advanced Three Phase Neutral Point Converter with Fault-Tolerance of Lithium-ion Battery</td>
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<td>Parallel AC-DC Three-Phase with Shared Leg Converters</td>
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<td></td>
<td>DC Bus Balancing Control Technique for Grid-Isolated Neutral Point Clamped Modular Inverter</td>
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<td>Analysis and Design of Planer Current Controller and Transformer with Grid-Isolated Neutral Point Clamped Modular Inverter</td>
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<td>A Universal Voltage Conversion/Decomposition to Improve THD and High Frequency Operation (PFC) Converter</td>
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<tr>
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<td>Available Bus Impedance Region for MOSFET Inverters and Transformer Control Design Using Phase Control</td>
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<tr>
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<td>A Novel Step-Current HMI Machine</td>
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<tr>
<td></td>
<td>On the Cross-Coupling Effects of Single-Phase Bearing Magnets</td>
</tr>
<tr>
<td></td>
<td>An Open Problem for More Electric Aircraft/MAN System ISolation of Systems of Aircrafts Can Be Qualified?</td>
</tr>
<tr>
<td></td>
<td>Very High Frequency Integration Voltage Regulator for Small Portable Devices</td>
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<td>Prediction of Short-Circuit Rejection Thermal Module in HVDC Applications</td>
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</table>

**DETAILED SCHEDULE**

**Ballroom ABCD**

12:10PM – 2:00PM **Awards Luncheon.**
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>203AB</td>
<td>020B: DAM: DRI Based Wind Power Systems</td>
</tr>
<tr>
<td>203C</td>
<td>020C: AC Microgrids: Operation and Energy Management</td>
</tr>
<tr>
<td>203E</td>
<td>020D: Battery Charging for Transportation Electrification</td>
</tr>
<tr>
<td>202A</td>
<td>020E: AC Converers II</td>
</tr>
<tr>
<td>202B</td>
<td>020B: DC-DC: Isolated Converters</td>
</tr>
<tr>
<td>202D</td>
<td>020C: Modeling and Control of DC-AC Converters II</td>
</tr>
<tr>
<td>202E</td>
<td>020E: Stability in Power Converters II</td>
</tr>
<tr>
<td>202C</td>
<td>020C: Design Optimization of Power Converters</td>
</tr>
<tr>
<td>101B</td>
<td>020B: Active Power Filters</td>
</tr>
<tr>
<td>101A</td>
<td>020A: Non-Conventional Machine Configurations II</td>
</tr>
<tr>
<td>102B</td>
<td>020A: Magnetic Gears</td>
</tr>
<tr>
<td>101CD</td>
<td>020A: High Speed and Direct Drives</td>
</tr>
<tr>
<td>102A</td>
<td>020A: Power Assemblies</td>
</tr>
</tbody>
</table>

**Thursday, September 22nd**

**Oral Sessions • 2:00PM – 3:40PM**

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>203AB</td>
<td>Flexible PCC: Voltage Unbalance Compensation Strategy for Autonomous Operation of Parallel DFIGs</td>
</tr>
<tr>
<td>203C</td>
<td>Controller for Combined Peak Load Shaping and Capacity Ensure: Utilizing Multiple Energy Storage Units in Microgrids</td>
</tr>
<tr>
<td>203E</td>
<td>A Primary Full-Integral Active Filter Auxiliary Power Module in Electric Vehicle Applications with Single-Phase Onboard Chargers</td>
</tr>
<tr>
<td>202A</td>
<td>SC MGDS: Zero-Voltage Switching Modularized Three-phase Grid Inverter</td>
</tr>
<tr>
<td>202B</td>
<td>Multi-Unit Inverter Based PV Systems with High Power Density in 10 cm X 0.5 cm Stacks for Flexible Automotive Systems</td>
</tr>
<tr>
<td>202D</td>
<td>A Triangle Phase-Shifting Strategy for Interfaced Critical-Mode Power Converters</td>
</tr>
<tr>
<td>202E</td>
<td>An Inherently Improved Design of LCC Filter for DC-DC Converters with Wide Input Voltage Range and Efficiency Improvement</td>
</tr>
<tr>
<td>202C</td>
<td>Multilevel Nine-Level Converter Universal Active Power Filter</td>
</tr>
<tr>
<td>101B</td>
<td>Design of Dual Purpose Voltage Combined Windings for Vehicles Motors</td>
</tr>
<tr>
<td>101A</td>
<td>Novel Reduction for High-Speed Motors</td>
</tr>
<tr>
<td>102B</td>
<td>Implementation of an Open-Ended Induction Motor Drive With a Floating Capacitor Bridge over a Wide Speed Range</td>
</tr>
<tr>
<td>101CD</td>
<td>Battery Design for SiC-Based Photovoltaic (PV) Systems Using a 10V 400 A SiC MOSFET in 100 Hz Operating</td>
</tr>
<tr>
<td>102A</td>
<td>Ultra-Fast Inductors Design for SiC-MOSFET Gate-Drivers and SiC-MOSFET Inverter</td>
</tr>
<tr>
<td>203B</td>
<td>020B: Three-Phase Inverter PAM</td>
</tr>
<tr>
<td>203E</td>
<td>020C: Three-Phase Inverter PAM</td>
</tr>
<tr>
<td>202A</td>
<td>020D: Three-Phase Inverter PAM</td>
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<tr>
<td>202B</td>
<td>020E: Three-Phase Inverter PAM</td>
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<tr>
<td>202D</td>
<td>020C: Three-Phase Inverter PAM</td>
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<tr>
<td>202E</td>
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<tr>
<td>202C</td>
<td>020C: Three-Phase Inverter PAM</td>
</tr>
<tr>
<td>101B</td>
<td>020B: Active Power Filters</td>
</tr>
<tr>
<td>101A</td>
<td>020A: Non-Conventional Machine Configurations II</td>
</tr>
<tr>
<td>102B</td>
<td>020A: Magnetic Gears</td>
</tr>
<tr>
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<td>020A: High Speed and Direct Drives</td>
</tr>
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</tbody>
</table>

**203AB:**

- **Utility Scale Battery Systems**
- **AC Microgrids: Operation and Energy Management**
- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**

**203C:**

- **AC Microgrids: Operation and Energy Management**
- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**

**203E:**

- **Flexible PCC: Voltage Unbalance Compensation Strategy for Autonomous Operation of Parallel DFIGs**
- **Controller for Combined Peak Load Shaping and Capacity Ensure: Utilizing Multiple Energy Storage Units in Microgrids**
- **A Primary Full-Integral Active Filter Auxiliary Power Module in Electric Vehicle Applications with Single-Phase Onboard Chargers**
- **SC MGDS: Zero-Voltage Switching Modularized Three-phase Grid Inverter**
- **Multi-Unit Inverter Based PV Systems with High Power Density in 10 cm X 0.5 cm Stacks for Flexible Automotive Systems**
- **A Triangle Phase-Shifting Strategy for Interfaced Critical-Mode Power Converters**
- **An Inherently Improved Design of LCC Filter for DC-DC Converters with Wide Input Voltage Range and Efficiency Improvement**
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- **Battery Design for SiC-Based Photovoltaic (PV) Systems Using a 10V 400 A SiC MOSFET in 100 Hz Operating**
- **Ultra-Fast Inductors Design for SiC-MOSFET Gate-Drivers and SiC-MOSFET Inverter**

**202A: Three-Phase Inverter PAM**

- **Utility Scale Battery Systems**
- **AC Microgrids: Operation and Energy Management**
- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**

**202B: Three-Phase Inverter PAM**

- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**

**202D: Three-Phase Inverter PAM**

- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**

**202E: Three-Phase Inverter PAM**

- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**

**202C: Three-Phase Inverter PAM**

- **Battery Charging for Transportation Electrification**
- **Three-Phase Inverter PAM**
- **Modular Multilevel Converters (MMC) III**
- **Modeling and Control of DC-AC Converters II**
- **Stability in Power Converters II**
- **Design Optimization of Power Converters**
- **Active Power Filters**
- **Non-Conventional Machine Configurations II**
- **Active Power Filters**
- **Power Assemblies**
Event Services

Registration
Saturday through Thursday
Main Lobby Foyer – 1st Floor, Wisconsin Center

On-site registration will be open during the following hours:
- Saturday, September 17th: 5:00PM – 7:00PM
- Sunday, September 18th: 7:00AM – 7:00PM
- Monday, September 19th: 7:00AM – 7:00PM
- Tuesday, September 20th: 7:30AM – 5:30PM
- Wednesday, September 21st: 7:30AM – 5:30PM
- Thursday, September 22nd: 7:30AM – 12:00PM

Full Conference and Tutorial Registration

Full Conference Registration admits one entrance into all technical sessions, plenary sessions, town hall meetings, access to the exhibition and all social functions. Additional guest social function tickets for receptions can be purchased at the Registration Desk.

Tutorials will take place on Sunday, September 18th, 2016. You may select one morning session and one afternoon session. The rates are outlined below. The registration rate is the same if you choose to attend either one or two tutorials. The registration fee includes materials for all 12 tutorials.

On-Site Registration Rates

<table>
<thead>
<tr>
<th>Category</th>
<th>Conference Only</th>
<th>Tutorial Only*</th>
<th>Conference &amp; Tutorial</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE Member</td>
<td>$900.00</td>
<td>$475.00</td>
<td>$1,300.00</td>
</tr>
<tr>
<td>Student IEEE Member</td>
<td>$400.00</td>
<td>$425.00</td>
<td>$750.00</td>
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<tr>
<td>Student Non-Member</td>
<td>$450.00</td>
<td>$475.00</td>
<td>$800.00</td>
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<tr>
<td>Society Member</td>
<td>$850.00</td>
<td>$425.00</td>
<td>$1,250.00</td>
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<tr>
<td>Life Member</td>
<td>$400.00</td>
<td>$400.00</td>
<td>$750.00</td>
</tr>
<tr>
<td>Non-Member</td>
<td>$1,050.00</td>
<td>$475.00</td>
<td>$1,450.00</td>
</tr>
</tbody>
</table>

*Access to specified sessions is permitted only if applicable for that day’s activities.

One-Day Registration

One-Day Registration admits one entrance into that day’s technical sessions, the plenary sessions*, town hall meetings*, industrial seminars*, and access to the exhibition.

One-Day Registration Rates

<table>
<thead>
<tr>
<th>Category</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Society Member</td>
<td>$300.00</td>
</tr>
<tr>
<td>IEEE Member</td>
<td>$350.00</td>
</tr>
<tr>
<td>Non-Member</td>
<td>$450.00</td>
</tr>
</tbody>
</table>

Certificate of Attendance

Certificates of Attendance will not be provided for ECCE 2016.

Receipts

All who register online will receive a receipt/confirmation via email. All registrants will also receive a receipt attached to their badge, which can be obtained upon check-in. If you need additional paperwork, please contact the customer service staff, located at the Registration Desk.

Expo Only

Expo Only Registration allows access to the Expo only on Tuesday, September 20th. Attendees may have access to the Expo hall complimentary on September 20th after 2:30PM. You may purchase an Expo Only Registration for $25 at the Registration Desk located in the Main Lobby Foyer before 2PM.

Guest Tickets

Guests may purchase a registration for $175, which includes admission to the opening reception, awards luncheon and conference banquet. A limited number of awards luncheon and conference banquet tickets will be sold onsite. You can still include your guest’s name on the registration form, even if he or she does not want to attend the social functions. You may also purchase individual event tickets per the rates below.

<table>
<thead>
<tr>
<th>Event</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Guest Ticket</td>
<td>$175.00</td>
</tr>
<tr>
<td>Opening Reception</td>
<td>$60.00</td>
</tr>
<tr>
<td>ECCE Banquet Only</td>
<td>$100.00</td>
</tr>
<tr>
<td>Awards Luncheon Only</td>
<td>$60.00</td>
</tr>
</tbody>
</table>

Badges

Badges should be worn at all official functions of the meeting. Badge checkers will be stationed throughout the meeting areas. Only those with technical registrations will be allowed into sessions. If you forget or lose your badge, you may obtain a second badge at the Registration Desk with proof of registration.

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.

Creative Digressions

Monday through Thursday
Room: 103B

Creative Digressions is what we call a space reserved for those conference attendees who need to go someplace to think, to discuss, and to organize their minds around the hubbub of activities around them. ECCE 2016 is packed with activities that fully engage the mental capacities of the participants, the din of activity and the excitement of absorbing and understanding new information and knowledge can sometimes be overwhelming. Think of Creative Digressions as an oasis within the conference. The room has been set aside with large tables set up for relaxed conversations rather than for presentation purposes; note pads, easels and white boards are provided in place of cocktail napkins and backs of envelopes to facilitate one-on-one discussions, idea generation sessions, business meetings, or social interactions. Coffee and tea, the lifeblood of engineering, will be provided to fuel the physical mind so that the innovative process can continue.

IAS/PELS Community Lounge

Monday through Thursday
Room: 103D

The IAS/PELS Community Lounge is an additional space for conference attendees to use as an area for team building and socializing. Unlike the Creative Digressions room, groups can book this room for exclusive use on a first-come, first-served basis. Please visit registration to reserve.
Accessibility for Registrants with Disabilities

The meeting staff will work with attendees to provide reasonable accommodations for those who require special needs. To request assistance on-site, please check in at the Registration Desk.

Distributing Commercial Material at ECCE

RULES FOR NON-EXHIBITORS

Distribution of commercial material in the ECCE 2016 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.

RULES FOR EXHIBITORS

Exhibitors may only distribute commercial materials in their booth, at Exhibitor Product Demos they are conducting and at press conferences they are holding. ECCE reserves the right to remove without notice any materials not in compliance with this policy.

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.

Hotels

The ECCE 2016 headquarter hotel is the Hilton Milwaukee City Center.

**Hilton Milwaukee City Center**

509 W Wisconsin Avenue
Milwaukee, WI 53203
414-271-7250

Internet Access

Guest Room Internet is complimentary in IEEE Guestrooms at the Hilton Milwaukee City Center.

There is complimentary Wi-Fi in the foyer space throughout the Wisconsin Center.

Local Transportation

Taxis are available in Milwaukee and staff at the information desk can assist you in calling a taxi. Popular ridesharing transportation companies Uber and Lyft are available in Milwaukee and these services offer affordable, discounted rates. For more information on these services, please download their mobile apps.

The Wisconsin Center’s parking lot is open to the public. The lot is located at 500 W. Wells Street and costs $15 to park. A great source for locating additional parking in the area is http://www.parkmilwaukee.com/.

General Information

Lost & Found

Any lost & found items should be turned into the Public Safety Office at the Wisconsin Center. The Public Safety Office is located on the north side of the building at 750 N 6th Street.

Visitor Information Desk

VISIT Milwaukee staff members will be available at their information desk in the Wisconsin Center on Monday through Friday, 8:00AM — 5:00PM. The desk is located at the front entrance of the Wisconsin Center, which is at 4th Street and Wisconsin Avenue. Stop by for visitor guides, maps, coupon books and other brochures!

Parking

The Wisconsin Center’s parking lot is open to the public. The lot is located at 500 W. Wells Street and costs $15 to park. A great source for locating additional parking in the area is http://www.parkmilwaukee.com/.

Meals & Refreshments

**MORNING REFRESHMENTS**

**Monday, Wednesday and Thursday — Room: 100/200 Foyers**

*Exhibit Hall A*

Monday, September 19th .......................... 10:30AM – 10:50AM
Tuesday, September 20th ........................ 11:10AM – 11:30AM
Wednesday, September 21st ..................... 10:10AM – 10:30AM
Thursday, September 22nd ........................ 10:10AM – 10:30AM

**LUNCH**

*Exhibit Hall A*

Tuesday, September 20th .............................. 1:00PM – 2:30PM

**ECCE BANQUET — OKTOBERFEST**

*Wisconsin Center Ballroom ABCD*

Wednesday, September 21st ......................... 7:00PM – 9:30PM

**AWARDS LUNCHEON**

*Wisconsin Center Ballroom ABCD*

Thursday, September 22nd .......................... 12:10PM – 2:00PM

**AFTERNOON REFRESHMENTS**

*Exhibit Hall A*

Tuesday, September 20th .............................. 4:30PM – 5:00PM
Wednesday, September 21st .......................... 3:10PM – 3:30PM

Spouses and Guest

Spouses and other guests of the conference are welcome to meet in the Creative Digressions in Room 103B on Monday and Tuesday from 9:00AM – 10:00AM for coffee and light refreshments. Information on things to do in Milwaukee will be provided.
Discover Milwaukee, Chicago's northern neighbor on Lake Michigan, home of brewpubs, summer festivals, attractions and colorful neighborhoods linked by RiverWalk.

Milwaukee is the only city in the world where the city icon along the spectacular, Lake Michigan shoreline — the MILWAUKEE ART MUSEUM — literally opens its “wings” to welcome all. Next door, maritime heritage meets 21st century cool at DISCOVERY WORLD with its high-tech displays and fresh and saltwater aquariums, also summer berth to Wisconsin’s official tall ship, the S/V DENIS SULLIVAN.

Stroll down the picturesque RIVERWALK — past the “BRONZE FONZ” statue of Henry Winkler's beloved “Happy Days” character — to the HISTORIC THIRD WARD. This six-square-block, converted warehouse district contains the city's highest concentration of art galleries, as well as theaters, specialty stores, restaurants and nightlife, and is anchored by foodie paradise MILWAUKEE PUBLIC MARKET, ranked among the top markets by Frommers.

Unleash your inner rebel at the world’s only HARLEY-DAVIDSON MUSEUM where a priceless display of 450 bikes celebrates the rich history of Harley, the passion of the riders and Harley's contribution to pop culture over the years. And it’s game on at POTAWATOMI HOTEL & CASINO for the excitement of more than 3,100 slot machines, 100 table games, an expanded, off-track betting room and numerous culinary options. In 2014, the casino expanded to include a 381room connected hotel.

Family fun is guaranteed at the nationally ranked MILWAUKEE COUNTY ZOO, MILWAUKEE PUBLIC MUSEUM and MILLER PARK BASEBALL STADIUM, while adults can enjoy the sample brews on brewery tours offered by MillerCoors and local microbreweries like SPRECHER BREWING, LAKEFRONT BREWERY (rated in the top 4 per Trip Advisor) and MILWAUKEE BREWING COMPANY. MILWAUKEE FOOD AND CITY TOURS treats you to culinary tours of the ethnic neighborhoods and excursion boats and kayaks beckon on the Milwaukee River and Lake Michigan.

Welcome to Milwaukee!
### IAS Committee Meetings

**IAS-IPCSD - Editorial Meeting**  
Sunday, September 18th  
3:00PM – 4:00PM  
*Room: 102A*

**IAS-IPCSD Department Meeting**  
Sunday, September 18th  
7:00PM – 8:00PM  
*Room: 102A*

**IAS Industrial Power Converter Committee (IPCC) Meeting**  
Monday, September 19th  
6:30PM – 7:30PM  
*Room: 102A*

**IAS Renewable and Sustainable Energy Conversion Systems (RESC) Meeting**  
Tuesday, September 20th  
2:00PM – 3:00PM  
*Room: 102A*

**IAS Transportation Systems Committee (TSC) Meeting**  
Tuesday, September 20th  
3:00PM – 4:00PM  
*Room: 102B*

**IAS Power Electronics Devices and Components Committee (PEDCC) Meeting**  
Tuesday, September 20th  
5:00PM – 6:00PM  
*Room: 102A*

**IAS Electrical Machines Committee (EMC) Meeting**  
Tuesday, September 20th  
5:00PM – 6:00PM  
*Room: 102B*

**IAS Industrial Drives Committee (IDC) Meeting**  
Tuesday, September 20th  
6:00PM – 7:00PM  
*Room: 102D*

**KIPE – IEEE/IAS Meeting**  
Wednesday, September 21st  
4:30PM – 6:00PM  
*Room: 103D*

**IEE-J/IAS-IEEE/IAS Meeting**  
Thursday, September 22nd  
10:30AM – 12:00PM  
*Room: 103B*

### ECCE Committee Meetings

**Committee Appreciation Dinner**  
Monday, September 19th  
7:30PM – 10:00PM  
*Harley-Davidson MOTOR Bar & Restaurant*

**2016 Steering Committee Meeting**  
Tuesday, September 20th  
10:30AM – 12:00PM  
*Gilpatrick | Hyatt Hotel*

**2016, 2017 & 2018 Organizing Committee Meetings**  
Wednesday, September 21st  
8:00AM – 10:00AM  
*IAS/PELS Community Lounge (Room 103E), Wisconsin Center*

**2016 Organizing Committee Debrief Meeting**  
Thursday, September 22nd  
4:00PM – 5:00PM  
*IAS/PELS Community Lounge (Room 103E), Wisconsin Center*
PELS and PELS/IAS Joint Committee Meetings

Please note, the majority of meetings for PELS will take place at the Hyatt. The Hyatt is located at 333 W Kilbourn Avenue and is 5 minutes walking distance from the Wisconsin Center.

CEU Credit Course – Modeling and Simulation for Power Electronics
Saturday, September 17th
8:00AM – 5:00PM
Room: Crystal | Hyatt Hotel

Pre Strategy Meeting Exec Team
Sunday, September 18th
9:30AM – 12:00PM
Room: Vue North | Hyatt Hotel

PELS AdCom Strategy Meeting
Sunday, September 18th
12:00PM – 5:00PM
Room: Vue North | Hyatt Hotel

Asian Power Electronics Coordination Committee Meeting (APECC)
Sunday, September 18th
6:30PM – 8:00PM
Room: Vue North | Hyatt Hotel

PELS Digital Media Meeting
Monday, September 19th
10:30AM – 11:30AM
Room: Gilpatrick | Hyatt Hotel

FEPPCON Organizing Committee Discussion
Monday, September 19th
10:15AM – 11:30 AM
Room: Lakeshore A | Hyatt Hotel

PELS Technical Committee and Standing Committee Chairs
Monday, September 19th
12:00 PM – 2:00 PM
Room: Lakeshore A | Hyatt Hotel

Editorial and Industry Advisory Board Meeting
Monday, September 19th
12:00 PM – 2:00 PM
Capital Grille Restaurant

ECCE Asia Coordination Committee Meeting
Monday, September 19th
12:00PM – 2:00PM
Room: Gilpatrick | Hyatt Hotel

International Technology Road Map on Wide Band Gap Semi Conductors ITRW Workshops
Monday, September 19th
2:00PM – 5:00PM
Room: Lakeshore B | Hyatt Hotel

PELS Bylaws and Constitution Meeting
Monday, September 19th
2:00PM – 3:30PM
Room: Gilpatrick | Hyatt Hotel

PELS Membership Committee Meeting
Monday, September 19th
2:00PM – 5:00PM
Room: Lakeshore A | Hyatt Hotel

PELS Chapter Chairs Meeting/Forum
Monday, September 19th
5:00PM – 6:30PM
Room: Lakeshore A | Hyatt Hotel

PELS Chapter Chairs Meeting and Dinner
Monday, September 19th
6:30PM – 8:30PM
Room: Lakeshore A | Hyatt Hotel

PELS Southern Conference Steering Committee (COBEP/SPEC)
Tuesday, September 20th
8:00AM – 9:00AM
Room: Lakeshore A | Hyatt Hotel

PELS/IAS Joint Motor Drives and Actuators Meeting (PELS TC3)
Tuesday, September 20th
9:00AM – 10:00AM
Room: Lakeshore A | Hyatt Hotel

Transportation Electrification Community Meeting
Tuesday, September 20th
9:00AM – 10:00AM
Room: Gilpatrick | Hyatt Hotel

PELS TC1 – Power and Control Core Technologies
Tuesday, September 20th
10:00AM – 12:00PM
Room: Lakeshore BC | Hyatt Hotel

International Future Energy Challenge 2016 (IFEC) Information Session
Tuesday, September 20th
10:00AM – 12:00PM
Room: Lakeshore A | Hyatt Hotel

PELS Awards Meeting
Tuesday, September 20th
10:30AM – 11:30AM
Room: Executive AB

PELS Fellows Committee (Members Only)
Tuesday, September 20th
12:00PM – 1:00PM
Room: Lakeshore A | Hyatt Hotel

PELS TC6 – High Performance and Emerging Technologies
Tuesday, September 20th
12:00PM – 2:00PM
Room: Lakeshore BC | Hyatt Hotel

IEMDC Steering Committee
Tuesday, September 20th
1:00PM – 2:00PM
Room: Gilpatrick | Hyatt Hotel

PELS TC2 - Power Conversion Systems and Components
Tuesday, September 20th
2:00PM – 3:30PM
Room: Gilpatrick | Hyatt Hotel

PELS/IAS Joint Vehicle and Transportation Systems Meeting (PELS TC4)
Tuesday, September 20th
3:00PM – 4:00PM
Room: Lakeshore B | Hyatt Hotel

PEDG Steering Committee Meeting
Tuesday, September 20th
3:00PM – 5:00PM
Room: Lakeshore A | Hyatt Hotel

Sister Society Cooperative Planning
Tuesday, September 20th
5:00PM – 6:00PM
Room: Gilpatrick | Hyatt Hotel

PELS TC5 – Sustainable Energy Technical Committee
Tuesday, September 20th
6:30PM – 7:30PM
Room: Gilpatrick | Hyatt Hotel

Women in Engineering Breakfast
Wednesday, September 21st
8:00AM – 9:00AM
Room: Lakeshore BC | Hyatt Hotel
PELS Products (Transactions) Committee Meeting
Wednesday, September 21st
9:00AM – 10:30AM
Room: Lakeshore BC | Hyatt Hotel

PELS JESTPE Paper Awards and Editorial Board Meeting
Wednesday, September 21st
10:30AM – 12:30PM
Room: Gilpatrick | Hyatt Hotel

IEEE Transactions on Power Electronics Paper Awards and Editorial Board Meeting
Wednesday, September 21st
11:30AM – 1:30PM
Room: Lakeshore Ballroom | Hyatt Hotel

PELS Nominations Committee (Members Only)
Wednesday, September 21st
12:30PM – 2:30PM
Room: Gilpatrick | Hyatt Hotel

ECCE Global Partnership Coordinating Meeting
Wednesday, September 21st
1:00PM – 2:30PM
Room: Milwaukee | Hyatt Hotel

PELS Technical Operations Committee Meeting
Wednesday, September 21st
1:30PM – 3:30PM
Room: Lakeshore BC | Hyatt Hotel

PELS Conferences Committee Meeting
Wednesday, September 21st
3:30PM – 5:30PM
Room: Gilpatrick | Hyatt Hotel

PELS Standards Committee Meeting
Wednesday, September 21st
2:00PM – 6:30PM
Room: Lakeshore BC | Hyatt Hotel

PELS Administrative Committee Meeting
Thursday, September 22nd
2:00PM – 6:00PM
Room: Lakeshore Ballroom | Hyatt Hotel

PELS Administrative Committee Dinner
Thursday, September 22nd
6:30PM – 9:30PM
Harbor House Restaurant
Special Events

Newcomers Orientation

Sunday, September 18th, 5:00PM – 5:45PM
Milwaukee Art Museum

Join us at the Milwaukee Art Museum prior to the Opening Reception for a short session intended to act as a guide for those who are new to ECCE. Join us to learn more about the week ahead with details on the agenda and types of sessions, navigating the Convention Center, and all the excitement Milwaukee has to offer! Light refreshments will be served.

Meet and Greet with the Fellows and Partners

Sunday, September 18th, 5:30PM – 7:30PM
Location: Milwaukee Art Museum

Meet and Greet with our IAS and PELS Fellows as well as our conference partners at the Sunday evening Opening Reception at the Milwaukee Art Museum. A chance to chat, take photos and congratulate the 2016 IEEE Power Electronics Society Class of Fellows that have chosen to receive their award at ECCE and to also thank our generous conference supporters and partners for their time and investment in ECCE 2016.

PELS Fellows

Vassilios Agelidis
The University of New South Wales
Australian Energy Research Institute
Australia

Honored for contributions to power electronics, renewable energy conversion and integration with electricity grid

Tsorng-Juu Liang
National Cheng Kung University
Dept of Electrical Engineering
Taiwan

Honored for contributions to power conversion for lighting and sustainable energy

Henry Chung
City University of Hong Kong
Dept. of Electronic Eng., Tat Chee Ave.
Hong Kong

Honored for contributions to power electronic converters for lighting

Xinbo Ruan
Nanjing University of Aeronautics & Astronautics
College of Automation Engineering
China

Honored for contributions to switching-mode power converter topologies and modulation strategies

Yungtaek Jang
Delta Products Corporation
Fremont, California, USA

Honored for contributions to efficiency optimization of ac-dc power supplies

IEEE POWER ELECTRONICS SOCIETY
Powering a Sustainable Future
Dr. Mohammad Islam
Halla Mechatronics
Bay City, Michigan, USA

Honored for development of electromagnetic sensors and actuators for automotive applications

Annette Muetze
Graz University of Technology
Graz, Austria

Honored for contributions to the analysis and mitigation of bearing currents in variable-speed drives

Blake Lloyd
Qualitrol- Iris Power
Mississauga, ON, Canada

Honored for development of non-intrusive diagnostics for electrical motors and generators

Opening Reception
Sunday, September 18th, 5:30PM – 7:30PM
Location: Milwaukee Art Museum

Join us at the beautiful Milwaukee Art Museum to kick off ECCE 2016! Take this time to mingle and network before the exciting week ahead. Light appetizers and beverages will be provided.

Bus and Parking information: The museum is within walking distance of the Wisconsin Center. For those planning to walk, volunteers will be stationed along the route to direct you. Transportation will also be provided to and from the reception. Buses will be stationed outside of the Wisconsin Center beginning at 5PM and will rotate on a continuous loop until 8:00PM. Parking is available at the museum for $8.00.

Expo Reception
Monday, September 19th, 4:00PM – 8:00PM
Exhibit Hall A

Enjoy a drink and light snacks while 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.

Technical Tours — Harley-Davidson
Powertrain Operations-Pilgrim Road Tour
Monday, September 19th, 12:15PM – 2:30PM
Location: Menomonee Falls, WI

Visit Harley Davidson's home of the “Big Twin”, located at its 849,000 square foot Pilgrim Road Powertrain Operations facility. The factory tour offers a view of the pilot line and designated machining areas. Come see Harley in action as they assemble their H-D engines and transmissions!

Optional Walking Tour
Wednesday, September 21st, 5:00PM – 6:00PM
Location: Wisconsin Center

Complimentary walking tours of Milwaukee will be available on Wednesday, September 21st from 5:00PM to 6:00PM. Historic Milwaukee will be leading tours so be sure to check out all that the downtown Milwaukee has to offer! The tours will be available on a first-come, first-serve basis. If you are interested in a tour, please meet at the front of the Wisconsin Center at 400 W. Wisconsin Ave for a 5:00PM departure.
Special Events (continued)

IAS & PELS Young Professionals Reception

Tuesday, September 20th, 6:30PM – 9:30PM
Safehouse, 779 North Front Street, Milwaukee

How about an opportunity to mingle, interact, learn from the best minds of IEEE and have some fun.

IEEE Industry Application Society – IAS and Power Electronics Society – PELS, give you this opportunity to learn from the life journey of the biggest leaders at ECCE along with an evening well spent talking to people from across the globe.

An evening filled with meeting new people, fun games, learning about the best practices in industry and academia, and having loads of fun with drinks and snacks. This event is free and open to students and young professionals. So make sure you don’t miss this wonderful chance to make new friends and meet new people. The event is also co-sponsored by IEEE Milwaukee Section IAS and PELS Chapters.

Please register @ https://goo.gl/forms/krf72p3vxfz0PYrB3 ,
to mark your presence for this amazing evening in Milwaukee.

Awards Luncheon

Thursday, September 22nd, 12:10PM – 2:00PM
Wisconsin Center Ballroom ABCD

The Awards Luncheon recognizes the 2016 IEEE Awardees accepting their award at ECCE 2016. The IEEE Awards Program pays tribute to technical professionals whose exceptional achievements and outstanding contributions have made a lasting impact on technology, society and the engineering profession.

ECCE Clubhouse

Open during Expo Hall hours
Exhibit Hall A

The ECCE Clubhouse is a place for exhibitors and attendees to recharge. Surrounded by the activity on the exhibit hall, the ECCE Clubhouse provides seating area for impromptu meetings, stimulating conversations and a chance to mingle with your new contacts. The Clubhouse has been set to provide both attendees and exhibitors an area to take a seat, grab a cup of coffee, re-charge their electronics and exchange ideas.

Women in Engineering Breakfast

Wednesday, September 21st, 8:00AM – 9:00AM
Lakeshore AB | Hyatt Hotel

Speaker: Prof. Mahshid Amirabadi
Visit WEMPEC Event on Friday, September 23

The Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) is celebrating its 35th anniversary this year, and we invite all ECCE attendees – including first-time visitors as well as alumni and long-time friends – to come spend the day after ECCE ends with us at the University of Wisconsin - Madison for this special open house event. For those of you who have not visited us before, Madison is only 120 km away from the conference site in Milwaukee.

Activities planned for the day include a mixture of open lab sessions to meet our students, presentations by our two co-founders, Emeritus Profs. Don Novotny and Tom Lipo, and plenty of opportunities for socializing, including a buffet lunch. Optional afternoon/early evening activities include campus tours and a boat cruise on lovely Lake Monona.

The environment will be CASUAL with an emphasis on schedule flexibility so that you can spend your time doing the things that most interest you. For your convenience and to avoid parking problems, bus transportation (for a minimal fee) is offered from Milwaukee to Madison and return.

For complete details, including a schedule for the day’s activities, please use the following link: https://applications.wempec.wisc.edu/ecce/form/landing.html Alternatively, you can find the Visit WEMPEC event as a menu item under the “Programs” tab at the top of the ECCE’16 home page.

Registration for our Visit WEMPEC event is required, and the online registration from is accessible from the link above. If you decide to join us, we ask your cooperation by registering as soon as possible in order to assist us with our preparations. There is a modest US$20 fee that is required of all participants to help us defray our costs for lunch and refreshments.

If you have any questions about this event, please contact our WEMPEC Administrative Director, Helene Demont, at demont@engr.wisc.edu.

Bob Lorenz and Tom Jahns, WEMPEC Co-Directors
Giri Venkataramanan, Bulent Sarlioglu, and Dan Ludois, WEMPEC Associate Directors
**Oral Presenters**

**SPEAKER READY ROOM**

Sunday through Thursday  
Room: 103A

**ALL Oral Presenters** must check in at the Speaker Ready Room at least 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.

The hours of operation of the Speaker Ready Room are as follows:

- Sunday, September 18th: 8:30AM – 5:00PM
- Monday, September 19th: 8:30AM – 5:00PM
- Tuesday, September 20th: 8:30AM – 12:00PM
- Wednesday, September 21st: 8:30AM – 12:00PM
- Thursday, September 22nd: 8:30AM – 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 4pm the day prior for speakers presenting before 12noon or by 12noon for speakers presenting after 1pm. 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**

A Presenters’ orientation breakfast will be held for oral presenters and session chairs from 7:00AM – 8:00AM, Monday through Thursday at the Wisconsin Center. The location for the breakfast is as follows:

**Monday**  
Room: 203ABC  
**Tuesday through Thursday**  
Room: Ballroom ABCD

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/Tuesday**

**Exhibit Hall A**

- Poster Session I . . . . . . . . . . . . Monday, September 19th, 5:30PM – 7:00PM
- Poster Session II . . . . . . Tuesday, September 20th, 11:00AM – 12:30PM
- Poster Session III . . . . Tuesday, September 20th, 3:00PM – 4:30PM

Posters will be on display on Monday and Tuesday in Exhibit Hall A at the Wisconsin Center. The poster presenters should be available for questions at their display boards during their scheduled poster presentation time. If you are unsure in which session your poster should be presented, please review the complete Technical Session schedule.

Poster Presenters will have access to Exhibit Hall A at the Wisconsin Center to set up and tear down their posters at the times listed below for each of the Poster Sessions.

**POSTER SESSION I**

- Setup . . . . . . . . . . . . . . Monday, September 19th, 3:30PM – 4:30PM
- Poster Session . . . . . . . . Monday, September 19th, 5:30PM – 7:00PM
- Breakdown . . . . . . . . . . . . Monday, September 19th, 7:00PM – 8:00PM

Presenters for Poster Session I must have their posters set-up no later than 4:30PM. Any posters that remain on the poster boards at 8:00PM, and do not belong in Poster Session II will be removed and kept at the Registration Desk.

**POSTER SESSION II**

- Setup . . . . . . . . . . . . . . Tuesday, September 20th, 9:00AM – 10:00AM
- Poster Session . . . . . . . . Tuesday, September 20th, 11:00AM – 12:30PM
- Breakdown . . . . . . . . . . . . Tuesday, September 20th, 12:30PM – 1:30PM

Presenters for Poster Session II must have their posters set-up no later than 10:00AM. Any posters that remain on the poster boards at 1:30PM, and do not belong in Poster Session III will be removed and kept at the Registration Desk.

**POSTER SESSION III**

- Setup . . . . . . . . . . . . . . Tuesday, September 20th, 1:30PM – 2:30PM
- Poster Session . . . . . . . . Tuesday, September 20th, 3:00PM – 4:30PM
- Breakdown . . . . . . . . . . . . Tuesday, September 20th, 4:30PM – 5:30PM

Presenters for Poster Session I must have their posters set-up no later than 2:30PM. Any posters that remain on the poster boards at 5:30PM, will be removed and kept at the Registration Desk.

Uncollected posters will be discarded.

**POSTER BOARDS & PUSH-PINS**

4’x8’ (1.2192m x 2.4384m) poster boards will be provided, so please keep these dimensions in mind when printing your posters. Push pins will be provided for all poster presenters.

**POSTER PRESENTERS’ ORIENTATION**

A Presenters’ orientation will be held for poster presenters on Monday and Tuesday at the Wisconsin Center. The orientation will be located at the back of Exhibit Hall A behind the posters as follows:

- Orientation . . . . . . . . . . . . Monday – 3:00PM – 3:30PM
- Orientation . . . . . . . . . . . . Tuesday – 8:30AM – 9:00AM

Poster Presenters should attend the orientation each day that they are scheduled to provide a poster presentation; you may only attend on days on which you are scheduled to present. Coffee and refreshment will be provided.
The distinguished plenary speakers were invited this year to share their insights on the trends and the future of various aspects of energy conversion. The diverse mix of presentations from the leaders in their field will set the tone for this year’s conference. The organizing committee is pleased to welcome each of these speakers and offers warm appreciation for their contribution to the success of the conference.

**“INTELLIGENT MOTOR CONTROL IN A CONNECTED ENTERPRISE”**
Mr. Blake Moret  
President and CEO, Rockwell Automation

Blake Moret is the CEO of Rockwell Automation. He has 30 years of experience in sales, systems, services and product groups across Rockwell Automation. This experience includes international assignments in Europe and Canada. In 2005, he returned to Rockwell Automation global headquarters in Milwaukee to serve as business lead for the company’s operator interface business. Two years later, he was named vice president and general manager, Customer Support and Maintenance. He then became the senior vice president of the Control Products and Solutions (CP&S) business of Rockwell Automation which provides intelligent motor control products, automation solutions, and support services to companies around the world. CP&S consists of four business units – Industrial Components Business, Power Control Business, Systems and Solutions Business and Customer Support and Maintenance.

**“OPTIONS TO CREATE A SUSTAINABLE ENERGY FUTURE”**
Prof. Arun Majumdar  
Stanford University and former Founding Director of APAR-E

Prof. Majumdar’s research focuses on thermochemical water splitting reactions to produce carbon-free hydrogen; ionocalorics—electrochemical reactions for thermal energy conversion; understanding the limits of heat and mass transport in nanostructured materials; and re-engineering the electricity grid. In October 2009, President Obama nominated Dr. Majumdar to be the founding director of the Advanced Research Projects Agency—Energy (ARPA-E), where he served until June 2012. Between March 2011 and June 2012, Arun was also the acting Under Secretary of Energy and a senior advisor to Secretary of Energy Steven Chu.

**“FUTURE OF THE SMARTGRID”**
Prof. Massoud Amin  
University of Minnesota

Massoud Amin is the Director of the Technological Leadership Institute (TLI), holds the Honeywell/H.W. Sweat Chair, is a professor of Electrical & Computer Engineering (ECE), and a University Distinguished Teaching Professor Award Recipient at the University of Minnesota. He is Chairman of the IEEE Smart Grid, a Fellow of the IEEE and ASME, and a member of two utility industry regional entities that oversee reliability and security: the Texas Reliability Entity (as board chairman) and the Midwest Reliability Organization (as a board member).

**“OPTIMIZED POWER MANAGEMENT USING DATA ANALYTICS”**
Mr. Michael Regelski  
Senior VP of Engineering and Chief Technology Officer, Electrical Sector, Eaton Corporation

Mr. Regelski is responsible for overseeing technology development, new product development processes, and codes and standards for all Electrical Sector engineering activities at Eaton Corporation. He also leads the Electrical Sector in developing technology-driven strategies and growth initiatives. Regelski holds three U.S. Patents for Smart Card Utilization in Security Applications; Distributed Multi-Server Enterprise; Architecture for Security Systems; and Automatic Download of information to Security Systems. He is also a published author specializing in distributed computing and data management.

**“HVDC RESEARCH AND DEVELOPMENT IN CHINA”**
Dr. Guangfu Tang  
Vice President, Global Energy Interconnection Research Institute, China

Guangfu Tang joined the CEPRI in 1998, where his focus was on power electronics application in power systems, including flexible AC transmission systems (FACTS), high voltage and ultrahigh voltage DC (HVDC/UHVDC) transmission systems, VSC HVDC transmission systems, and DC grids. He became the executive director of the State Grid Smart Grid Research Institute of China in 2012. He is now a vice president of Globe Energy Interconnection Research Institute, China. Dr. Tang served on CIGRE SC B4 committee. He is a member of CIGRESC B4 AG4 and IEC SC22F WG25 and MT22. He is also a member of the IEEE PES Narain Hingorani FACTS and Custom Power Award Committee.
What does the Industrial Internet of Things (IIoT) have to do with energy conversion? Why should we care?

Room: 102C

Emcee: Thomas Jahns, Grainger Professor of Power Electronics and Electrical Machines

Organizer: Peter Wung, Staff Engineer, GE Aviation

Panelists: Steve Collier, Director Smart Grid Strategies, Milsoft Utility Solutions
Ronnie Pettersson, Global Director of Product Management, ABB
Joseph Salvo, Director at GE Global Research
Cliff Whitehead, Manager, Business Development at Rockwell Automation

Description:

• Why the Internet of Things (IoT)?
• What is the IIoT?
  ▶ Sensors
  ▶ Communications
  ▶ Storage and computing
    ■ Analytics: Big Data, AI.
  ▶ Cybersecurity
  ▶ Resiliency
  ▶ Standards
• Why are large industrial companies, vendors, and users investing in the IIoT? What is in it for them?
• How do you monetize IoT and communicate the value to your customers and your own organization?
• What are the obstacles from companies for NOT jumping in?

The term Internet of Things has become an ubiquitous and trendy term in the popular media. Consumer Electronics Show (CES) featured the IoT prominently in 2016 in the product offering and we have been inundated by a plethora of articles and press releases trying to describe the IoT. Much of the attention has focused on the consumer market and the remarkable products and gadgets flooding the market.

To a lesser degree, the idea of the Industrial Internet of Things (IIoT) has also been a hot topic, but specifically for the commercial and industrial segments. This is an as yet unexplored part of the story that we, as technologists, must become more familiar with.

This Town Hall meeting brings together four leading experts and visionaries, all actually working on industry based IIoT projects and products. We have paired them with a renowned academic expert in the electric machines and power electronics realm to represent the interest of the general audience, bringing a curious mindset and a lifelong learner’s perspectives to the discussion.

This session is not just a recitation of statistics and facts, it is planned to be highly participatory. We invite questions and thought provoking inquiries about the amorphous idea of the IIoT and we foresee this exercise promoting discussions, arguments, rigorous exchange of information, opinions, and ideas. The panelists are all experts, they will be armed with information and data, but they will have worked in the area and bring practical knowledge and a practitioner’s perspective and experience to the discussion.
Close to the Edge: The New Frontier of the Grid?

Room: 202C

Moderator:
Johan H Enslin, EPIC, UNC Charlotte

Panelists:
Igor Stamenkovic, EATON
Deepak Divan, Varentec / Georgia Tech
Ryan Kennedy, Atom Power
Chad Eckhardt, GridBridge
TBD, Duke Energy

Abstract:
An integrated grid is developing at the edge of the grid. Traditionally grid operators did not have any visibility or control over the final few meters of the grid close to the customer’s premise. With Advanced Metering Infrastructure (AMI), robust communication infrastructure, affordable sensors, solid-state protection and smart converter technology, the grid edge provides the ideal location to integrate distributed renewable energy, demand response technologies, OT-IT implementations and energy storage for the customer-focused utility of the future. The selected panelists will discuss challenges and opportunities to integrate grid-edge modernization technologies and business cases into a legacy and aging grid.
SIMULATION AND MODELING

SS1: Challenges of Simulating Power Electronic Systems

Tuesday, September 20th, 8:30AM – 11:00AM
Room 103C

The growth of electric vehicles and transportation, development and integration of renewable power, and broader adoption of motor control from industrial equipment to consumer products is driving the use of power electronics. Power electronics-based systems depend on optimized and energy-efficient embedded controls. An important step in developing these controls is system-level simulation.

In this panel discussion, thought leaders from academia and industry define the challenges of simulating power electronics, and experts in simulation technologies & approaches explain how they address these challenges. The session concludes with questions from the audience.

Moderator:
Jim Sember, Executive Director of WEMPEC

Thought Leaders:
Prof. Rob Cuzner, University of Wisconsin-Milwaukee, and Tim Obermann, Chief Engineer, Milwaukee Tool

Simulation Experts:
Christian Dufour (OPAL-RT), Kris Eberle (Plexim), Albert Dunford (Powersim), Kerry Grand (MathWorks), and Dr. Ivan Celanovic (Typhoon HIL)

CYBER SECURITY OF THE GRID I

SS2: Cybersecurity for Energy Delivery Systems

Wednesday, September 21st, 8:30AM – 10:00AM
Room 103C

The Cybersecurity for Energy Delivery Systems (CEDS) program emphasizes collaboration among the government, industry, universities, national laboratories, and end users to advance research and development in cybersecurity that is tailored to the unique performance requirements, design and operational environment of energy delivery systems. The aim of the program is to reduce the risk of energy disruptions due to cyber incidents as well as survive an intentional cyber assault with no loss of critical function. This presentation will describe the CEDS program, and in particular, the alignment of the CEDS program with the energy sector’s Roadmap to Achieve Energy Delivery Systems Cybersecurity, www.controlsystemsroadmap.net. The program will be delivered in two sections with section one beginning at 8:30 on Wednesday and section two taking place at 10:30 on Wednesday.

The first talk is an overview of a U.S. Department of Energy cybersecurity program known as CEDS – cybersecurity for energy delivery systems by program director Dr. Carol Hawk. This will be followed by presentations from Dr. Dmitry Ishchenko of ABB on a project they are undertaking to harden some of their equipment, and one by Prof. Osama Mohammad on securing smart grids. Prof. Mohammad and the fourth speaker, Dr. Tim Yardley, represent two recently awarded research centers in cybersecurity, SEEDS and CREDC, respectively.

SS3: Cyber Security of the Grid II

Wednesday, September 21st, 10:30AM – 12:00PM
Room 103C

The second session will begin with two talks on cybersecurity for vehicular systems. The first of these will be given by Dr. Stacey Prowell from Oak Ridge National Laboratory. The second will be given by Dr. Ashok Moghe from Cisco Systems. The final talks return to electric energy delivery systems. The third talk in this session is by Dennis Gammel of Schweitzer Engineering on cyber defense methods for industrial control systems. The final talk is provided by Bruno Sinopoli from Carnegie Mellon University on hardening cyber-physical systems.

SiC DEVICES

SS4: Practical Implementation of SiC MOSFETs for Industrial Applications

Wednesday, September 21st, 1:30PM – 3:00PM
Room 103C

SiC devices are now beginning to fulfill their many years of promise and are finding their way into niche industrial applications. This session, hosted by Infineon, GE and ABB will cover several aspects of the practical use of SiC devices from chip concept, thorough module layout, design implementation and applications. There will be four 20 minute presentations and a 15 minute open panel Q&A session with a group of technical experts in the field.

Our goal is to make this session informative and practical, and address some of the very real challenges that system and design engineers face when making decisions concerning the use of SiC MOSFETs.

Presentations.

1) SiC Trench MOSFETs. Design philosophy, performance and future challenges.
Peter Friedrichs (Infineon Germany)

2) SiC MOSFETs and modules for high power industrial applications.
Ljubisa Stevanovic (GE USA)

3) Practical implementation of a buck boost converter using SiC MOSFETs.
Martin Knecht (Infineon Germany) and David Levett (Infineon USA)

4) SiC for MV Applications.
Uwe Badstuebner (ABB Switzerland Ltd.)
SS5: Water Energy Nexus
Wednesday, September 21st, 3:30PM – 5:00PM
Room 103C

The Water Energy Nexus refers to both the use of water in energy production and the use of energy to extract, purify, deliver, heat, cool, treat and dispose of water. A broad range of products, processes, research topics and societal impacts fall under this category, however the intersection between energy conversion, renewable energy and water is resulting in several emerging and relevant technologies associated with achieving net zero energy usage and increased energy efficiency, self-sufficiency and resilience. Relevant products and research areas include real-time condition monitoring; integrated flow sensor technology; use of energy storage and renewables to prevent basement water back-up; alternatives to reverse osmosis systems; efficient, net zero energy waste water treatment; green technology for storm water treatment; low energy sewage inspection; and combined heat and power. Milwaukee is fast becoming a center for research and development in the water-energy area through the leadership of University of Wisconsin-Milwaukee (UWM), Marquette University, Midwest Energy Research Consortium (MWERC), the Milwaukee Water Council, Milwaukee Metropolitan Sewerage District (MMSD) and a host of area companies including AO Smith, Eaton Corp., Rockwell, Bosch Rexroth, ABB, Rexnord Industries, Schneider Electric and others.

This special session will include presentations on new developments in water-energy and future trends.

Moderator:
Bruce Beihoff, Assistant Professor, University of Wisconsin-Milwaukee

Presenters:
Low Energy Consumption Waste Water Treatment Systems
Kevin Shafer, Executive Director of MMSD

Waste Water Treatment and Hydro-Power Technologies
Johan Enslin, Duke Energy Distinguished Chair in Power Engineering Systems at University of North Carolina
Ryoichi Amano, Professor of Mechanical Engineering at UWM specializing in fluid mechanics and heat transfer

Real-Time Water Sensors in Intelligent Water Distribution Systems
Junhong Chen, UWM Distinguished Professor specializing in energy conversion, storage and conservation, water sensors and pollution control

SS6: Advanced Electrical Machines I
Thursday, September 22nd, 8:30AM – 10:00AM
Room 103C

The advent and applications of the electrical machines in industry started in 19th century. Now, in 21st century, there are still strong investments and developments in designing and manufacturing electrical machines with high efficiency – as imposed by international standards – and high torque density – as imposed by modern applications as green aircrafts, electrical vehicles or renewables. Compared to the industry work horse, cheap, robust, reliable, i.e. the induction machines, the brushless permanent magnet machines (BPM) are currently representing the industrial electromagnetic/thermal/mechanical solution with the highest torque density. Superior in performance to any other electric motor topology: induction, reluctance, DC, wound-field synchronous, the large scale development of the BPM machines was possible when two rare-earth based permanent magnets were invented and the power electronics developments lead to cheap and highly efficient components.

While the theoretical aspects are largely analyzed and discussed in research papers coming from academia, the practical implementation and the encountered challenges in industrial environment is less debated and shared within the engineering community.

This two parts special session gathers experts from the industry to present various aspects and approaches in developing, prototyping and moving into mass production of the well established induction motors or the highest torque density solution: BPM machines.

The challenges in automotive, aviation, in building large BPM machines, the selection criteria of the permanent magnet materials, industrial production of induction and BPM machines and their presence in automotive industry to build EV/PHEV is illustrated in this special session.

The intended audience includes: engineers and researches from industry, student and academics, all with a focus on the analysis, development and production of brushless permanent magnet machines.

The session will involve two sessions. The first session will include the following presentations:

Automotive Motors: Recent Accomplishments and Challenges Ahead
Author: Bruno Lequesne, E-Motors Consulting, LLC, USA

More Electric Aircraft (MEA) Path Forward
Author: Hao Huang, Technology Chief, GE Aviation Electrical Power, USA

Induction Motors in the 21st Century
Author: Steven Englebretson, ABB R&D, USA

The Design and Application of Latest Generation Permanent Magnet Machines
Author: Steven Stretz, Regal Beloit, USA

SS7: Advanced Electrical Machines II
Thursday, September 22nd, 10:30AM – 12:00PM
Room 103C

The second portion of the session will include the following presentations:

Design, Manufacturing and Testing of Large Permanent Magnet Generators
Author: Haran Karmaker, TECO-Westinghouse, USA

Rare Earth Based Permanent Magnets for Electric Machines: Material Selection, Failure Risks and Design Considerations
Authors: Melania Jasinski, Heeju Choi and Jinfang Liu, Engineering at Electron Energy Corp., USA

Traction Motor Solutions for Automotive Applications
Authors: Mircea Popescu, James Goss, Dave Staton, Motor Design Ltd., UK

This two parts special session gathers experts from the industry to present various aspects and approaches in developing, prototyping and moving into mass production of the well established induction motors or the highest torque density solution: BPM machines.
Mechanical circuit breakers have been the main protective devices in the century old AC grid. Due to the existence of current zero crossing, these devices with proper arc managements have served the function well. However, the fault current clearance time is in the range of several to tens of line cycles. As a consequence of the slow clearance speed, the fault current level is typically very high, resulting in significant challenges in substation design and coordination since all equipment must be rated to handle the high fault current levels. With the increased integration of more and more renewable and distributed generations in the distribution system, the fault current pattern is changing and the fault current level can be even higher. Therefore, faster protection are needed.

Compared to the AC grid, DC grid provides many advantages. At low voltage levels, LVDC such as 380VDC microgrids find more and more applications in renewable energy integrations and commercial buildings because of higher efficiency due to significantly simplified power conversion stages. Various energy sources, loads and storages are easily interconnected; and the power quality and system stability are improved. At high voltage levels, HVDC system has been increasingly used due to its high transmission efficiency very long distance when compared with HVAC system. Medium voltage DC (MVDC) is also actively studied for distribution system implementation and shipboard power. However, one of the most challenging issues for DC grids is their protection and control. Due to the absence of current zero crossing, traditional mechanical circuit breaker cannot be used. Also the protection speed must be significantly improved otherwise the fault current will be too high.

This tutorial’s objective is to provide an overview of the circuit breaker technology with an emphasis on the challenges and needs for ultra-fast circuit protection in AC and DC grids. The tutorial is organized in four parts: Part I provides a review of basic functions and technologies of AC circuit breakers in conventional AC systems, the challenges emerging from the protection and control of DC systems and advanced AC systems, as well as various circuit interruption technologies. Part II gives more details regarding the solid state circuit breakers. Part III focuses on the fast acting mechanical switch which is the key component to achieve low-loss high speed protection functions. In the end, Part IV identifies the challenges of high performance circuit breaker. Future research can be focused on high speed actuators, optimized solid state switches for circuit breakers, new topologies and system study for coordinated protection and control.

Modular Multilevel Converters (MMC), with distinctive features of modularity, scalability, easy assembly, high quality voltage waveform, outstanding control performance, easy redundancy and high efficiency, are becoming a competitive power conversion topology for medium and high voltage applications. They have already revolutionized voltage sourced converters (VSC) based high voltage direct current (VSC-HVDC) power transmission systems, pushing the voltage and power ratings to an unprecedented high level, and are the key technology for building multi-terminal HVDC systems and future DC grids. At present, MMCS are also being considered in many medium-voltage (MV) applications, such as machine drives, energy storage interface etc.

However, the use of hundreds of sub-modules involving thousands of components and associated control and measurement signals, demands very high requirements for the control, monitoring, and communication of the MMC. Simultaneous management of multiple control objectives, including control of active/reactive power, regulation of the input and output voltages/currents, balancing of the sub-module capacitor voltages, suppression of the circulating current, further increases the control difficulties. In addition, there are significant challenges facing the development of large scale HVDC grid including power flow control, DC fault protection etc. Over the past years, significant research efforts have been made in the academics and industries to tackle these problems. The purpose of this tutorial is to provide a systematic introduction of the MMC on the operating principles, converter models, modulation strategies, control schemes etc, and to give a comprehensive review of the latest achievements, emerging applications, and remaining challenges.

This tutorial will start with an overview of MMC characteristics and operating principles. Detailed MMC control will then be described including the available modulation strategies, capacitor voltage balancing schemes, circulating current control, as well as the capacitor pre-charging and fault tolerant operation. Efficient modeling and simulation techniques for MMC, both off-line and real-time, are then presented. Furthermore, this tutorial will give special emphasis to the applications of MMC: 1) MMC in HVDCs, specifying the design considerations of MMC-HVDC system, the key equipment for future large scale DC grid and its power flow control and challenges in DC fault protection; 2) MMC used as variable speed drives, showing its great feasibility and advantages over other multilevel topologies, but also revealing the disadvantage of the excessive capacitor voltage ripple at low speeds and possible methods for its attenuation; 3) Real project experience of multi-terminal MMC-HVDC system will be presented and finally, the other emerging MMC applications and future research opportunities will be discussed.
T1-3 Linearized Modeling and Stability Analysis of AC Power Electronic Based Power Systems

Room: 102B
Instructors: Frede Blaabjerg, Aalborg University, Denmark, Xiongfei Wang, Aalborg University, Denmark

Power electronics technology is changing the way of electricity generation, transmission, and consumption. A vast range of grid applications of power electronics can be found in renewable energy power generations, flexible dc and ac power transmission systems, adjustable speed drives and other energy-efficient power loads. The ac power electronic based power systems are thus evolving into electrical grids at different power levels, ranging from standalone power systems and microgrids to large-scale renewable power plants.

The dynamic variations of switching instants make power electronic converters nonlinear and time-variant, which, together with their wideband control dynamics, tend to cause a number of stability and power quality problems. Besides the high-frequency switching harmonics, the frequency coupling effect of the outer power control and grid synchronization loops of grid-connected converters may lead to non-characteristic harmonic distortions. Moreover, more capacitances are being presented in the power electronic based power systems, due to the parasitic capacitances of power transmission cables and capacitances of converter-filters. The interactions among the ac-dc converters and the weak or resonant power grids may give rise to instability phenomena in a wide frequency range.

There have been many research efforts made for small-signal modeling of grid-connected converters and system stabilization at different frequencies. The state-space averaging method with the dq transformation is widely used for small-signal linearization, which, however, yields a real space vector model requiring the use of multivariable stability criterion. Moreover, the use of state-space averaging filter neglects the effect of switching frequency harmonics, which is merely justified for converters with high switching to fundamental frequency ratio. To overcome these drawbacks, the generalized averaging method, dynamic phasor models, and harmonic state-space modeling based on linear time-periodic systems have been developed.

This tutorial thus gives first a comprehensive review of linearized modeling methods of ac-dc converters for frequency coupling analysis and stability prediction. The principle of harmonic state-space modeling method is exemplified by a grid-connected converter with low switching to fundamental frequency ratio. The use of complex transfer functions to represent the dq-frame converter model is also discussed. The instability phenomena associated with the different control loops, e.g. current control, grid synchronization, and power control, are illustrated. Tools for system-level stability analysis with multiple ac-dc converters are then discussed and implemented with a few examples. Perspectives on the challenges and future trends of modeling and stability analysis of ac power electronic based power systems are finally given.

T1-4 The Origin of Converters

Room: 102C
Instructors: Tsai-Fu Wu, National Tsing Hua University, Taiwan

PWM converters have been widely applied for power processing and they are typically the stems of other types of converters, such as quasi-resonant, Z-source and switched-inductor hybrid converters. Development of PWM converters has been spanning over a century, starting from the buck converter. The well-known PWM converters include buck, boost, buck-boost, cuk, SEPIC, Zeta, Z-source, etc. Many attempts have been made to develop these converters based mostly on canonical cell concepts and by introducing extra LC filters to the cells.

Charles Darwin published a book, namely “The Origin of Species”. He claimed organic beings were evolved from the original species. Analogously, does there exist the origin of converters? This tutorial lecture presents identification of the original converter, from which the rest of converters can be evolved and derived systematically. The processes of converter evolution and derivation including coding and synthesizing will be then presented, which bridge transfer gains or codes to converter topologies uniquely. Unlike conventional approaches based on switching cell or LC cell concept, we will develop converters from the original converter and its derived. During presentation, the well-known converters will be illustrated with the discussed processes. This tutorial will provide research experts, engineers and students a prospective vision of power converter evolution, derivation and development.

T1-5 Advanced High-Power Industrial Drives

Room: 102D
Instructor: Richard Zhang, GE Power Conversion, China, Jie Shen, GE Global Research, Stefan Schroeder, GE Global Research

This tutorial gives a lecture on high-power medium-voltage converters from industrial point of view. Firstly it introduces the motivations applying high power drives for various applications. Then it introduces devices, topologies and controls that have been applied for industrial drives. Moreover, some GE’s customized solutions are presented to serve special applications, including a 35MW O&G drive, a 2x27MVA 4-quadrant motor testbed, a 11MW/590Hz high-speed O&G drive, etc. Finally, the emerging technologies and applications are discussed, including the SiC devices, advanced cooling concepts and subsea drives.

The presenters are from GE Power Conversion and GE Global Research that have been working in this area since years. The authors have made similar topics on European PhD summit and ECCE2014.

T1-6 Power Semiconductors for Vehicle Traction Inverters: From Discretes to Power Modules, from Silicon to Wide Band Gap devices

Room: 103C
Instructors: Andre Christmann, Infineon Technologies, USA, David Levett, Infineon Technologies, USA

This tutorial will provide an overview of the use of power semiconductors in vehicle traction inverter applications. It will cover four major aspects of three-phase inverters for DC-AC power conversion in HEVs, PHEVs, and EVs:

- Inverter design principles for high efficiency
- Silicon packaging
- Integration of different package types into an Inverter
- Performance assessment of different families of semiconductors: IGBTs, MOSFETs and SiC
T2-1 Electric Machine Design for Automotive Applications

Room: 101B
Instructors: James Goss, Motor Design Ltd., UK, Mircea Popescu, Motor Design Ltd., UK

There is currently significant activity in the development of electric machines for automotive applications where a wide variety of possible solutions can be seen. This tutorial aims to evaluate a range of the most common design options in terms of performance, cost and manufacturability. The tutorial will be focussed upon a set of typical electric machine specifications through which the following design variations will be explored:

- Machine configurations: A comparison between the permanent magnet motor solutions - with magnetless solutions – induction motors and synchronous reluctance motors is undertaken. In addition, various rotor topologies particularly for the permanent magnet motors are compared for example multilayer interior PM, surface mounted, outer rotor and simple interior PM.

- Winding technologies: The two main winding categories, concentrated and distributed, are compared and within these various technologies evaluated. For concentrated windings, open slot tooth wound, segmented and edge wound. For distributed, bar wound and multistranded. Clearly these winding approaches are linked to various slot/pole combinations and winding connections which are also discussed.

- Material variations: Copper and aluminum have interesting trade-offs in terms of cost, conductivity, density and AC loss which is considered in the choice of winding material. In induction motor rotors this choice is also important and contains various trade-offs between cost and performance. Different magnet materials are investigated with ferrite magnets proving an interesting option for low cost designs. Various electrical steel grades are also compared.

- Cooling approaches: The common cooling mechanisms found in automotive designs are discussed and their effectiveness with various machine and winding types evaluated. These cooling approaches include stator water jackets, shaft cooling, oil spray cooling and air cooling.

The performance of the design choices will be evaluated using sophisticated electromagnetic and thermal modelling techniques. The modelling will evaluate continuous and peak torque/speed characteristics, performance over duty cycles and efficiency maps as well as accounting for aspects such as AC winding loss, voltage harmonics, demagnetization and complex heat transfer paths.

T2-2 High Power Si & SiC Module Technology & Application Considerations

Room: 101CD
Instructor: John F. Donlon, Powerex, Inc., PA, USA, Eric R. Motto, Powerex, Inc., PA, USA

High Power Semiconductor modules are the workhorse power switch for industrial applications. This seminar will discuss the issues a designer must deal with in using these devices including interpretation of device ratings, gate drive requirements, and providing device and system protection. The intent of this seminar is to aid the designer in choosing and applying a power module to a new product. Questions and concerns a designer might have will be addressed by the various techniques and circuit examples that will be presented. Chip technology and packaging options will be discussed with special attention to the tradeoffs between silicon and silicon carbide. The practical application of SiC power devices today and in the future will be discussed. The attendees should leave the course with a better understanding of the power module, specifically as a device and how it functions in an application. The goal will be to impart an understanding of desirable features, characteristics, and limitations. This will include the application in power circuits, protection from internal and external disturbances, and an understanding of thermal design, handling, and reliability considerations. The seminar is intended for design engineers having to deal with conflicting and conflicting information on device data sheets and should be of interest to anyone who uses, applies, procures, or specifies power electronic products based on high power IGBTs as the power switch.

T2-3 Shipboard DC Microgrids

Room: 102B
Instructors: Josep M. Guerrero, Aalborg University, Denmark, Rober Cuzner, University of Wisconsin - Milwaukee, US, Giorgio Sulligoi, Trieste University, Italy, Shantha Gamini, Univ. of Tasmania, Australia

Under normal operating conditions at sea, the ship electrical system can be considered as a typical isolated microgrid. When the ship docks to the seaport and is powered with shore power it makes a grid connected microgrid. Thus, ship microgrids may resemble some analogies to commercial microgrids with similar issues and opportunities. Moreover, with the ever growing demands for emission reduction and fuel efficiency improvement, sustainable energy sources are becoming an integral part of marine electrical power systems. In addition, the intermittency and slow dynamics of these sources together with the presence of pulse loads, such as radar, make energy storage inevitable in future shipboard power systems to achieve faster transient characteristics.

These sources and energy storage elements are predominantly dc and thus onboard dc distribution is often used for integration and thereby improve the energy conversion efficiency. Therefore, future shipboard power systems are predicted to be predominantly dc microgrids.

This tutorial provides an overview of power system architectures of present and future ship microgrids, various sources, loads and their characteristics, control technologies and optimization methods in both islanded and grid connected operations. Protection coordination, multi-zonal architectures and fault isolation in future shipboard dc microgrids are also discussed in detail as the challenges in realization of future MVDC shipboard microgrids. The tutorial session is recommended for audience from both industry and academia with an interest in ship microgrids. In general, any participant who is interested in learning about the latest trends in this area is welcomed.
The smart grid (SG) as a research area is advancing dealing with a wider range of topics such as power systems, energy generation and telecommunication. The conventional utility grid used to operate in a passive mode absorbing energy from the substations and delivering it to the customers. This approach is well developed but the needs of the state-of-the-art technology require a bidirectional flow of power and data. Nevertheless, smart grid systems provide more flexible, reliable, sustainable, secure and two-way communication service. Especially, integration of renewable energy sources, electrical vehicles and distributed generations (DG) in to network can be achieved in an efficient way in smart grid system. All these positive aspects of smart grids have been attained by integration of power electronics and telecommunication technologies with the grid. This presentation deals with contributions of power electronics to SG in the context of generation, conversion, and distribution.

T2-5 Modeling and Control of Grid Inverters

Room: 102D
Instructor: Mark Dehong Xu, Zhejiang University, China

With the increase of renewable energy penetration to the utility, the requirements to the grid inverter become higher and higher. One aspect of these requirements is that the grid inverter has higher power quality. Therefore, LCL filters have been widely used in the grid inverter. However, the grid inverter with LCL filter is sensitive. The damping control of it is critical to its proper operation.

To analytically design the controller for the grid inverter, dynamical models for either single-phase or three-phase inverters with LCL filter are needed. With the dynamical model, transfer functions in dq rotating frame are able to be derived. Then the control can be designed analytically with traditional control theory.

Since the transfer function of the grid inverter with LCL filter is the 3rd order, the bandwidth of the close loop will become narrower with the conventional PI controller design methodology. In this tutorial, a novel control scheme is introduced, which is known as Weighted Average Current Control (WACC). With WACC, the transfer function is transformed into the 1st order. It can widen the bandwidth significantly and realize damping control at the same time. Extensions of Weighted Average Current Control will be also introduced. DC current injection to the grid, which is caused by the grid inverter, is harmful to devices in the distribution systems. Generally the DC current injection occurs due to the asymmetry of the power device characteristics and control or gating drives in the grid inverter. An active DC current rejection control to the Grid is introduced. It is effective for both single phase and three phase grid inverter.

The power quality of the grid inverter is deteriorated when the harmonics of the PCC voltage is poor. It is especially serious for high power grid inverters since the PWM switching frequency is deliberately selected to be lower to satisfy the efficiency requirement. Selective harmonics suppressing control loop may be added to reduce the effect of PCC voltage harmonics influence.

For three phase grid inverter, there exist different PWM methods such as Continuous PWM, Discontinuous PWM, Selective Harmonics Elimination PWM (SHEPWM) etc. The power loss distribution in the components of the grid inverter varies with the changing of the loading. One PWM method, which is good for the heavy load, may be not ideal for the light load. On the other hand, one PWM method, which is good for static state such as SHEPWM, may be not suitable to Low Voltage Ride Through condition. Hybrid PWM for the grid inverter comprises with the different operating conditions. It can increase the performance of the grid inverter with the regards to the entire loading condition.

T2-6 Predictive Control - A simple and Powerful Method of Control Power Converters and Drives

Room: 103C
Instructors: Ralph Kennel, Technische Universitat Munchen, Germany, Jose Rodriguez, Federico Santa Maria Technical University, Chile, M. Kazmierkowski, University of Technology, Poland

This tutorial provides a fundamentally different perspective to control of switching power electronic systems. It is based on controlling the time evolution of the switching states (i.e., switching sequences) as well as controlling the switching transition of the power semiconductor device of the solid state electronic system. The former – i.e., switching-sequence based control (SBC) yields rapid response under transient condition, optimal equilibrium response, and yields seamless transition between the two states of dynamics. The first part of the tutorial will primarily focus on SBC for power electronics systems. By enabling integration of modulation and control, SBC precludes the need for ad-hoc offline modulation synthesis. In other words, an optimal switching sequence for the power converter is generated dynamically without the need for prior determination of a modulation scheme (which generates a pre-determined switching sequence) in typical conventional approaches. One of the distinctions between SBC and conventional model predictive control (MPC) is that SBC ensure optimal determination of the switching sequence of the power converter under stability bound. The tutorial will provide the mechanism to carry out SBC and MPC control syntheses and demonstrate the differences between SBC and MPC. Several device, converter, and network level implementations (e.g., motor drive, multilevel converter, microgrid, parallel inverters, aircraft power system) of the SBC will be provided.

The second part of the tutorial reviews control and modulation methods that fully exploit the performance potential of high-power converters, by ensuring fast control at very low switching frequencies and low harmonic distortions. To achieve this, the control and modulation problem is addressed in one computational stage. To this end, the benefits of deadbeat control methods (such as direct torque control) are combined with the optimal steady-state performance of optimized pulse patterns, by resolving the antagonism between the two. As a result, the current harmonic distortions and the switching losses can be reduced simultaneously, when compared to carrier-based PWM. Indeed, at low switching frequencies, the resulting steady-state behavior is similar to that of optimized pulse patterns. During transients, however, very fast current and torque response times are achieved, similar to deadbeat control. To this end, two control and modulation methods will be presented. First, a direct MPC with long prediction horizon. Using a branch and bound technique, the optimization problem can be solved efficiently for long prediction horizons. Large performance benefits result for converters with LC filters, which do not require an additional active damping loop. This formulation generalizes the well-known finite control set MPC formulation. Second, a fast closed-loop control based on optimized pulse patterns will be provided. Experimental results on a five-level medium-voltage drive will be demonstrated.

Finally, the tutorial will focus on switching transition control (STC). The primary objective of STC is to demonstrate how key power electronic system parameters including di/dt and dv/dt stress, switching loss, electromagnetic noise emission can be controlled dynamically by modulating the dynamics of the power semiconductor devices. Both electrical and newly developed optical control mechanisms to achieve STC will be demonstrated. In the context of the latter, mechanisms for monolithic integration of switching sequence control as well as switching transition control will be outlined and the revolutionary impact of such a novel integration on system performance will be demonstrated with practical applications.
## S1 Modular Multi-Level Converters, HVDC, and DC Grids I

**Room:** 203DE  
**Chairs:** Enrico Santi, Ghanshyamsinh Gohil

### 1:30PM | The Modular Embedded Multilevel Converter: A Voltage Source Converter with IGBTs and Thyristors
Di Zhang, Rajib Datta, Andrew Rockhill, Qin Lei and Luis Garces, GE, United States; Eaton, United States; ASU, United States

### 1:55PM | Multi-Module-Cascade High-Voltage Composite Switch
Binbin Wang, Yao Lu, Xinnian Sun, Wenxi Yao and Zhengyu Lu, Zhejiang University, China; Hangzhou D-River Electric Technology Company, China; Hangzhou Silver Lake Electric Equipment Company, China

### 2:20PM | Step-Up MMC with Staircase Modulation: Analysis, Control, and Switching Strategy
Younes Sangsafdizi and Ali Mehrizi-Sani, Washington State University, United States

### 2:45PM | A High Step-Up Ratio Soft-Switching DC-DC Converter for Interconnection of MVDC and HVDC Grids
Shenghui Cui, Nils Soltau and Rik W. De Doncker, RWTH Aachen University, Germany

### 3:10PM | Fault Tolerant Cell Design for MMC-based Multiport Power Converters
Alberto Zapico, Mario Lopez, Alberto Rodriguez and Fernando Briz, University of Oviedo, Spain

### 3:35PM | HIL Platform Design and Controller Verification for MMC Based HVDC Networks
Luis Herrera, Xiu Yao and Jin Wang, University of Dayton Research Institute, United States; University at Buffalo, United States; The Ohio State University, United States

## S2 Renewable Energy I

**Room:** 203C  
**Chairs:** Wei Qiao, Liyan Qu

### 1:30PM | Energy Storage Opportunities and Capabilities in a Type 3 Wind Turbine Generator
Eduard Muljadi, Vahan Gevorgian and Anderson Hoke, National Renewable Energy Laboratory, United States

### 1:55PM | Assessment of System Frequency Support Effect of a PMSG-WTG Using Torque-Limit Based Inertial Control
Xiao Wang, Wenzhong Gao, Jianhui Wang, Ziping Wu, Weihang Yan, Vahan Gevorgian, Yingchen Zhang, Eduard Muljadi, Moses Kang, Min Hwang and Yong Cheol Kang, University of Denver, Northeastern Univ., United States; University of Denver, United States; Northeastern Univ., China; National Renewable Energy Laboratory, United States; Chonbuk National Univ., Korea (South)

## ORAL SESSIONS

### 2:20PM | Improved Efficiency of Local EPS through Variable Switching Frequency Control of Distributed Resources
Jose M. Cano, Andres Suarez, Angel Navarro-Rodriguez and Pablo Garcia, University of Oviedo, Spain

### 2:45PM | Smart EV Charging System for Maximising Power Delivery from Renewable Sources
Fearghal Kineavy and Maeve Duffy, NUI Galway, Ireland

### 3:10PM | Instantaneous Frequency Regulation of Microgrids via Power Shedding of Smart Load and Power Limiting of Renewable Generation
Shuo Yan, Ming Hao Wang, Tian Bo Yang and S. Y. Ron Hui, The University of Hong Kong, Hong Kong

### 3:35PM | Modeling and Identification of Harmonic Instability Problems in Wind Farms
Esmail Ebrahimzadeh, Frede Blaabjerg, Xiongfei Wang and Claus Leth Bak, Aalborg University, Denmark

### 2:20PM | Voltage Stability Analysis Using A Complete Model of Grid-Connected Voltage-Source Converters
Zhi-Xiang Zou, Andreas Martin Kettner, Giampaolo Buticchi, Marco Liserre and Mario Paolone, University of Kiel, Germany; Ecole polytechnique federale de Lausanne, Switzerland

### 2:45PM | Resonant Control for Power Converters Connected to Weak and Micro Grid Systems with Variant Frequency
Jaime Rohten, Pedro Melin, Jose Espinoza, Daniel Sbarbaro, Jose Silva and Marcelo Perez, Bio Bio University, Chile; Concepcion University, Chile; Santa Maria University, Chile

### 3:10PM | Extended-Horizon Finite-Control-Set Predictive Control of a Multilevel Inverter for Grid-Tie Photovoltaic Systems
Jose Silva, Jose Espinoza, Jaime Rohten, Luis Moran, Eduardo Espinosa, Carlos Baier and Javier Munoz, Concepcion University, Chile; Catholic University, Chile; Talca University, Chile

### 3:35PM | A Novel Seamless Transfer Control Strategy for Wide Range Load
Kinyong Kim, Dongsul Shin, Jong-Pil Lee, Tae-Jin Kim, Dong-wook Yoo and Heejie Kim, Pusan National University, Korea; Republic of; LG Electronics, Korea, Republic of; Korea Electrotechnology Research Institute, Korea, Republic of
**S4  DC-DC Converters: Switched Capacitor**

Room: 102D  
Chairs: Alireza Khaligh, Tiefu Zhao

### 1:30PM  |  Hybrid Switched-Capacitor Quadratic Boost Converters with Very High DC Gain and Low Voltage Stress On Their Semiconductor Devices  
Manxin Chen, Jiefei Hu, Li Kerui and Adrian Ioinovici, Sun Yat-sen University, China; Holon Institute of Technology, Israel

### 1:55PM  |  Mixed Switched-Capacitor Based High Conversion Ratio Converter and Generalization for Renewable Energy Applications  
Kerui Li, Manxin Chen, Jiefei Hu and Adrian Ioinovici, Sun Yat-sen University, China; Holon Institute of Technology, Israel

### 2:20PM  |  A High Step-Up DC-DC Converter with Switched-Capacitor and ZVS Realization  
Zhipeng Zheng and Liangrong He, Xiamen University, China

### 2:45PM  |  A Flying Capacitor Multilevel Converter with Sampled Valley-Current Detection for Multi-Mode Operation and Capacitor Voltage Balancing  
Jan Rentmeister, Christopher Schaefer, Benedict Foo and Jason Stauth, Dartmouth College, United States

### 3:10PM  |  Resonant Switched Capacitor Stacked Topology Enabling High DC-DC Conversion Voltage Ratios and Efficient Wide Range Regulation  
Yongjun Li, Huai Wang, Guorong Zhu and Frede Blaabjerg, Aalborg University, Denmark; Wuhan University of Technology, China

### 3:35PM  |  Bi-Directional Bridge Modular Switched-Capacitor-Based DC-DC Converter with Phase-Shift Control  
Ye Ding, Liangzong He and Zhao Liu, Xiamen University, China; Nanjing University of Science and Technology, China

**S5  Multi-Phase Rectifiers**

Room: 202E  
Chairs: Luca Zarri, Mahshid Amirabadi

### 1:30PM  |  A Review of Electronic Inductor Technique for Power Factor Correction in Three-Phase Adjustable Speed Drives  
Pooya Davari, Yongheng Yang, Firuz Zare and Frede Blaabjerg, Aalborg University, Denmark; The University of Queensland, Australia

### 1:55PM  |  The Power-Loss Analysis and Efficiency Maximization of A Silicon-Carbide MOSFET Based Three-phase 10kW Bi-directional EV Charger Using Variable-DC-Bus Control  
Kevin (Hua) Bai, Chenguang Jiang, Hui Teng and Bo Lei, Kettering University, United States

### 2:20PM  |  Modular Multi-Parallel Rectifiers (MMR) with Two DC Link Current Sensors  
Firuz Zare, Danfoss Drives A/S, Denmark

### 2:45PM  |  Comparison of Three-phase Active Rectifier Solutions for Avionic Applications: Impact of the Avionic Standard DO-160 F and Failure Modes  
Uros Borovic, Sisi Zhao, Marcelo Silva, Yann E. Bouvier, Miroslav Vasic, Jesus A. Oliver, Pedro Alou, Jose A. Cobos, Fernando Arevalo, Juan Carlos Garcia-Tembleque, Jorge Carmena, Constantino Garcia and Predrag Pejovic, Universidad Politecnica de Madrid, Spain; Indra Sistemas, Spain; Fac. of Electr. Eng., Univ. of Belgrade, Serbia and Montenegro

**S6  Single-Phase Inverters**

Room: 203AB  
Chairs: Aaron Cramer, Roberto Petrella

### 1:30PM  |  A Generic Topology Derivation Method for Single-phase Converters with Active Capacitive DC-links  
Haoran Wang, Huai Wang, Guorong Zhu and Frede Blaabjerg, Aalborg University, Denmark; Wuhan University of Technology, China

### 1:55PM  |  Power Decoupling Method for Single Phase PV System Using Cuk Derived Micro-Inverter  
Anindita Jamatia, Vasav Gautam and Parthasarathi Sensarma, Indian Institute of Technology, Kanpur, India

### 2:20PM  |  A Multi-port, Isolated PV Microinverter with Low Decoupling Capacitance and Integrated Battery Charger  
Shiladri Chakraborty and Souvik Chattopadhyay, Indian Institute of Technology Kharagpur, India

### 2:45PM  |  A Single Phase Transformerless String Inverter with Large Voltage Swing of Half Bridge Capacitors for Active Power Decoupling  
Jinia Roy, Yinglai Xia and Raja Ayyanar, Arizona State University, United States

### 3:10PM  |  A-Source Impedance Network  
Yam Siwakoti, Frede Blaabjerg, Veda Prakash Galigekere and Marian K. Kazimierczuk, Aalborg University, Denmark; Wright State University, United States

### 3:35PM  |  A Semi-Two-Stage DC-AC Power Conversion System with Improved Efficiency Based on A Dual-input Inverter  
Tiantian Mu, Hongfei Wu, Lei Zhu and Wenying Jiang, Nanjing Univ. of Aeronautics and Astronautics, China

**S7  DC-DC Converters I**

Room: 102C  
Chairs: Praveen Jain, Liangzong He

### 1:30PM  |  Single-Input Multiple-Output Synchronous dc-dc Buck Converter  
Bharath Kumar Sabbarapu, Omar Nezamuddin, Andrew McGinnis and Euzeli dos Santos, Indiana University-Purdue University-Indianapoli, United States

### 1:55PM  |  Dual-Input Dual-Output Single-Switch Dc-Dc Converter for Renewable Energy Applications  
Aluisio Alves de Melo Bento, Edison Roberto Cabral da Silva and Diego Alberto Acevedo Bueno, Federal University of Campina Grande, Brazil

### 2:20PM  |  A High Step-Up Interleaved Converter with Coupled Inductor and Voltage-Lift Technique  
Atsushi Matsuda and Hirotaka Koizumi, Tokyo University of Science, Japan
2:45PM | Single Resonant Cell Based Multilevel Soft-Switching DC-DC Converter for Medium Voltage Conversion
Jiepin Zhang, Trillion Q Zheng, Xiaofeng Yang and Miao Wang, Beijing Jiaotong University, China

3:10PM | Unified Model of High Voltage Gain DC-DC Converter with Multi-cell Diode-Capacitor/Inductor Network
Yan Zhang, Liu Jinjun, Dong Zhuo and Yanfei Liu, Xi’an Jiaotong University, China; Queen’s University, Canada

3:35PM | Comparative Evaluation of a Triangular Current Mode (TCM) and Clamp-Switch TCM DC-DC Boost Converter
Oliver Knecht, Dominik Boris and Johann Walter Kolar, ETH Zurich, Switzerland

S8 DC-DC: Dual Active Bridge

Room: 102E
Chairs: Regan Zane, Zhiqiang Guo

1:30PM | Analytically Constrained ZVS Operation to Reduce Commutation Losses for High Boost Dual-Active Bridge Converters
Jan Riedel, Donald Grahame Holmes, Brendan Peter McGrath and Carlos Teixeira, Robert Bosch (SEA) Pte Ltd, Singapore; RMIT University, Australia

1:55PM | Passive Auxiliary Circuit for ZVS Operation of A Wide-DC-Range Dual-Active-Bridge Bidirectional Converter for Transportation Applications
Alireira Safaei, Praveen Jain and Alireira Bakhshai, Osram Sylvania, United States; Queen’s University, Canada

2:20PM | Charge-Based ZVS Modulation of a 3-5 Level Bidirectional Dual Active Bridge DC-DC Converter
Georgios Stakianakis, Jordi Everts, Henk Huisman, Cornelis Wijnands and Elena Lomonova, Eindhoven University of Technology, Netherlands

2:45PM | Parallel-Connected Bidirectional Current-Fed Dual Active Bridge DC-DC Converters with Decentralized Control
Deshang Sha, Wenqi Yuan, Guo Xu, Fulin You and Jianliang Chen, Beijing Institute of Technology, Automation, China

3:10PM | Asymmetrical Duty-Cycle Control of Three-Phase Dual-Active Bridge Converter for Soft-Switching Range Extension
Jingxin Hu, Nils Soltau and Rik W. De Doncker, RWTH Aachen University, Germany

3:35PM | Proposal of Dual Active Bridge Converter with Auxiliary Circuit for Multiple Pulse Width Modulation
Kazuaki Kojima, Yukinori Tsuruta and Atsuo Kawamura, Yokohama National University, Japan

S9 Electromagnetic Interference (EMI) in Power Converters

Room: 102A
Chairs: Shuo Wang, Sung Yeul Park

1:30PM | A Simple Low-Cost Common Mode Active EMI Filter Using a push-pull Amplifier
Dongil Shin, Changwoo Son, Seonho Jeon, Bongjin Cho, Jinwook Han and Jingook Kim, Ulsan National Institute of Science and Tech, Korea (South); Home Appliance Control Research Division LG, Korea (South)

1:55PM | Two-capacitor Transformer Winding Capacitance Models for Common-Mode EMI Noise Analysis in Isolated DC-DC Converters
Huan Zhang and Shuo Wang, University of Florida, United States

2:20PM | Performance of Common-Mode-Voltage-Cancellation PWM Strategies with Consideration of Commutation Residues due to Double-Switching Waveforms
Mehdi Messaoudi, Arnaud Videt, Nadir Idir, Hocine Boulharts and Heu Vang, Schneider Toshiba Inverter, France; Univ. Lille, L2EP, France; Toshiba Schneider Inverter, Japan

2:45PM | Identification of the Temporal Source of Frequency Domain Characteristics of SiC MOSFET Based Power Converter Waveforms
Samuel Walder, Xibo Yuan, Ian Laird and J. O. Dalton Jeremy, University of Bristol, United Kingdom

3:10PM | Resonance Phenomenon Influencing the Conducted-Mode Emission Test
Christian Wolf, Grundfos A/S, Denmark

3:35PM | Modeling, Analysis and Design of Differential Mode Active EMI Filters with Feedforward and Feedback Configurations for AC-DC Converters
Rajib Goswami, Shuo Wang and Zhang Yingjie, University of Texas at San Antonio, United States; University of Florida, United States

S10 Modeling and Control of DC-AC Converters I

Room: 202D
Chairs: Xu She, Yi Deng

1:30PM | Compensation for Inverter Nonlinearity Considering Voltage Drops and Switching Delays of Each Leg’s Switches
Myeong-Chan Kang, Sang-Hoon Lee and Young-Doo Yoon, Myongji University, Korea (South)

1:55PM | Small-signal Terminal-Characteristics Modeling of Three-Phase Droop-Controlled Inverters
Zeng Liu, Jinjun Liu, Dushan Boroyevich, Rolando Burgos and Teng Liu, Xi’an Jiaotong University; Virginia Tech, China; Xi’an Jiaotong University, China; Virginia Tech, United States

2:20PM | Enhancement of Current and Voltage Controllers Performance by Means of Lead Compensation and Anti-Windup for Islanded Microgrids
Federico de Bosio, Luiz Antonio deSouza Ribeiro, Francisco Freijedo, Josep Guerrero and Michele Pastorelli, Politecnico di Torino, Italy; Federal University of Maranhao, Brazil; Ecole Polytechnique Federale de Lausanne, Switzerland; Aalborg University, Denmark

2:45PM | DC-Link Current Ripple Component RMS Value Estimation Considering Anti-Parallel Diode Reverse Recovery in Voltage Source Inverters
Jing Guo and Ali Emadi, McMaster University, Canada

3:10PM | Digital Dead-Beat and Repetitive Combined Control for Stand-Alone Four-Leg VSI
Alessandro Lidodzi, Luca Solera, Fabio Crescimbini, Chao Ji and Pericle Zanchetta, ROMA TRE University, Italy; The University of Nottingham, United Kingdom

3:35PM | Modeling, Analysis, and Impedance Design of Battery Energy Stored Single-Phase Quasi-Z-Source Photovoltaic Inverter System
Yushan Liu, Hairham Abu-Rub, Baoming Ge, Robert S. Balog and Yaosuo Xue, Texas A and M University at Qatar, Qatar; Texas A and M University, United States; Oak Ridge National Laboratory, United States
S11 Induction Machines

Room: 101A
Chairs: Juan Carlos Balda, Andrea Cavagnino

1:30PM | High Torque Density Induction Motor with Integrated Magnetic Gear
Dalia Abdelhamid and Andrew Knight, University of Calgary, Canada

1:55PM | Accurate Determination of Induction Machine Torque and Current Versus Speed Characteristics
Emmanuel Agamloh, Andrea Cavagnino and Silvio Vascotto, Advanced Energy, United States; Politecnico di Torino, Italy

2:20PM | The Novel SLIM Method for the Determination of the Iron Core Saturation Level in Induction Motors
Konstantinos N. Gyftakis, Coventry University, United Kingdom

2:45PM | Rotor Design to Reduce Secondary Winding Harmonic Loss for Induction Motor in Hybrid Electric Vehicle Application
Haodong Li and Keith Klontz, Advanced MotorTech, United States

3:10PM | A Novel In Situ Efficiency Estimation Algorithm for Three-Phase Induction Motors Operating with Distorted Unbalanced Voltages
Maher Al-Badri, Pragasen Pillay and Pierre Angers, Concordia University, Canada; Hydro-Quebec, Canada

3:35PM | Development and Efficiency Estimation of a Regenerative Test Rig for Induction Motor Testing
Jamlick Murimi Kinyua, Mohamed A. Khan and Paul Barendse, University of Cape Town, South Africa

S12 Prof. Subhasis Nandi Memorial Session: Diagnostics of Electric Machines

Room: 102B
Chairs: Hamid Fekri, Sang Bin Lee

1:30PM | A Voltage Based Approach for Fault Detection and Separation in Permanent Magnet Synchronous Machines
Reem En Naddad, Cristian A. Lopez, Shanelle Foster and Elias Strangas, Michigan State University, United States

1:55PM | Permanent Magnet Generator Turn Fault Detection Using Kalman Filter Technique
Bo Wang, Jiabin Wang, Antonio Grillo, Vipulkumar I. Patel, Zhigang Sun, Ellis Chong and Riona Smitham, The University of Sheffield, United Kingdom; Rolls-Royce plc, United Kingdom

2:20PM | Influence of Blade Pass Frequency Vibrations on MCSA-based Rotor Fault Detection of Induction Motors
Yonghyun Park, Sang Bin Lee, Myung Jeong, Jose Antonino-Daviu and Mike Teska, Korea University, Korea, Republic of; UNIVERSITAT POLITECNICA DE VALENCIA, Spain; SKF Condition Monitoring Center, United States

2:45PM | Stator Insulation Quality Assurance Testing for Appliance Motors with Aluminum Windings
Daewoong Choi, Taeyeun Kang, Sang Bin Lee, Jaegyu Kim and Jihoon Kim, Samsung Electronics, Korea, Republic of; Korea University, Korea, Republic of

3:10PM | Robust Detection of Rotor Winding Asymmetries in Wound Rotor Induction Motors via Integral Current Analysis
Jose Antonino-Daviu, Alfredo Quijano-Lopez, Vicente Climente-Alarcon and Carlos Garin Abellan, Universitat Politècnica de València, Spain; Aalto University, Finland; FYM Italcentro Group, Spain

3:35PM | Asynchronous Motors Fault Detection Using ANN and Fuzzy Logic Methods
Negin Lashkari, Hamid Fekri Azgomi, Javad Poshtan and Majid Poshtan, Iran University of Science and Technology, Iran; California Polytechnic State University, United States

S13 Control of Electric Drives I

Room: 101CD
Chairs: Radu Bojoi, Roberto Petrella

1:30PM | Minimizing Torque Ripple of Highly Saturated Salient Pole Synchronous Machines by Applying DB-DTFC
Michael Saur, Daniel Gaona, Jelena Zdraukovic, Bastian Lehner, Robert Lorenz and Dieter Gerling, Universitaet der Bundeswehr, Germany; University of Madison, United States

1:55PM | Using Volt-sec. Sensing to Directly Improve Torque Accuracy and Self-Sensing at Very Low Speeds
Yukai Wang, Naoto Niumura, Ben Rudolph and Robert Lorenz, University of Wisconsin – Madison, WEMPEC, United States; TMEIC, Fuchu work, Japan; TMEIC Corporation, Roanoke, United States

2:20PM | Torque Ripple Reduction for 6-stator/4-rotor-pole Variable Flux Reluctance Machines by Using Harmonic Field Current Injection
Beomseok Lee and Zi-Qiang Zhu, The University of Sheffield, United Kingdom

2:45PM | Novel On-Line Optimal Bandwidth Search and Auto Tuning Techniques for Servo Motor Drives
Chih-Jung Hsu and Jen-Shin Lai, Taipei Tech., Taiwan

3:10PM | Open-loop Control for Permanent Magnet Synchronous Motor Driven by Square-wave Voltage and Stabilization Control
Daisuke Sato and Jun-ichi Itoh, Nagaoka University of Technology, Japan

3:35PM | A Robust Current Control Based on Proportional-Integral Observers for Permanent Magnet Synchronous Machines
Milo De Soricellis, Davide Da Ru’ and Silverio Bolognani, BOSCH GmbH, Germany; University of Padova, Italy

S14 Medium Voltage Drives and High Power Drives

Room: 101B
Chairs: Shih-Chin Yang, Uday Deshpande

1:30PM | A Pumpback Test Bench for IGCT-based 11MW/595Hz Variable-Frequency-Drives with 1.25MW Grid Capability
Jie Shen, Stefan Schroeder, Fan Zhang, Kunlun Chen and Richard Zhang, GE Global Research, China; GE Global Research, Germany; GE Power Conversion, China

1:55PM | Grounding Concept and Common-Mode Filter Design Methodology for Transformerless MV Drives
Marius Mechelinski, Stefan Schroeder, Jie Shen and Rik W. De Doncker, GE Global Research Europe, Munich, Germany; GE Global Research China, Shanghai, China; E.ON ERC, RWTH Aachen University, Germany

2:20PM | Utilisation of Series Connected Transformers for Multiple Active Rectifier Units
Wim van der Merwe, Mathieu Giroux, Pasi Tallinen and Jonas Wahlstrom, ABB Switzerland, Switzerland; ABB Finland, Finland
2:45PM | Common-Mode Voltage Limits for the Transformerless Design of MV Drives to Prevent Bearing Current Issues
Marius Mechlinski, Stefan Schroeder, Jie Shen and Rik W. De Doncker, GE Global Research Europe, Munich, Germany; GE Global Research China, Shanghai, China; E.ON ERC, RWTH Aachen University, Germany

3:10PM | A Robust Sensorless Start-up Method using Four Step Sequence for LCI system
Hyunsung An and Hanju Cha, Chungnam national university, Korea (South); Chungnam National University, Korea (South)

3:35PM | Virtual Voltage Source Control for 2x27 MVA Machine Test Bench
Jie Shen, Jingkui Shi, Jun Zhu, Yulong Li, Bo Qu and Hongwu She, GE Global Research, China; GE Power Conversion, China

S15 Power Modules
Room: 202C
Chairs: Muhammad Nawaz, Douglas C Hopkins

1:30PM | Performance Comparison of 10 kV-15 kV High Voltage SiC Modules and High Voltage Switch using Series Connected LV SiC MOSFET devices
Kasunaidu Vechalapu and Subhashish Bhattacharya, NC State University, United States

1:55PM | Development of an Ultra-high Density Power Chip on Bus (PCoB) Module
Yang Xu, Iqbal Hussein, Harvey West, Wensong Yu and Douglas Hopkins, North Carolina State University, United States

2:20PM | Optimized Power Modules for Silicon Carbide MOSFET
Guillaume Regnent, Pierre-Olivier Jeannin, Jeffrey Ewanchuk, David Frey, Stefan Mollor and Jean-Paul Femieux, G2ELAB, France; Mitsubishi Electric RandD Centre Europe, France

2:45PM | An Improved Wire-bonded Power Module with Double-End Sourced Structure
Miao Wang, Fang Luo and Longya Xu, the Ohio State University, United States

3:10PM | An Initial Consideration of Silicon Carbide Devices in Pressure-Packages
Jose Angel Ortiz Gonzalez, Olayiwola Atalase, Li Ran, Philip Mawby, Pushparajah Rajaguru and Christopher Bailey, University of Warwick, United Kingdom; University of Greenwich, United Kingdom

3:35PM | Effect of Junction Temperature Swing Durations on a Lifetime of a Transfer Molded IGBT Module
Choi UI-Min, Blaabjerg Frede and Jorgensen Soren, Aalborg University, Denmark; Grundfos Holding A/S, Denmark

S16 Wireless Power Transfer I
Room: 202B
Chairs: Yaow-Ming Chen, Chris Mi

1:30PM | An Inductive and Capacitive Integrated Couper and Its LCL Compensation Circuit Design for Wireless Power Transfer
Fei Lu, Hua Zhang, Heath Hofmann and Chris Mi, University of Michigan, United States; Northwestern Polytechnical University, China; San Diego State University, United States

1:55PM | Design Procedure of Optimum Self-Inductances of Magnetic Pads in Inductive Power Transfer (IPT) for Electric Vehicles
Minhyuck Kang, Jongeun Byeon, Dong Myoung Joo, Minkook Kim and Byoung Kuk Lee, Sungkyunkwan University, Korea (South)

2:20PM | Design High Power and High Efficiency Inverter Operating at 13.56MHz for Wireless Power Transfer Systems
Kien Trung Nguyen and Kan Akatsu, Shibaura Institute of Technology, Japan

2:45PM | Improved Design Optimization Approach for High Efficiency Matching Networks
Ashish Kumar, Sreyam Sinha, Alhossein Sepahvand and Khurram Afridi, University of Colorado Boulder, United States

3:10PM | Efficiency Optimization Method of Wireless Power Transfer System with Multiple Transmitters and Single Receiver
Cheng Zhang, Deyan Lin and Shu Yuen Ron Hui, The University of Hong Kong, Hong Kong

3:35PM | Maximum Efficiency Tracking in Wireless Power Transfer for Battery Charger: Phase Shift and Frequency Control
Devendra Patil, Marco Sirico, Lei Gu and Babak Fahimi, University of Texas at Dallas, United States; University of Naples Federico II, Italy

Tuesday, September 20th 8:30AM – 11:00AM

S17 Photovoltaic Converters I
Room: 203AB
Chairs: Francisco Canales, Liming Liu

8:30AM | Low Power Factor Operation of the PV Inverter with Power Decoupling Function
Yusuke Seta and Toshihisa Shimizu, Tokyo Metropolitan University, Japan

8:55AM | Stand-Alone Photovoltaic Asymmetrical Cascade Converter
Alan Felinto, Italo da Silva, Cursino Jacobina, Joao Mello, Isaac Freitas and Nustenil Marinus, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil

9:20AM | Ground Leakage Current Suppression in a 50 kW 5-level T-type Transformerless PV Inverter
Lu Wang, Yanjun Shi, Yuxiang Shi, Ren Xie and Hui Li, FSU, United States

9:45AM | A High Performance T-type Single Phase Double Grounded Transformer-less Photovoltaic Inverter with Active Power Decoupling Yinglai Xia, Jinia Roy and Raja Ayyanar, Arizona State University, United States

10:10AM | Low Leakage Current Transformerless Three-Phase Photovoltaic Inverter
Liwei Zhou, Feng Gao, Guang Shen, Tao Xu and Weiqi Wang, Shandong University, China; State Grid Rizhao Power Supply Company, China

10:35AM | Operation of Dual-Input Central Capacitor Photovoltaic Inverter Under Unbalanced Grid Voltage Condition
Mengxing Chen, Feng Gao and Chongsheng Jia, Shandong University, China
S18  Modular Multi-Level Converters, HVDC, and DC Grids II

Room: 203E
Chairs: Rajib Datta, Ali Mehrizi-Sani

8:30AM  Impact on Small-Signal dynamics of Using Circulating Currents Instead of AC-Currents to Control the DC Voltage in MMC HVDC Terminals
Gilbert Bergna, Jon Are Suul and Salvatore D’Arco, SINTEF Energy Research, Norway; NTNU / SINTEF Energy Research, Norway

8:55AM  Control of VSC-HVDC with Electromechanical Characteristics and Unified Primary Strategy
Weiyi Zhang, Kumars Rouzbah, J. Ignacio Candela, Alvaro Luna and Pedro Rodriguez, Technical University of Catalonia, Spain; Abengoa, Spain

9:20AM  A Novel Interline DC Power Flow Controller for Meshed HVDC Grids
Guangfu Ning, Wu Chen and Xu Zhu, Southeast University, China

9:45AM  Impedance-based and Eigenvalue Based Stability Assessment Compared in VSC-HVDC System
Mohammad Amin, Atle Rygg and Marta Molinas, Norwegian University of Science and Technology, Norway

10:10AM  Performance Analysis of a Triple-Active Bridge Converter for Interconnection of Future DC-Grids
Markus Neubert, Anton Gorodnichev, Jan Gottschlich and Rik W. De Doncker, RWTH Aachen University, ISEA, Germany

10:35AM  DC Fault Protection of Multi-Terminal VSC-HVDC System with Hybrid DC Circuit Breaker
Yaloli Li, Jin Liu, Xiaoji Shi, Fred Wang and Leon Tolbert, University of Tennessee, United States

S19  Renewable Energy II

Room: 203C
Chairs: Alex Q Huang, Xueguang Zhang

8:30AM  Partial Power DC-DC Converter for Photovoltaic String Inverters
Alexander Morrison, Jaime Zapata, Samir Kouro, Marcelo Perez, Thierry Meynard and Hugues Renaudineau, Universidad Tecnica Federico Santa Maria, Chile; University of Toulouse, France

8:55AM  On Reactive Power Injection Control of Distributed Grid-tied AC-stacked PV Inverter Architecture
Hamidreza Jafarian, Babak Parkhindeh, Johan Enslin, Robert Cox and Shibashis Bhowmik, UNCC, United States; SineWatts, United States

9:20AM  A Cost-Effective Power Ramp-Rate Control Strategy for Single-Phase Two-Stage Grid-Connected Photovoltaic Systems
Aniya Sangwongwanich, Yongheng Yang and Frede Blaabjerg, Aalborg University, Denmark

9:45AM  Delta Power Control Strategy for Multi-String Grid-Connected PV Inverters
Aniya Sangwongwanich, Yongheng Yang, Frede Blaabjerg and Dezso Sera, Aalborg University, Denmark

10:10AM  Battery Storage Sizing for a Grid Tied PV System Based on Operating Cost Minimization
Mohamed Badawy, Fatih Cingoz and Yilmaz Sozer, University of Akron, United States

10:35AM  Dynamic Braking System of a Tidal Generator
Eduard Muiliadi, Alan Wright, Vahan Gevorgian, James Donegan, Cian Marnagh and Jarlath McEntee, National Renewable Energy Laboratory, United States; Ocean Renewable Power Corporation, United States

S20  Utility Applications I

Room: 202A
Chairs: Fernando Briz, Rajasekharareddy Chilipi

8:30AM  Multi-frequency Power Routing for Cascaded H-Bridge Inverters in Smart Transformer Application
Younggi Ko, Markus Andresen, Giampaolo Buticchi, Luca Concare and Marco Lisierre, Christian-Albrechts-University, Germany; University of Parma, Italy

8:55AM  A High Power Medium Voltage Resonant Dual Active Bridge for DC Distribution Networks
Mohammed Agamy, Dong Dong, Luis J. Garces, Yingqi Zhang, Mark Dame, Ashraf Sayd Atalla and Yan Pan, GE Global Research Center, United States; GE Global Research Center, China

9:20AM  Mu Synthesized Robust Controller for Multi-SST Islanded Smart Grid
Tong Yao, Isaac Leonard, Raja Ayyanar and Konstantinos Tsakalis, Arizona State University, United States; Florida State University, United States

9:45AM  Cascaded Open-End Winding Transformer based DVR
Gregory Carlos, Cursino Jacobina, Euzeli Dos Santos Jr. and Joao Melo, Federal Institute of Alagoas – IFAL, Brazil; Federal University of Campina Grande – UFCG, Brazil; Indiana University-Purdue University Indianapolis, United States

10:10AM  Modeling and Control of Grid Based Multiport Power Converter
Mohammed Alsolami, Xuan Zhang, Karun Potty and Jin Wang, King Abdulaziz University, United States; The Ohio State University, United States

10:35AM  Economic Feasibility Analysis and Operational Testing of a Community Energy Storage System
Ben Knueven, Jim Ostrowski, Ben Ollis, Philip Imringer, Michael Starke, Andrew Herron, Dan King, Bailu Xiao, Yaosuo Xue, Peter Karlson, Christine Labaza, David Maxwell, Seelan Thambipillah, Pablo Valencia and Sebastien Massin, University of Texas – Austin (UTK), United States; Oak Ridge National Laboratory (ORNL), United States; General Motors Company, United States; ABB, United States

S21  Electric Machines for Transportation Electrification

Room: 102D
Chairs: Jason Stauth, Emmanuel Agamloh

8:30AM  Electrical Machine Acoustic Noise Reduction Based on Rotor Surface Modifications
Andreas Andersson and Torbjorn Thiringer, Volvo Car Group, Sweden; Chalmers University of Technology, Sweden

8:55AM  Integrated Control of an IPM Motor Drive and Hybrid Energy Storage System for Electric Vehicles
Mohamed Badawy, Tausif Husain and Yilmaz Sozer, University of Akron, United States

9:20AM  Investigation and Analysis of Temperature Effects on Interior Permanent Magnet Machines
Sihong Li, Bulent Sarlioglu, Sinisa Jurkovic, Nitin Patel and Peter Savagian, University of Wisconsin-Madison, United States; General Motors Company, United States
9:45AM | A Novel Flux-Switching Permanent Magnet Motor-Compressor with Integrated Airfoil-Shaped Rotor Design
Yingjie Li, Dheeraj Bobba, Erik Schubert, Hao Ding, Casey Morris and Bulent Sarlioglu, Electrical and Computer Engineering, UW-Madison, United States

10:10AM | Novel 6-Slot 4-Pole Dual-Stator Flux-Switching Permanent Magnet Machine Comparison Studies for High-Speed Applications
Yingjie Li, Ju Hyung Kim, Riccardo Leuzii, Mingda Liu and Bulent Sarlioglu, Electrical and Computer Engineering, UW-Madison, United States; Elec. and Info. Engineering, Politecnico di Bari, Italy

10:35AM | High-Specific-Power Electric Machines for Electrified Transportation Applications – Technology Options
Xiaolong Zhang and Kiruba Sivasubramaniam Haran, University of Illinois, Urbana-Champaign, United States

S22 Multilevel Converter Applications
Room: 202E
Chairs: Giri Venkataramanan, Qin Lei

8:30AM | A Fully FPGA-Based Real-time Simulator for the Cascaded STATCOM
Jiaxin Zhu, Guodong Teng, Yang Qin, Daorong Lu, Haibing Hu and Yan Xing, Nanjing Univ. of Aeronautics and Astronautics, China

8:55AM | A Broad Range of Speed Control of a Permanent Magnet Synchronous Motor Driven by a Modular Multilevel TSBC Converter
Wataru Kawamura, Yuto Chiba and Hirofumi Akagi, Tokyo Institute of Technology, Japan; Komatsu Limited, Japan

9:20AM | Comparison of SiC and GaN Devices for Front-End Isolation of Quasi-Z-Source Cascaded Multilevel Photovoltaic Inverter
Yushan Liu, Baoming Ge, Haitham Abu-Rub, Haiyu Zhang and Robert S. Balog, Texas A and M University at Qatar, Qatar; Texas A and M University, United States

9:45AM | Which is more suitable to a Modular Multilevel SDBC Inverter for Utility-Scale PV Applications, Phase-Shifted PWM or Level-Shifted PWM?
Paul Sochor and Hirofumi Akagi, Tokyo Institute of Technology, Japan

10:10AM | A Symmetrical Hybrid Nine-Level Inverter for High Speed Open-Winding Motor Drive System
Kui Wang, Yongdong Li, Zedong Zheng, Dabo Wei and Boran Fan, Tsinghua University, China

10:35AM | Control of Neutral-Point Voltage in Three-Phase Four-Wire Three-Level NPC Inverter Based on the Disassembly of Zero Level
Chenchen Wang, Xiahe Si and Hongliang Xin, Beijing Jiaotong University, China

S23 Modeling and Control of DC-DC Converters I
Room: 102C
Chairs: Johann Walter Kolar, Juan Rivas-Davila

8:30AM | Observer-based Nonlinear Control for Frequency Modulated Dual-Active-Bridge Converter
Duy-Dinh Nguyen, Manh-Linh Nguyen, Tuyen Nguyen-Duc and Goro Fujita, Shibaura Institute of Technology, Japan; Tokyo University of Science, Japan

9:45AM | A Novel Large-Signal Stability Analysis Approach Based on Semi-Tensor Product of Matrices With Lyapunov Stability Theorem Using for DC-DC Converters
Hong Li, Fang Ren, Bo Zhang, Jianing Shang, Jinhu Lv and Hongsheng Qi, Beijing Jiaotong University, China; South China University of Technology, China; Chinese Academy of Sciences, China

10:10AM | A Study on the Control Loop Design of Non-Isolated Configurations for Hybrid Storage Systems
Ramy Georgious, Jorge Garcia, Angel Navarro-Rodriguez and Pablo Garcia, University of Oviedo, Spain

10:35AM | Effects of Non-Ideal Compensators for the High-Bandwidth Low-Standby-Power Computer V-Core Converter Applications
Ching-Wei Yin, Dan Chen, Sheng-Fu Hsiao, Ching-Jan Chen and Hung-Shou Nien, EE, National Taiwan University, Taiwan; Richteck Technology Corporation, Taiwan
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<tr>
<th>Time</th>
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<tr>
<td>8:30AM</td>
<td>Constrained Long-Horizon Direct Model Predictive Control for Power Electronics</td>
<td>Petros Karamanakos, Tobias Geyer and Ralph Kennel, Technical University of Munich, Germany; ABB Switzerland LTD., Corporate Research, Switzerland</td>
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<td>8:55AM</td>
<td>Thermal-based Finite Control Set Model Predictive Control for IGBT Power Electronic Converters</td>
<td>Johannes Falck, Markus Andreassen and Marco Liserre, Kiel University, Germany</td>
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<td>9:20AM</td>
<td>Modulated Model Predictive Control for Active Split DC-bus 4-leg Inverters</td>
<td>Stefano Bifaretti, Luca Tarisciotti, Alessandro Lidozzi, Sabino Pipolo, Luca Solero and Pericle Zanchetta, University of Rome Tor Vergata, Italy; University of Nottingham, United Kingdom; Roma Tre University, Italy</td>
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<td>9:45AM</td>
<td>Computationally Efficient Sphere Decoding for Long-Horizon Direct Model Predictive Control</td>
<td>Petros Karamanakos, Tobias Geyer, Toit Mouton and Ralph Kennel, Technical University of Munich, Germany; ABB Switzerland LTD., Corporate Research, Switzerland; Stellenbosch University, South Africa</td>
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<td>10:10AM</td>
<td>Fixed Frequency Finite-State Model Predictive Control for Indirect Matrix Converters with Optimal Switching Pattern</td>
<td>Jiaxing Lei, Luca Tarisciotti, Andrew Trentin, Pericle Zanchetta, Patrick Wheeler and Andrea Formentini, Nanjing University, China; University of Nottingham, United Kingdom</td>
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<tr>
<td>10:35AM</td>
<td>Improved Steady State Behavior of Finite Control Set Model Predictive Control applied to a Flying Capacitor Converter</td>
<td>Margarita Norambuena, Pablo Lezana and Jose Rodriguez, Technische Universitaet Berlin, Germany; Universidad Tecnica Federico Santa Maria, Chile; Universidad Andres Bello, Chile</td>
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<td>A New Application and Experimental Validation of Moulding Technology for Ferrite Magnet Assisted Synchronous Reluctance Machine</td>
<td>Qian Wu, Kaiyuan Lu, Keld Folsach Rasmussen and Peter Omand Rasmussen, Aalborg University, Denmark; Grundfos A/S, Denmark</td>
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<td>8:55AM</td>
<td>Magnetic Field Analytical Computation in Synchronous Reluctance Machines Considering the Iron Saturation</td>
<td>Hanafy Mahmoud, Nicola Chiodotto and Nicola Bianchi, Padova University, Italy</td>
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<td>9:20AM</td>
<td>Performance Comparison of Short Pitched and Full Pitched Switched Reluctance Machines for Off-Road Vehicle Applications</td>
<td>Tassif Hussein, Wasi Uddin and Yilmaz Sozer, University of Akron, United States</td>
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<td>9:45AM</td>
<td>A Fault Tolerant Machine Drive Based on Permanent Magnet Assisted Synchronous Reluctance Machine</td>
<td>Bo Wang, Jiabin Wang, Antonio Griffo, Zhigang Sun and Ellis Chong, The University of Sheffield, United Kingdom; Rolls-Royce plc, United Kingdom</td>
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<td>10:10AM</td>
<td>A General Approach for the Analysis and Comparison of Hybrid Synchronous Machines With Single-Axis or Bi-Axial Excitation</td>
<td>Fabio Giulii Capponi, Gabriele Borocci, Ian Boldea, Giulio De Donato and Federico Caricchi, University of Roma “La Sapienza”, Italy; Politeh. Univ. of Timisoara, Romania</td>
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<td>10:35AM</td>
<td>Flux Modulation Principles of DC-Biased Sinusoidal Current Vernier Reluctance Machines</td>
<td>Shaofeng Jia, Ronghai Ou, Dawei Li and Jian Li, Huazhong University of Science and Technology, China</td>
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<td>Stator Lamination Geometry Influence on the Building Factor of Synchronous Reluctance Motor Cores</td>
<td>Andrea Cavagnino and Zbigniew Gmyrek, Politecnico di Torino, Italy; Lodz University of Technology, Poland</td>
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<td>8:55AM</td>
<td>Influence of PM Coating on PM Magnetization State Estimation Methods Based on Magnetoresistance Effect</td>
<td>Daniel Fernandez, David Reigosa, Juan Manuel Guerrero, Zi-Qiang Zhu and Fernando Briz, University of Oviedo, Spain; University of Sheffield, United Kingdom</td>
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<tr>
<td>9:20AM</td>
<td>Investigation of the Impact of Production Processes on Iron Losses of Laminated Stator Cores for Electric Machines</td>
<td>Marc Veigel, Alexandra Kraemer, Gisela Lanza and Martin Doppelbauer, Karlsruhe Institute of Technology, Germany</td>
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<tr>
<td>9:45AM</td>
<td>Influence of Manufacturing Tolerances on Cogging Torque in Interior Permanent Magnet Machines with Eccentric and Sinusoidal RotorContours</td>
<td>Xiao Ge and Z. Q. Zhu, University of Sheffield, United Kingdom</td>
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<tr>
<td>10:10AM</td>
<td>A Practical Approach of Electromagnetic Analysis with the Effect of the Residual Strain due to Manufacturing Processes</td>
<td>Hiroyuki Sano, Katsuyuki Narita, Eríze Zeze, Takashi Yamada, Kazuki Ueta and Kan Akatsu, JSOL Corporation, Japan; Shibaura Institute of Technology, Japan</td>
</tr>
<tr>
<td>10:35AM</td>
<td>Investigation of Emerging Magnetic Materials for Application in Axial-Flux PM Machines</td>
<td>Solmaz Kahourzade, Nesimi Ertugrul and Wen Soong, University of Adelaide, Australia</td>
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<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker Details</th>
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<tbody>
<tr>
<td>8:30AM</td>
<td>A Compact Active Filter to Eliminate Common-Mode Voltage in a SiC-based Motor Drive</td>
<td>Kellan Euerle, Kartik Iyer, Eric Severson, Rohit Baranwal, Saurabh Tewari and Ned Mohan, University of Minnesota, United States; MTS Systems Corporation, United States</td>
</tr>
<tr>
<td>8:55AM</td>
<td>Stator Inter-Turn Fault Detection for Seamless Fault-Tolerant Operation of Five-Phase Induction Motors</td>
<td>Vivek M. Sundaram and Hamid A. Toliyat, Texas A and M University, United States</td>
</tr>
<tr>
<td>9:20AM</td>
<td>Rotor Temperature Estimation in Doubly-Fed Induction Machines Using Rotating High Frequency Signal Injection</td>
<td>David Reigosa, Juan Manuel Guerrero and Fernando Briz, University of Oviedo, Spain</td>
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<td>9:45AM</td>
<td>Maximum Torque Output for Volts/Hz Controlled Induction Machines in Flux-weakening Region</td>
<td>Kai Wang, Kevin Lee, Wenxi Yao and Fayi Chen, Eaton Corporation, China; Eaton Corporation, United States; Zhejiang University, China</td>
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<td>Time</td>
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<td>10:10AM</td>
<td><strong>PM and IPM Motor Drives I</strong></td>
<td><strong>Room: 101CD</strong></td>
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<tr>
<td>8:30AM</td>
<td><strong>A Novel Direct Torque Control Strategy for Interior Permanent Magnet Synchronous Motors Driven by a Three-level Simplified Neutral Point Clamped Inverter</strong></td>
<td>Tung Ngo, Gilbert Foo, Craig Baguley, Deepu Mohan and Xinan Zhang, Auckland University of Technology, New Zealand; Nanyang Technological University, Singapore; University of New South Wales, Australia</td>
</tr>
<tr>
<td>8:55AM</td>
<td><strong>Comparison Between SiC and GaN Devices in 6.78 MHz 2.2 kW Resonant Inverters for Wireless Power Transfer</strong></td>
<td>Jungwon Choi, Daisuke Tsuchiya and Juan Rivas, Stanford University, United States; DAIHEN Advanced Component, Inc, Japan</td>
</tr>
<tr>
<td>9:20AM</td>
<td><strong>Comparison of GaN FET and Si MOSFET Based Vienna Rectifiers</strong></td>
<td>Yutong Zhu and Yehui Han, University of Wisconsin Madison, United States</td>
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<td>9:45AM</td>
<td><strong>Comparison of GaN and SiC Power Devices in Application to MW-scale Quasi-Z-Source Cascaded Multilevel Inverters</strong></td>
<td>Haiyu Zhang, Baoming Ge, Yushan Liu, Robert S. Balog and Haiitham Abu-Rub, Texas A and M University, United States; Texas A and M University at Qatar, Qatar</td>
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<tr>
<td>10:10AM</td>
<td><strong>Comparison of Deadtime Effects on the Performance of dc-dc Converters with GaN FETs and Silicon MOSFETs</strong></td>
<td>John Glaser and David Reusch, Efficient Power Conversion, United States</td>
</tr>
<tr>
<td>8:30AM</td>
<td><strong>High Speed Optical Gate Driver for Wide Band Gap Power Transistors</strong></td>
<td>Davy Colin and Nicolas Rouger, Grenoble Electrical Engineering Laboratory, France</td>
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<td>8:55AM</td>
<td><strong>Reduction of Oscillations in a GaN Bridge Leg Using Active Gate Driving with Sub-ns Resolution, Arbitrary Gate-Impedance Patterns</strong></td>
<td>Harry C. P. Dymond, Dawei Liu, Jianjing Wang, Jeremy J. O. Dalton, Neville McNeill, Dinesh Pamunwawa, Simon J. Hollis and Bernard H. Stark, University of Bristol, United Kingdom</td>
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<tr>
<td>9:20AM</td>
<td><strong>Design Considerations and Comparison of High-speed Gate Drivers for Si IGBT and SiC MOSFET Modules</strong></td>
<td>Shan Yin, King Jet Tseng, Pengfei Tu, Rejeki Simanjorang and Amit K. Gupta, Nanyang Technological University, Singapore; Rolls-Royce Singapore Pte. Ltd., Singapore</td>
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<tr>
<td>9:45AM</td>
<td><strong>Active Gate Driving Technique for a 1200 V SiC MOSFET to Minimize Detrimental Effects of Parasitic Inductance in the Converter Layout</strong></td>
<td>Parthasarathy Nayak and Kamalesh Hatua, Indian Institute of Technology Madras, India</td>
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<td>10:10AM</td>
<td><strong>Comprehensive Evaluation of Gate Boost Driver for SIC-MOSFETS</strong></td>
<td>Koji Yamaguchi and Yukihiko Sato, IHI Corporation, Japan; Chiba University, Japan</td>
</tr>
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<td>8:30AM</td>
<td><strong>Wide Bandgap Applications: Comparative Studies</strong></td>
<td>Xiu Yao, Robert Pilawa-Podgurski</td>
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<td>8:30AM</td>
<td><strong>Comparative Evaluation of 15 kV SiC IGBT and 15 kV SiC MOSFET for 3-Phase Medium Voltage High Power Grid Connected Converter Applications</strong></td>
<td>Sachin Madhusoodhan, Krishna Mainali, Aweesheh Tripathi, Arun Kadavelugu, Kasunaidu Vechalapu, Dhaval Patel and Subhashish Bhattacharya, North Carolina State University, United States</td>
</tr>
<tr>
<td>10:35AM</td>
<td><strong>Gate Driver for the Active Thermal Control of a DCDC GaN Based Converter</strong></td>
<td>Pramod Kumar Prasobbu, Giampaolo Buticchi, Stephan Brueske and Marco Liserre, Kiel University, Germany</td>
</tr>
</tbody>
</table>
**S32 Wireless Power Transfer II**

*Room: 202B*

**Chairs:** Khurram Afridi, Huai Wang

- **8:30AM** | [A Wireless Power Transfer System with a Double Current Rectifier for EVs](#)
  Toshiyuki Fujita, Tomio Yasuda and Hirofumi Akagi, Technova inc., Japan; Tokyo Institute of Technology, Japan

- **8:55AM** | [Hybrid Control of Inductive Power Transfer Charger for Electric Vehicles using LCCL-S Resonant Network in Limited Operating Frequency Range](#)
  Jongeun Byeon, Minhyuck Kang, Minkyook Kim, Dong-Myoung Joo and Byoung Kuk Lee, Sungkyunkwan University, Korea (South)

- **9:20AM** | [Closed-Loop Control Design for WPT System Using Power and Data Frequency Division Multiplexing Technique](#)
  Zhongnan Qian, Ruichi Wang, Zhikun Wang, Jin Du, Jiande Wu and Xiangning He, Zhejiang University, China

**Wednesday, September 21st 8:30AM – 10:10AM**

**S33 Photovoltaic Converters II**

*Room: 203AB*

**Chairs:** Nathan Weise, JaeHo Choi

- **8:30AM** | [A 50kW High Power Density Paralleled-five-level PV Converter based on SiC T-type MOSFET Modules](#)
  Yanjun Shi, Yuxiang Shi, Lu Wang, Ren Xie and Hui Li, FSU, United States

- **8:55AM** | [PV Array Voltage Range Extension for Photovoltaic Inverters Using a Mini-Boost](#)
  Emanuel Serban, Francisco Paz and Ordonez Martin, ECE Department, Univ. of British Columbia, Canada

- **9:20AM** | [Submodule Integrated Boost DC-DC Converters With No External Input Capacitor or Input Inductor for Low Power Photovoltaic Applications](#)
  Jen-Hung Huang, Brad Lehman and Ting Qian, Northeastern University, United States; Tongji University, China

- **9:45AM** | [Effective Control Approach for Multi-PVs Based Resonant Converter through Cross-switched Structure](#)
  Ali Elrayyah, Amr Ibrahim and Yilmaz Sozer, Qatar Environmental and Energy Research Inst, Qatar; University of Akron, United States

**S34 Converter Applications for Alternative Energy Systems**

*Room: 203C*

**Chairs:** Andrew Hintz, Shaojun Xie

- **8:30AM** | [Control Scheme for the Wide Operation Range of Induction Generator with a Vienna Rectifier in Wind Turbine Systems](#)
  Jin-Hyuk Park, June-Seok Lee and Kyo-Beum Lee, Ajou University, Korea (South); KRRI, Korea (South)

- **8:55AM** | [GaN Based High Gain Non-Isolated DC-DC Stage of Microinverter with Extended-Duty-Ratio Boost](#)
  Jinia Roy and Raja Ayyanar, Arizona State University, United States

- **9:20AM** | [High-Efficiency Three-Level SEPIC for Grid-Tied PV Systems](#)
  Min-Kwon Yang, Seung-Jae Lee, Jun Heo and Woo-Young Choi, Chonbuk National University, Korea (South)

- **9:45AM** | [A Novel Zero-voltage-switched Multi-resonant DC-DC Converter](#)
  Ling Gu and Ke Jin, Nanjing University of Aero. and Astro., China

**S35 Modeling, Analysis, and Control of Grid-Connected Converters I**

*Room: 202D*

**Chairs:** Fred Wang, Paolo Mattavelli

- **8:30AM** | [Seamless Transfer Strategy Considering Power Balance in Parallel Operation](#)
  Chee Seung-Jun, Lee Younggi, Son Young-Kwang, Sul Seung-Ki, Lim Changjin and Huh Sungjae, Seoul National University, Korea (South); LG Electronics, Korea (South)

- **8:55AM** | [Robust Control for Parallel Operated L-Inverters with Uncertainty and Disturbance Estimator](#)
  Yejin Wang, Qingshang Zhong and Bibebei Ren, Texas Tech University, United States; Illinois Institute of Technology, United States

- **9:20AM** | [Active and Reactive Power Operational Region for Grid-Interactive Cascaded H-Bridge Multilevel Converters](#)
  Jacob Lamb and Mirafzal Behrooz, Kansas State University, United States

- **9:45AM** | [Harmonic Stability Analysis and Controller Parameter Design of Three-Phase Inverter-Based Multi-Bus AC Systems Based on Sequence Impedances](#)
  Wenciao Cao, Yiwei Ma and Fred Wang, The University of Tennessee, Knoxville, United States

**S36 Utility Applications II**

*Room: 202A*

**Chairs:** Deepak Divan, Alireza Nami

- **8:30AM** | [Full-ZVS Modulation for All-SiC ISOP-Type Isolated Front End (IFE) Solid-State Transformer](#)
  Jonas E. Huber, Daniel Rothmund, Li Wang and Johann W. Kolar, Power Electronic Systems Lab, ETH Zurich, Switzerland; FREEDM Systems Center, NC State University, United States

- **8:55AM** | [Stability issues in reverse power flow limitation in a Smart Transformer-fed distribution grid](#)
  Giovanni De Carne, Giampaolo Buticchi and Marco Liserre, Christian-Albrechts University of Kiel, Germany
9:45AM | Soft-Switching Solid State Transformer (S4T)
Hao Chen and Deepak Divan, Georgia Institute of Technology, United States

S37  DC Microgrids I

Room: 203DE
Chairs: Giovanna Oriti, Babak Parkhideh

8:30AM | Hierarchical Coordination of a Hybrid AC/DC SmartGrid with Central/Distributed Energy Storage
Pablo Arboleya, Cristina Gonzalez-Moran, Pablo Garcia, Jorge Garcia and Bassam Mohamed, University of Oviedo, Spain

8:55AM | Dynamic Optimal Power Flow for DC Microgrids with Distributed Battery Energy Storage Systems
Thomas Morstyn, Branislav Hredzak and Vassilios Agelidis, University of New South Wales, Australia

9:20AM | DC Electric Springs with Modified Droop Control for Storage Reduction in DC Microgrids
Ming Hao Wang, Shuo Yan, Siew Chong Tan and Shu Yuen Ron Hui, The University of Hong Kong, Hong Kong

9:45AM | Optimal Droop Surface Control of Dc Microgrids Based on Battery State of Charge
Arthur Jones and Wayne Weaver, Michigan Technological University, United States

S38  Transportation Electrification I

Room: 102D
Chairs: Bulent Sarlioglu, Tim Burress

8:30AM | A Modified Z-source Converter based Single Phase PV/Grid Inter-connected DC Charging Converter for Future Transportation Electrification
Siddhartha A. Singh, Giampaolo Carli, Najath A. Azeez and Sheldon S. Williamson, University of Ontario Institute of Technology, Canada; EMD Technologies – Heico Corporation., Canada

8:55AM | Comprehensive design comparison of using different order harmonics as the power carrier in wireless power transfer for PHEV and EV Wireless Charging
Hulong Zeng and Fang Z. Peng, Michigan State University, United States

Akshay Rathore and Suvendu Samanta, Concordia University, Montreal, Canada

9:45AM | Reduction on Radiation Noise Level for Inductive Power Transfer Systems with Spread Spectrum focusing on Combined Impedance of Coils and Capacitors
Kent Inoue, Keisuke Kusaka and Jun-ichi Itoh, Nagaoka University of Technology, Japan

S39  Modeling and Control of DC-DC Converters II

Room: 102C
Chairs: Reza Sabzehgar, Liuchen Chang

8:30AM | A New High-Frequency Simulation Model for Multi-Winding Transformers used in Switched-Mode Power Supplies
Ripunjoy Phukan, Lakshmi Ravi, Amirhossein Shahrinia and Rangarajan Tallam, Georgia Institute of Technology, Atlanta GA, United States; Rockwell Automation, Mequon WI, United States; Alfred University, Alfred NY, United States

8:55AM | Multi-Phase Sliding Mode Control for Chattering Suppression in a DC-DC Converter
Woonki Na, Pengyuan Chen, Harkamal Singh and Jonghoon Kim, Cal St Univ-Fresno, United States; Chosun University, Korea (South)

9:20AM | Gradient-reference-current Control of Tri-state Buck Converter to Improve Dynamic Response over Wide Load Range
Shuhan Liao, Xiaoming Zha, Fei Liu, Wenjun Liu and Kun Feng, Wuhan University, China

9:45AM | A Control Strategy for Paralleled Bi-Directional DC-DC Converters Used in Energy Storage Systems
Zhenya Zhang, Zhao Zhang, Shaojun Xie and Chen Yang, Nanjing University of Aero. and Astronautics, China

S40  Modulation Techniques II

Room: 102E
Chairs: Madhu Sudhan Chinthavali, Sufei Li

8:30AM | Steady-State Analysis of the Phase Shift Modulated LLC Resonant Converter
Wei Liu, Binbin Wang, Wenxi Yao, Zhengyu Lu and Xiaoyi Xu, Zhejiang University, China; State Grid Nantong Supply Company, China

8:55AM | Practical Implementation of Global Synchronous Pulse Width Modulation with Time Delay Compensation and Distributed Calculation Capabilities
Tao Xu, Feng Gao and Liwei Zhou, Shandong University, China

9:20AM | Research on Zero-Sequence Circulating Currents in Parallel Three-Level Grid-Tied Photovoltaic inverters
Yang Li, Xu Yang, Wenjie Chen and Zhang Feng, Xi’an Jiaotong University, China

9:45AM | Modified Pulse Energy Modulation Technique of a Three-Switch Buck-Boost Inverter
Shuang Xu, Rimeng Shao, Liuchen Chang and Shuying Yang, University of New Brunswick, Canada; Hefei University of Technology, China

S41  Modeling, Control and Stability of Modular Multilevel Converters

Room: 202E
Chairs: Rik De Doncker, Pragasen Pillay

8:30AM | MMC-HVDC: Simulation and Control Strategy
Suman Debnath and Madhusudhan Chinthavali, Oak Ridge National Laboratory, United States
8:55AM | Hybrid Railway Power Conditioner Based on Half-Bridge Modular Multilevel Converter
Li Liu and Ning Yi Dai, University of Macau, Macau

9:20AM | A PWM Method Reducing Harmonics of Two Interleaved Converters
Jaejin Han, Younggi Lee and Seung-Ki Sul, Seoul National University, Korea (South)

9:45AM | DC Impedance Modeling and Stability Analysis of Modular Multilevel Converter for MVDC Application
Ran Mo, Qing Ye and Hui Li, Florida State University, United States

S42 Reluctance Machines II

Room: 102B
Chairs: Babak Fahimi, Sufei Li

8:30AM | Segmented Rotor Design of Concentrated Wound Switched Reluctance Motor (SRM) for Torque Ripple Minimization
Md Ashifanor Kabir and Iqbal Hasaan, North Carolina State University, United States; North Carolina State University, United States

8:55AM | Extending the Speed Range of A Switched Reluctance Motor Using a Fast Demagnetizing Technique
Mohamad Abd Elmutalab, Elrayyah Ali, Taufi Husain and Yilmaz Sozer, University of Akron, United States; Qatar Environmental and Energy Research Inst, Qatar

9:20AM | Development and Analysis of U-core Switched Reluctance Machine
Rasmus Jaeger, Simon Staal Nielsen, Kristian Kongerslev and Peter Omand Rasmussen, Aalborg University, Denmark; Hydratech Industries, Denmark

9:45AM | Torque Ripple and Acoustic Noise of Current Modulations of a Pseudo-Sinusoidal Switched Reluctance Motor
Qingping Ma, Lanhua Zhang, Xiaonan Zhao, Xuesen Cui and Jih-Sheng Lai, Virginia Tech, United States; North China Electric Power University, China

S43 PM Machines I

Room: 101A
Chairs: Ayman El-Refaie, Ali Bazzi

8:30AM | Proposal of Electrically Reversal Magnetic Pole Type Variable Magnetic Flux PM Motor
Masahiro Aoyama, Kazukiyo Nakajima and Toshihiko Noguchi, SUZUKI Motor Corporation, Japan; Shizuoka University, Japan

8:55AM | Torque and Core Loss Characterization of a Variable-Flux Permanent-Magnet Machine
Chirag Desai and Pragasan Pillay, Concordia University, Canada

9:20AM | Examination to Enhance Efficiency of V-shaped IPMSM Using Concentrated Winding Structure at High Speed and High Torque Area
Ayato Nihonyanagi, Takemoto Takemoto, Satoshi Ogasawara, Naohiko Aoki and Kwansu Lee, Hokkaido University, Japan; LG Electronics JAPAN Lab. Inc., Japan

9:45AM | Advanced High Torque Density Non-overlapping Winding PM Vernier Machines
Tianjie Zou, Dawei Li, Ronghai Qu, Jian Li and Dong Jiang, Huazhong University of Science and Technology, China

S44 Drive/Utility Interface

Room: 101B
Chairs: Nabeel Demerdash, Shih-Chin Yang

8:30AM | Synchronous Switching of Non-Line-Start Permanent Magnet Synchronous Machines between Inverter and Grid Drives
Ronggang Ni, Dianqiao Xu, Frede Blaabjerg, Gaolin Wang, Binbin Li and Kaiyuan Lu, Harbin Institute of Technology, China; Aalborg University, Denmark

8:55AM | Instability Detection and Protection Scheme for Efficiency Optimized V/F Driven Synchronous Reluctance Motors (SynRM)
Sara Ahmed, Gholamreza Jalali, Zach Pan and Hongrae Kim, Virginia Polytechnic Institute and State University, United States; North Carolina State University, United States; ABB Inc., United States

9:20AM | Power-Quality-Oriented Optimization in Multiple Three-Phase Adjustable Speed Drives
Yongheng Yang, Pooya Davari, Frede Blaabjerg and Firuz Zare, Aalborg University, Denmark; The University of Queensland, Australia

9:45AM | A Four-Quadrant Permanent Magnet Synchronous Machine Drive with a Tiny DC Link Capacitor
Mahima Gupta and Giri Venkataramanan, University of Wisconsin – Madison, United States

S45 PM and IPM Motor Drives II

Room: 101C
Chairs: Omer Onar, Rakib Islam

8:30AM | Effect of Position Sensor Error on the Performance of IPMSM drives
Ramakrishnan Raja, Tomy Sebastian, Mengqi Wang, Mohammad Islam and Abraham Gebregergis, Halla Mechatronics, Bay City, Michigan, United States; University of Michigan – Dearborn, Michigan, United States

8:55AM | Signal-Injection-Aided Position and Speed Estimation for PMSM Drives with Low-Resolution Position Sensors
Giulio De Donato, Giacomo Scolzi, Mario Pulvirenti, Giuseppe Scarcella and Fabio Giulii Capponi, University of Rome – La Sapienza, Italy; University of Catania, Italy; University of Catania, Italy; university of Rome – La Sapienza, Italy

9:20AM | Integrated Switch Current Sensor for Shortcircuit Protection and Current Control of 1.7-kV SiC MOSFET Modules
Jun Wang, Zhiyu Shen, Rolando Burgos and Dushan Boroyevich, Center for Power Electronics Systems (CPES), United States

9:45AM | Current Reconstruction Method for PMSM Drive System with a DC Link Shunt Resistor
Han-Beom Yeom, Hyun-Keun Ku and Jang-Mok Kim, LG Electronics, Korea (South); Pusan National University, Korea (South)

S46 Modeling of WBG Devices and Modules

Room: 202C
Chairs: Enrico Santi, Robert Pilawa-Podgurski

8:30AM | PSpice Modeling Platform for SiC Power MOSFET Modules with Extensive Experimental Validation
Lorenzo Ceccarelli, Muhammad Nawaz and Francesco Iannuzzo, Aalborg University, Denmark; ABB Corporate Research Center, Sweden
8:55AM | Development of Simulink-Based SiC MOSFET Modeling Platform for Series Connected Devices
Georgios Tsolaridis, Kalle Ilves, Paula Diaz Reigoza, Muhammad Nawaz and Francesco Iannuzzo, ABB Corporate Research Center, Sweden; Aalborg University, Denmark

9:20AM | An Accurate Subcircuit Model of SiC Half Bridge Module for Switching Loss Optimization
Pengfei Tu, Shan Yin, Peng Wang, King Jet Tseng, Chen Qi, Xiaolei Hu, Michael Adam Zagradnik and Rejeki Simanjorang, Nanyang Technological University, Singapore; Rolls-Royce Singapore Pte Ltd, Singapore

9:45AM | Spatial Electro-Thermal Modeling and Simulation of Power Electronic Modules
Christoph van der Broeck, Lukas Ruppert and Rik De Doncker, ISEA, RWTH Aachen University, Germany, France

Wednesday, September 21st

10:30AM | A Variable Step-Size MPPT for Sensorless Current Model Predictive Control for Photovoltaic Systems
Morcos Metry, Mohammad B. Shadmand, Robert S. Balog and Haiitham Abu-Rub, Texas A and M University, United States; Texas A and M University at Qatar, Qatar

10:55AM | Study on the Unbalanced Current Injection Capability of Grid-Connected Photovoltaic Neutral-Point-Clamped Inverter
Hossein Dehghani Tafti, Ali Itfekhar Maswood, Karthik Kandasamy, Ziyu Lim, Gabriel Oei Heo Peng, Geor Roger Konstantinou and Josep Pou, Nanyang Technological University, Singapore; University of New South Wales, Australia

11:20AM | Adaptive Dc Link Voltage Control Scheme for Single Phase Inverters with Dynamic Power Decoupling
Yinglai Xia and Raja Ayyanar, Arizona State University, United States

11:45AM | ZVS Analysis and Power Flow Control for Three Limb Transformer Enabled SiC Mosfet Based Three Port DAB Integrating PV and Energy Storage(ES)
Ritwik Chattopadhyay and Subhashish Bhattacharya, NCSU, United States

58 2016 IEEE ENERGY CONVERSION CONGRESS & EXPOSITION®
### S51 Utility Applications III

**Room:** 202A  
**Chairs:** Srdjan Lukic, Deepak Divan

#### 10:30AM | DC Solid State Transformer Based on Input-Series-Output-Parallel Dual-Active-Bridge for MVDC Power Distribution
Biao Zhao, Qiang Song, Jianguo Li and Wenhua Liu, Tsinghua University, China; Tsinghua University, China

#### 10:55AM | Six-Leg Single-Phase to Three-Phase Converter
Nayara Brandao de Freitas, Cursinno Brandao Jacobina, Ayşan Caisson Noroço Maia and Alexandre Cunha Oliveira, Federal University of Campina Grande, Brazil

#### 11:20AM | Flexible Transformers for Distribution Grid Control
Hao Chen, Prasad Kandula, Anish Prasai, Joe Schatz and Deepak Divan, Georgia institute of technology, United States; Georgia Institute of Technology, United States; Varentec, Inc., United States; Southern Company, United States

#### 11:45AM | Comparative Analysis of Modular Multiport Power Electronic Transformer Topologies
Mario Lopez, Fernando Briz, Mariam Saeed, Manuel Arias and Alberto Rodriguez, University of Oviedo, Spain

### S52 Modeling, Analysis, and Control of Grid-Connected Converters II

**Room:** 202D  
**Chairs:** Frederik Blaabjerg, Gilbert Bergna-Diaz

#### 10:30AM | Advanced Control of a High Power Converter Connected to Weak Grids
Shahparasti Mahdi, Catalin Pedro, Luna Alvaro, Candelaria Jose Ignacio and Rodriquez Pedro, Technical University of Catalonia, Spain; Ingeta Ltda, Spain

Shibin Qin and Robert Pilawa-Podgurski, University of Illinois at Urbana-Champaign, United States

#### 11:20AM | Control Design in SS-Synthesis Framework for Grid-Connected Inverters with Higher Order Filters
Nima Amouzegar Ashitian, Mohsen Azizi and Sayed Ali Khajehoddin, University of Alberta, Canada; Michigan Technological University, United States

#### 11:45AM | Sensorless Current Model Predictive Control for Maximum Power Point Tracking of Single-Phase subMultilevel Inverter for Photovoltaic Systems
Morcos Mety, Seracay Bayhan, Mohammad B. Shadmand, Robert S. Balog and Hairham Abu-Rub, Texas A and M University, United States; Texas A and M University, Qatar, Qatar

### S53 DC Microgrids II

**Room:** 203D  
**Chairs:** Josep M. Guerrero, Ali Davoudi

#### 10:30AM | An Adaptive Power Distributed Control Method to Ensure Proportional Load Power Sharing in DC Microgrid Considering Equivalent Line Impedances
Duy Hung Dam and Hong Hee Lee, University of Ulsan, Korea (South)

#### 10:55AM | The Performance of Polytopic Models in Smart DC Microgrids
Aian Frances, Rafael Asensi, Oscar Garcia, Roberto Prieto and Javier Uceda, Universidade Politecnica de Madrid, Spain

#### 11:20AM | Study on DC Arc Faults in Ring-Bus DC Microgrids with Constant Power Loads
Xiu Yao, University at Buffalo, SUNY, United States

#### 11:45AM | Stability Analysis and Improvement of a Dual Active Bridge (DAB) Converter Enabled DC Microgrid based on a Reduced-order Low Frequency Model
Qing Ye, Ran Mo and Hui Li, Florida State University, United States

### S54 Datacenters and Telecommunication Applications

**Room:** 102E  
**Chairs:** Philip Krein, Johan Enslin

#### 10:30AM | Soft-Switching Operation of Edge-Resonant Output-Inductor-Less Full-Bridge Converter
Kazuhide Domoto, Yoichi Ishizuka, Seiya Abe and Tamotsu Ninomiya, Nagasaki University, Japan; Kyushu Institute of Technology, Japan; Green Electronics Research Institute, Kitakyushu, Japan

#### 10:55AM | High Efficiency Two-Stage 48V VRM with PCB Winding Matrix Transformer
Mohamed Ahmed, Chao Fei, Fred C. Lee and Qiang Li, CPES – Virginia Tech, United States

#### 11:20AM | Hierarchical Protection Architecture for 380V DC Data Center Application
Kai Tan, Xiaojing Song, Chang Peng, Pengkun Liu and Alex Huang, North Carolina State University, United States; North Carolina State University, United States

#### 11:45AM | Device Loss Comparison of GaN Device Based LLC, Dual Active Bridge and Phase Shift Quasi Switched Capacitor Circuit
Boxue Hu, Xuan Zhang, Lixing Fu, He Li, Yousef M. Abdullah, Yafeng Wang, Lurao Liu and Jin Wang, The Ohio State University, United States

### S55 Transportation Electrification II

**Room:** 102D  
**Chairs:** Sinisa Jurkovic, Bruno Lequesne

#### 10:30AM | Loss Optimizing Control of a Multiphase Interleaving DC-DC Converter for Use in a Hybrid Electric Vehicle DriveTrain
Rashidrezar Karimi, Dennis Kaczorowski, Alexander Zlotnik and Mertens Axel, Leibniz University of Hannover, Germany

#### 10:55AM | Traction Inverter Evaluation Method Based on Driving Cycles for Electric and Hybrid Electric Vehicles
Fan Xu and Lihua Chen, Ford Motor Company, United States

#### 11:20AM | Model Predictive Control based Field-weakening Strategy for Traction EV used Induction Motor
Jianyong Su, Rui Gao and Idgal Hussain, Harbin Institute of Technology, China; North Carolina State University, United States

#### 11:45AM | Design Optimization and Development of Electric Traction Machines for Cadillac CT6 PHEV
Sinisa Jurkovic, Khwaja Rahma and Peter Savagian, General Motors, United States
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<tr>
<th>Session</th>
<th>Title</th>
<th>Time</th>
<th>Authors/Institutions</th>
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<tbody>
<tr>
<td>S56</td>
<td><strong>PFC Rectifiers</strong></td>
<td>10:30AM</td>
<td>Gilsu Choi, Yichao Zhang and Thomas Jahns, University of Wisconsin – Madison, United States</td>
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<td><strong>Active Virtual Ground – Bridgeless PFC Topology</strong></td>
<td>10:55AM</td>
<td>Carl Ngai-Ma Ho, University of Manitoba, Canada; ABB (China) Ltd., China</td>
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<td>S57</td>
<td><strong>Modeling and Control of Multilevel Converters</strong></td>
<td>11:20AM</td>
<td>Dong Dong, Luis Garces, Mohammad Agamy, Yan Pan, Xinhui Wu, He Xu, Hongwu She, GE Global Research, China</td>
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<td></td>
<td><strong>Optimized Resonant Pulsed Power Supplies with Deadbeat – Repetitive Regulation</strong></td>
<td>10:55AM</td>
<td>Nicole Bianchi, Alessandro Castagnini, Giulio Secondo and Pietro Savio Termini, University of Padova, Italy; ABB, Discrete Automation and Motion Division, Italy</td>
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<td>S58</td>
<td><strong>Modeling and Control of Resonant Converters</strong></td>
<td>11:45AM</td>
<td>Chao JI, Jon Clare and Pericle Zanchetta, University of Nottingham, United Kingdom</td>
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<td>S59</td>
<td><strong>Electric Machines for Automotive Applications I</strong></td>
<td>10:30AM</td>
<td>Chao Ji, Jon Clare and Pericle Zanchetta, University of Nottingham, United Kingdom</td>
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<td><strong>Test Results for a High Temperature Non-Permanent Magnet Traction Motor</strong></td>
<td>10:55AM</td>
<td>Hui Yang, Z. Q. Zhu, Heyun Lin, Shuhua Fang and Yunkai Huang, Southeast University, China; University of Sheffield, United Kingdom</td>
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<td><strong>Vehicular Suspension and Propulsion Using Double Sided Linear Induction Machines</strong></td>
<td>11:45AM</td>
<td>Tom Cox, Fred Eastham and Matt Dickinson, The University of Nottingham, United Kingdom; Force Engineering Ltd., United Kingdom</td>
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<td>S60</td>
<td><strong>PM Machines II</strong></td>
<td>10:30AM</td>
<td>Nicola Bianchi, Alessandro Castagnini, Giulio Secondo and Pietro Savio Termini, University of Padova, Italy; ABB, Discrete Automation and Motion Division, Italy</td>
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<td><strong>Experimental Verification of Rotor Demagnetization in a Fractional-Slot Concentrated-Winding PM Synchronous Machine under Drive Fault Conditions</strong></td>
<td>10:55AM</td>
<td>Gilsu Choi, Yichao Zhang and Thomas Jahns, University of Wisconsin – Madison, United States</td>
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<td><strong>Influence of Stator Configuration on High Frequency Signal Injection Based Permanent Magnet Temperature Estimation in PM Synchronous Machines</strong></td>
<td>11:20AM</td>
<td>Gilsu Choi and Thomas Jahns, University of Wisconsin – Madison, United States</td>
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<td></td>
<td><strong>Analysis and Design Guidelines to Mitigate Demagnetization Vulnerability in PM Synchronous Machines</strong></td>
<td>11:45AM</td>
<td>Nicola Bianchi, Alessandro Castagnini, Giulio Secondo and Pietro Savio Termini, University of Padova, Italy; ABB, Discrete Automation and Motion Division, Italy</td>
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<td></td>
<td><strong>The Nature of the Torque Ripple in Fractional-slot PMAREL Machines</strong></td>
<td>10:30AM</td>
<td>Dong Dong, Luis Garces, Mohammad Agamy, Yan Pan, Xinhui Wu, He Xu, Hongwu She, GE Global Research, China</td>
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<td></td>
<td><strong>Cost effective Capacitor Voltage Balancing Control for Five-level Grid-tied Inverters</strong></td>
<td>10:55AM</td>
<td>Mingchen Gu, Li Zhang, Kai Sun, Yan Xing and Peng Xu, Nanjing Univ. of Aeronautics and Astronautics, China; Hohai University, China; Tsinghua University, China</td>
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<td></td>
<td><strong>A Single Phase T-type Inverter Operating in Boundary Conduction Mode</strong></td>
<td>11:20AM</td>
<td>Zhen Zhang, Junming Zhang and Xinke Wu, Zhejiang University, China; Zhejiang University, China</td>
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<td><strong>Three-Phase Four-Wire AC-DC-AC Multilevel Topologies Obtained from an Interconnection of Three-leg Converters</strong></td>
<td>11:45AM</td>
<td>Aysslan Caisson Noroes Maia, Cursino Brandao Jacobina, Nayara Brandao de Freitas, Antonio de Paula Dias Queiroz and Edison Roberto Cabral da Silva, Federal University of Campina Grande, Brazil</td>
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<td></td>
<td><strong>High Efficiency Bridgeless Power Factor Correction Buck Converter for High Frequency AC Systems</strong></td>
<td>11:45AM</td>
<td>Chao Ji, Jon Clare and Pericle Zanchetta, University of Nottingham, United Kingdom</td>
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**S61  Multilevel Motor Drives**

*Room: 101B*

*Chairs: Luca Zarri, Yi Deng*

**10:30AM | A Fault-Tolerant T-Type Multilevel Inverter Topology with Soft-Switching Capability Based on Si and SiC Hybrid Phase Legs**

Jiangbiao He, Nathan Weise, Ramin Katebi, Lixiang Wei and Nabeel Demerdash,
GE Global Research, United States; Marquette University, United States; Rockwell Automation, United States

**10:55AM | An On-Line Diagnostic Method for Open-Circuit Switch Faults in NPC Multilevel Converters**

Jiangbiao He and Nabeel Demerdash, GE Global Research, United States; Marquette University, United States

**11:20AM | Analysis of Neutral Point Deviation in 3-level NPC Converter under Unbalanced 3-phase AC Grid**

Kyungsung Jung and Youngsug Suh, Elect. Eng. Chonbuk Nat’l Univ., Korea (South)

**11:45AM | A Modulation Technique of Neutral Point Clamped Converters with Common-Mode Voltage Reduction and Neutral-Point Potential Balance**

Meng-Jiang Tsai, Hsin-Chih Chen, Po-Tai Cheng, Meng-Ru Tsai and Yao-Bang Wang, National Tsing Hua University, Taiwan

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**S62  PM and IPM Motor Drives III**

*Room: 101CD*

*Chairs: Takahiro Suzuki, Nicola Bianchi*

**10:30AM | Magnet Temperature Effects on the Useful Properties of Variable Flux PM Synchronous Machines and a Mitigating Method for Magnetization Changes**

Brent Gagas, Kenseku Sasaki, Apoorva Athavale, Takashi Kato and Robert Lorenz, University of Wisconsin-Madison, WEMPEC, United States; Nissan Motor Co., Ltd., Japan

**10:55AM | Nonintrusive Online Rotor Permanent Magnet Temperature Tracking for Permanent Magnet Synchronous Machine Based on Third Harmonic Voltage**

Hanlin Zhan and Z.Q. Zhu, The University of Sheffield, United Kingdom

**11:20AM | Permanent Magnet Temperature Estimation in PMSM Using Low Cost Hall Effect Sensors**

Daniel Fernandez, Doosoo Hyan, Yonghyun Park, David Reigosa, Sang Bin Lee, Dong Myung Lee and Fernando Briz, University of Oviedo, Spain; Dept. of Elec. Eng., Korea University, Seoul, Korea (South); Dept. of Elec. Eng., Hongik University, Seoul, Korea (South)

**11:45AM | Analysis and Suppression of Zero Sequence Circulating Current in Open Winding Permanent Magnet Synchronous Machine Drives with Common DC Bus**

Hanlin Zhan, Z.Q. Zhu and Milijana Odavic, The University of Sheffield, United Kingdom

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**S63  Wide Bandgap Applications: SiC**

*Room: 202C*

*Chairs: Ruxi Wang, Jerry Hudgins*

**10:30AM | A Compact 100-A, 850-V, Silicon Carbide Solid-State DC Circuit Breaker**

Damian Urciuoli, Oladimeji Ibitayo, Gail Koebke, Gregory Ovrebo and Ronald Green, U.S. Army Research Laboratory, United States

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**S64  LED Drivers**

*Room: 102A*

*Chairs: Huai Wang, David Perreault*

**10:30AM | Precise and Full-Range Dimming Control for An Off-Line Single-Inductor-Multiple-Output LED Driver**

Sinan Li, Yue Guo, Ting Leung Albert Lee, Siew Chong Tan and Shu Yuen Ron Hui, The University of Hong Kong, Hong Kong

**10:55AM | Design and Implementation of a Retrofit LED Lamp for AC Mains and Ballasts**

Tsung-Juu Liang, Huan-Hao Chang, Kai-Hui Chen and Li-An Hsu, National Cheng Kung University, Taiwan

**11:20AM | A Current Compensator for Mitigating the Influence of Long Cable Inductance between the LED Driver and the Light Source**

Rui Zhou, Ryan Shun-Chung Yeung, Henry Shu-Hung Chung, John Yau-Chung Chan and Norman Chung-fai Tse, City University of Hong Kong, Hong Kong

**11:45AM | Investigation into the Use of Single Inductor for Driving Multiple Series-Connected LED Channels**

Xiaoqing Zhan, Henry Shu-Hung Chung and Ruihong Zhang, City University of Hong Kong, Hong Kong; Northwestern Polytechnical University, China

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**Wednesday, September 21st 1:30PM – 3:10PM**

**S65  Modeling and Control of Alternative Energy Applications**

*Room: 203C*

*Chairs: Eduard Muljadi, Ranjit Mahanty*

**1:30PM | Using Markov Switching Model for Solar Irradiance Forecasting in Remote Microgrids**

Ayush Shykya, Semhar Michael, Christopher Saunders, Douglas Armstrong, Prakash Pandey, Santosh Chalise and Reinaldo Tonkoski, South Dakota State University, United States

**1:55PM | Determining Maximum MPP-Tracking Sampling Frequency for Input-Voltage-Controlled PV-Interfacing Converter**

Jyn Kvimaki, Moshe Sitbon, Sergei Kolesnik, Alon Kuperman and Teuvo Suntio, Tampere University of Technology, Finland; Ariel University, Israel

**2:20PM | Real-time Emulation of a Pressure Retarded Osmosis Power Generation System**

Sudharshan Käärthik, Jonathan Maisonneuve and Pragasen Pillay, Concordia University, Canada
2:45PM  |  Efficient FCTV Provision considering DWT and DWPT-based Noise Suppression for Overcoming the Noise-Induced Voltage Loss in PEM Fuel Cell
Jonghoon Kim, Woonki Na and Youngsug Tak, Chosun University, Korea (South); California State University, Fresno, United States; Inha University, Korea (South)

**S66  Utility Applications IV**

**Room: 202A**
**Chairs: Fariba Fateh, Xu She**

1:30PM  |  Field Test Results for a 12.47 kV 3-Phase 1 MVA Power Router
Rajendra Prasad Kandula, Hao Chen, Anish Prasai, Frank Lambert, Joe Schatz, Thomas Powell, Timothy Heidel, Colin Schauer and Deepak Divvan, Georgia Institute of Technology, United States; Varentec, United States; Southern University of Science and Technology, China; Georgia Power, United States; Advanced Research Projects Agency-Energy, United States; Booz Allen Hamilton, United States

1:55PM  |  DC Capacitor Voltage Balancing Control for Delta-Connected Cascaded H-Bridge STATCOM Considering the Unbalanced Grid and Load Conditions
Jae-Jung Jung, Joon-Hee Lee, Seung-Ki Sul, Gum Tae Son and Young-Ho Chung, Seoul National University, Korea (South); LS Industrial Systems Co. Ltd, Korea (South)

2:20PM  |  Advanced Grid Simulator for Multi-Megawatt Power Converter Testing and Certification
Przemyslaw Koralewicz, Vahan Gevorgian, Pieder Joerg, Wim van der Merwe and Robb Wallen, ABB, Poland; NREL, United States; ABB, Switzerland

2:45PM  |  Experimental Verification of Capacitance Reduction in MMC-Based STATCOM
Takanori Isebe, Long Zhang, Ryuji Iijima, Hiroshi Tadano, Yoshikazu Kawanami and Katsushi Terazono, University of Tsukuba, Japan; Yaskawa Electric Corp., Japan

**S67  Modeling, Analysis, and Control of Grid-Connected Converters III**

**Room: 202D**
**Chairs: Ali Davoudi, Edison da Silva**

1:30PM  |  A Comparative Study of Methods for Estimating Virtual Flux at the Point of Common Coupling in Grid Connected Voltage Source Converters With LCL Filter
Nurul Fazlin Roslan, Jon Are Suul, Alvaro Luna, Joan Rocabet, Ignacio Candela and Pedro Rodriguez, Universitat Politècnica de Catalunya, Terrassa, Spain; SINTEF Energy Research, Trondheim, Norway; Abengoa Research Centre, Seville, Spain

1:55PM  |  A Novel Model Predictive Sliding Mode Control for AC/DC Converters with Output Voltage and Load Resistance Variations
Tingting He, Li Li, Jianguo Zhu and Zheng Linteng, FEIT, University of Technology, Sydney, Australia

2:20PM  |  A Novel Virtual Synchronous Generator Control Strategy Based on Improved Swing Equation Emulating and Power Decoupling Method
Mingxuan Li, Yue Wang, Ningyi Xu, Yonghui Liu, Wenti Wang, Hao Wang and Wanjun Lei, Xi’an Jiaotong University, China

2:45PM  |  Virtual Impedance-Based Active Damping for LCL Resonance in Grid-Connected Voltage Source Inverters with Grid Current Feedback
Teng Liu, Zeng Liu, Jinjun Liu and Zipeng Liu, Xi’an Jiaotong University, China

**S68  WBG in Traction Application**

**Room: 102D**
**Chairs: Burak Ozpineci, Anand Sathyan**

1:30PM  |  Component Design and Implementation of a 60 kW Full SiC Traction Inverter with Boost Converter
Avrid Merkert, Jan-Kaspar Mueller and Axel Mertens, Leibniz Universitaet Hannover, Germany

1:55PM  |  Design Methodology for a Planarized High Power Density EV/HEV Traction Drive using SiC Power Modules
Dhrubo Rahman, Adam Morgan, Yang Xu, Rui Gao, Wensong Yu, Douglas C. Hopkins and Iqbal Hussein, North Carolina State University, United States

2:20PM  |  A SiC-Based High-Performance Medium-Voltage Fast Charger for Plug-in Electric Vehicles
Srđjan Srdić, Xinyu Liang, Chi Zhang, Wensong Yu and Srđjan Lukić, North Carolina State University, United States

2:45PM  |  An Integrated Onboard Charger and Accessory Power Converter for Traction Drive Systems with a Boost Converter
Gui-Jia Su and Lixin Tang, Oak Ridge National Lab, United States

**S69  Single Phase Rectifiers**

**Room: 202E**
**Chairs: Adam Skorek, Stefan Schroeder**

1:30PM  |  Current-stress Reduction of the Neutral Inductor in a Rectifier with Two Outputs
Wen-Long Ming and Qiong-Chang Zhong, The University of Sheffield, United Kingdom; Illinois Institute of Technology, United States

1:55PM  |  Single-stage AC/DC Dual Inductor BCM Current-Fed Push-Pull for HB-LED lighting applications
Ignacio Castro, Kevin Martin, Manuel Arias, Diego G. Lamar, Marta M. Hernandez and Javier Sebastian, University of Oviedo, Spain

2:20PM  |  Asymmetric Single-Phase Current Source Rectifiers
Loulou Cost, Montie Vitorino, Mauricio Correa, Darlan Fernandes and Oliveira Marcus, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil; Tocantins Federal Institute of Technology, Brazil

2:45PM  |  A Bridgeless Controlled Rectifier for Single Split-Phase Systems
Nusteni S de M. L. Marinus, Cursino B Jacobina, Euzeli C dos Santos Jr., Nady Rocha and Nayara B. Freitas, Federal University of Campina Grande, Brazil; Indiana University Purdue University Indianapolis, United States

**S70  Multilevel Converters**

**Room: 202B**
**Chairs: Ningyi Dai, Marcello Pucci**

1:30PM  |  Modulation Method for Single-Phase Six-Switch Five-Level ANPC Inverter
Lei Kou, Hongliang Wang, Yan-Fei Liu, Paresh C. Sen and Yan Zhang, Queen’s University, Canada

1:55PM  |  Modified SVPWM to Eliminate Common-Mode Voltages for Five-Level ANPC Inverters
Quoc Anh Le and Dong-Choon Lee, Yeungnam University, Korea, Republic of Korea; Korea University of Science and Technology, Korea (South)
2:20PM | THD and Efficiency improvement in Multi-Level Inverters Through an Open End Winding Configuration
Salvatore De Caro, Salvatore Foti, Tommaso Scimone, Antonio Testa, Mario Cacciato, Giuseppe Scaccella and Giacomo Scelba, University of Messina, Italy; University of Catania, Italy; University of Catania, Italy

2:45PM | A Source-Type Harmonic Energy Unbalance Suppression Method Based on Carrier Frequency Optimization for Cascaded Multilevel APF
Zezhou Yang, Shangshen Li, Xiaoming Zha, Jianjun Sun and Wang Yi, School of Electrical Engineering, Wuhan University, China

S71  DC-DC Converters II
Room: 102C
Chairs: Yan-Fei Liu, Lixiang Wei

1:30PM | Small-Signal Model and Control of the Interleaved Two-Phase Coupled-Inductor Boost Converter
Brendan C. Barry, John G. Hayes, Marek S. Rylko, Robert Stala, Adam Penczek, Andrzej Mondzik and Robert T. Ryan, University College Cork, Ireland; dtw Sp. z o.o., Poland

1:55PM | A Robust Design Framework for Stable Digital Peak Current-Mode Control Under Uniform Sampling
Amrit Singha, Santanu Kapat and Jayanta Pal, Indian Institute of Technology Kharagpur, India; Indian Institute of Technology Bhubaneswar, India

2:20PM | Modeling and Decoupled Control of a Non-isolated High Step-up/down Bidirectional DC-DC Converter
Haixu Shi, Xi Xiao, Hongfei Wu and Kai Sun, Tsinghua University, China; Nanjing University of Aeronautics Astronautics, China

2:45PM | Non-Isolated High-Gain Three-Port Converter for Hybrid Storage Systems
Jorge Garcia, Ramy Georgious, Pablo Garcia and Angel Navarro-Rodriguez, University of Oviedo, Spain

S72  Reliability, Diagnostic and Faults Analysis in Power Converters I
Room: 102E
Chairs: Jiangchao Qin, Martin Ordonez

1:30PM | System-level Reliability Assessment of Power Stage in Fuel Cell Application
Diao Zhou, Huai Wang, Frede Blaabjerg, Soeren Kudsen Kaer and Daniel Blom Hansen, Aalborg University, Denmark; Dantherm Power A/S, Denmark

1:55PM | A Novel Online ESR and C Identification Method for Output Capacitor of Flyback Converter
Hui Li, Kai Yao, Xufeng Zhou, Fei Yang and Junfang Zhang, Nanjing University of Science and Technology, China; Nanjing University of Science and Technology, China

2:20PM | Fault Ride-Through Capability for Grid-Supporting Inverters
Prasanna Piya, Masoud Karimi-Ghartemani and Ali S. Khajehoddin, Mississippi State University, United States; University of Alberta, Canada

2:45PM | Analysis of Hybrid Energy Storage Systems with DC Link Fault Ride-Through Capability
Ramy Georgious, Mark Sumner, Jorge Garcia and Pablo Garcia, University of Oviedo, Spain; University of Nottingham, England
1:55PM | Simulation of Cable Charging Current and Its Effects on Operation of Low Power AC Drives
Helen Lewis-Rzeszutek, Ripunjoy Phukan, Rangarajan Tallam, Mark Solveson and Timothy Clancy, Rockwell Automation, United States; Georgia Institute of Technology, United States; Ansys, United States; General Cable, United States

2:20PM | Systematic Modeling for a Three Phase Inverter with Motor and Long Cable using Optimization Method
Hui Zhao, Shuo Wang, Jianjun Min and Zhi Yongjian, University of Florida, United States; China South Railway, China

2:45PM | Performance Evaluation of SiC MOSFETs with Long Power Cable and Induction Motor
Peizhong Yi, Puneeth Kumar Srikanta Murthy and Lixiang Wei, Rockwell Automation, United States

S76 Sensorless Drives I
Room: 101CD
Chairs: Giacomo Scelba, Ramakrishnan Raja

1:30PM | Design Consideration of Interior Permanent Magnet Machine Position Sensorless Drive Using Square-wave Voltage Injection
Shih-Chin Yang, Sheng-Ming Yang and Jing-Hui Hu, National Taiwan University, Taiwan; National Taiwan University of Technology, Taiwan

1:55PM | A Synchro-Perspective-Based High-Frequency Signal Injection Method for Position-Sensorless Vector Control of Doubly-Fed Induction Machines
Anuwat Srivorakul and Surapong Suwankawin, Chulalongkorn University, Thailand

2:20PM | Enhancing Estimation Accuracy by Applying Cross-Correlation Image Tracking to Self-Sensing Including Evaluation on a Low Salienity Ratio Machine
Timothy Slininger, Yinghan Xu and Robert Lorenz, University of Wisconsin, Madison, United States

2:45PM | The Crowded Axis of the Frequency: Optimal Pole/Zero Allocation for a Full Speed Sensorless Synchronous Motor Drives
Virginia Manzolini, Mattia Morandin and Silverio Bolognani, University of Padova, Italy

S77 Junction Temperature Sensing and Monitoring
Room: 102A
Chairs: Adam Skorek, Tanya Gachovska

1:30PM | An IGBT Junction Temperature Measurement Method via Combined TSEPs For Eliminating Impact of Collector Current
Xiang Wang, Chong Zhu, Haoze Luo, Zhou Lu, Wuhua Li, Xiangning He, Jun Ma, Guodong Chen, Ye Tian and Enxing Yang, Zhejiang University, China; Aalborg University, China; Shanghai Electric, China

1:55PM | DeltaTj Control of Switching Power Devices at Thermal Boundaries via Physics-Based Loss Manipulation
Timothy Polom, Boru Wang and Robert Lorenz, University of Wisconsin-Madison, United States

2:20PM | Online Junction Temperature Monitoring Using Turn-Off Delay Time for Silicon Carbide Power Devices
Zheyu Zhang, Xuanlyu Wu, Fred Wang, Daniel Costinett, Leon Tolbert and Blalock Benjamin, The University of Tennessee, United States; Xi’an Jiaotong University, China

2:45PM | Simple Analog Detection of Turn-off Delay Time for IGBT Junction Temperature Estimation
Simon Weber, Michael Schlüeter, Daniel Borowski and Axel Mertens, Leibniz University of Hanover, Germany

S78 Wide Bandgap Applications: GaN
Room: 202C
Chairs: Filippo Chimento, Jean-Luc Schanen

1:30PM | Design of a 10 kW GaN-based High Power Density Three Phase Inverter
He Li, Xuan Zhang, Zhengda Zhang, Chengcheng Yao, Feng Qi, Boxue Hu, Liming Liu and Jin Wang, The Ohio State University, United States; ABB Corporate Research, United States

1:55PM | High-frequency DC-DC Converter in Electric Vehicle Based on GaN Transistors
Zhenjin Pang, Xiaoyong Ren, Junlin Xiang, Qianhong Chen, Xinbo Ruan and Wu Chen, Nanjing univ. of Aeronautics and Astronautics, China; Southeast University, China

2:20PM | A GaN-based Flying-Capacitor Multilevel Boost Converter for High Step-up Conversion
Zitao Liao, Yutian Lei and Robert Pilawa-Podgurski, University of Illinois, United States

2:45PM | A GaN based High Frequency Active-clamp Buck Converter for Automotive Applications
Chenhao Nan, Raja Ayyanar and Youhao Xi, Arizona State University, United States; Texas Instruments Inc., United States

S79 Applications of Droop Control
Room: 203AB
Chairs: Tsorg-Juu Liang, Keyue Smedley

1:30PM | Energy Storage Size and Fuel Consumption Reduction in a Microgrid Using Virtual Droop Control Framework
Ashish Solanki and Adel Nasiri, SandC Electric, United States; UW-Milwaukee, United States

1:55PM | Seamless Black Start and Reconnection of LCL-filtered Solid State Transformer Based On Droop Control
Yonghwan Cho, Yongsu Han, Richard Byron Beddingfield, Jung-Ik Ha and Subhashish Bhattacharya, North Carolina State University, United States; Seoul National University, Korea (South)

2:20PM | A Circulating Current Suppression Method for Parallel Connected Voltage-Source-Inverters (VSI) with Common DC and AC Buses
Baoze Wei, Xiaoqiang Guo, Josep M. Guerrero and Juan C. Vasquez, Aalborg University, Denmark; Yanshan University, China

2:45PM | Decentralized Method for Load Sharing and Power Management in a Hybrid Single/Three-Phase Islanded Microgrid Consisting of Hybrid Source PV/Battery Units
Yaser Karimi, Josep M. Guerrero and Hashem Oraee, Sharif University of Technology, Iran; Aalborg University, Denmark
**TECH PROGRAM SCHEDULE | ORAL SESSIONS**

**S80 | DC Microgrids III**
- Room: 203DE
- Chairs: Norma Anglani, Tsorng-Juu Liang

1:30PM | A New Secondary Control Approach for Voltage Regulation in DC Microgrids
Saeed Peyghami-Akhuleh, Hossein Mokhtari, Pooya Davari, Poh Chiang Loh and Frede Blaabjerg, Sharif University of Technology, Iran; Aalborg University, Denmark

1:55PM | CERTS Microgrids with Photovoltaic Microsources and Feeder Flow Control
Zhe Chen, Dinesh Pattabiraman, Robert H. Lasseter and Thomas M. Jahns, University of Wisconsin Madison, United States

2:20PM | Combined Optimization of SSCB Snubber and Freewheeling Path for Surgeless and Quick Bus Fault Interruption In Low-Voltage DC Microgrid
Wenjun Liu, Xiaqio Xiong, Hua Yang, Kun Feng, Si Zhang and Fei Liu, Wuhan University, China

2:45PM | Symmetric Droop Control for Improved Hybrid AC/DC Microgrid Transient Performance
Philip Hart, Robert Lasseter and Thomas Jahns, University of Wisconsin-Madison, United States

**Wednesday, September 21st 3:30PM – 5:10PM**

**S81 | Wind Energy Control and Operations**
- Room: 203AB
- Chairs: Eduard Muljadi, Pedro Rodriguez

3:30PM | Small Scale Reluctance Synchronous Generator Wind-Turbine System with DC Transmission Linked Inverters
Joshua Cole Mitchell, Maarten Jan Kamper and Christoph M. Hackl, Stellenbosch University, South Africa; Munich University, Germany

3:55PM | Short-Term Forecasting of Inertial Response from a Wind Power Plant
Eduard Muljadi, Vahan Gevorgian and Anderson Hoke, National Renewable Energy Laboratory, United States

4:20PM | A 3.0MW Case Study of the Influence of PM Cost on Wind Turbine Cost of Energy
Matthew Henriksen, Bogi Bech Jensen, Nenad Mijatovic and Holboell Joachim, ABB Corporate Research, United States; University of the Faroe Islands, Faroe Islands; Technical University of Denmark, Denmark

4:45PM | Direct Power Control of a Doubly Fed Induction Generator Wind Power System in Stand-Alone and Grid-Connected Modes with Seamless Transition
Sam Mahmodicherati, Malik Elbuluk and Yilmaz Sozer, The University of Akron, United States; The University of Akron, United States

**S82 | Energy Harvesting Systems**
- Room: 203C
- Chairs: Mohamed Badawy, Xiongfei Wang

3:30PM | Temperature Dependence of Efficiency in Renewable Magnetohydrodynamic Power Generation Systems
Eva Cosoroaba and Babak Fahimi, The University of Texas at Dallas, United States

3:55PM | Modeling, Analysis and Design of An Undersea Storage System
Seyyedmahdi Jafari, Mehdi Farasat and Amir Masoud, Louisiana State University, United States; Louisiana State University, United States

4:20PM | The Joint Design of a Compressed Air and Wind Energy System for Mechanical Spillage Recovery
Jie Cheng and Fred Choobineh, University of Nebraska-Lincoln, United States

4:45PM | Experimental Control of a Hydraulic Wind Power Transfer System under Wind and Load Disturbances
Masoud Vaezi and Afshin Izadian, Purdue School of Engineering and Technology, United States

**S83 | Utility Applications V**
- Room: 202A
- Chairs: Olivier Trescases, Srdjan Lukic

3:30PM | Field Upgradeable Transformer: A Fractionally-Rated Voltage Regulator for the Distribution System
Rajendra Prasad Kandula, Hao Chen, Anish Prasai, Joe Schatz and Deepak Divan, Georgia Institute of Technology, United States; Varentec, Inc., United States; Southern Company, United States

3:55PM | New Configuration of Multi-Functional Grid-Connected Inverter to Improve Both Current-Based and Voltage-Based Power Quality
Wooyoung Choi, Woogkul Lee, Di Han and Bulent Sarlioglu, University of Wisconsin-Madison, United States

4:20PM | Model Predictive Control of A Matrix-Converter Based Solid State Transformer for Utility Grid Interaction
Yushan Liu, Haitham Abu-Rub, Baoming Ge, Robert S. Balog and Yaosuo Xue, Texas A and M University at Qatar, Qatar; Texas A and M University, United States; Oak Ridge National Laboratory, United States

4:45PM | A Triple Port Active Bridge Converter based Power Electronic Transformer
Venkat Nag Someswar Rao Jakk and Ashok Shukla, Department of Electrical Engineering, IIT Bombay, India

**S84 | Modeling, Analysis, and Control of Grid-Connected Converters IV**
- Room: 202D
- Chairs: Paolo Mattavelli, John Lam

3:30PM | Evaluation of Active Islanding Detection Based Methods Under Non-Liner-loads Scenarios
David Reigosa, Cristian Blanco, Juan Manuel Guerrero and Fernando Briz, University of Oviedo, Spain
3:55PM | Decentralized Adaptive Control for Interconnected Boost Converters based on backstepping approach
Arturo Hernandez-Mendez, Jesus Linares-Flores and Hebertt Sira-Ramirez,
Universidad Tecnologica de la Mixteca, Mexico; Centro de Investigacion y de Estudios Avanzados, Mexico

4:20PM | Impedance Synthesis by Inverter Control for Active Loads in Anti-Islanding Testbenches
Tommaso Caldiognotto, Luca Dalla Santa, Paolo Magnone and Paolo Mattavelli,
University of Padova, Italy

4:45PM | A Unified Impedance Model of Voltage-Source Converters with Phase-Locked Loop Effect
Xiongfei Wang, Lennart Harnefors, Fred Blaabjerg and Poh Chiang Loh,
Aalborg University, Denmark; ABB Corporate Research Center, Sweden

S85 More Electric Aircraft
Room: 102D
Chairs: Pat Wheeler, Bulent Sarlioglu

3:30PM | An Induction Generator based Auxiliary Power Unit for Power Generation and Management System for More Electric Aircraft
Yijiang Jia and Kaushik Rashekar, University of Texas at Dallas, United States

3:55PM | Design and Optimization of a High Performance Isolated Three Phase AC/DC Converter for Aircraft Applications
Qiong Wang, Xunxing Zhang, Rolando Burgos, Dushan Boroyevich, Adam White and Mustansir Kheraluwala, CPES, Virginia Tech, United States; UTC Aerospace Systems, United States

4:20PM | Taking Into Account Interactions Between Converters in the Design of Aircraft Power Networks
Qian Li, Andrea Formentini, Arnaud Baraston, Xinxing Zhang, Pericle Zanchetta, Jean-Luc Schanen and Dushan Boroyevich, CPES Virginia Tech, United States; University of Nottingham, United Kingdom; G2ELab – University Grenoble Alsace, France

4:45PM | Stability Assessment of A Droop-Controlled Multi-Generator System in the More Electric Aircraft Using Parameter Space Approach
Fei Gao, Xiancheng Zheng and Serhiy Bozhko, The University of Nottingham, United Kingdom; Northwestern Polytechnical University, China

S86 DC-DC Converters: High Frequency
Room: 102C
Chairs: Seth Sanders, Juan Rivas-Davila

3:30PM | A GaN-Based Partial Power Converter with MHz Reconfigurable Switched-Capacitor and RF SEPIC
Junjian Zhao and Yehui Han, University of Wisconsin-Madison, United States

3:55PM | Monolithic Multilevel GaN Converter for Envelope Tracking in RF Power Amplifiers
Alihossein Sepahvand, Parisa Momen Roodaki, Yuanzhe Zhang, Zoya Popovic and Dragan Maksimovic, University of Colorado at Boulder, United States

4:20PM | An Improved PDM Control Method for a High Frequency Quasi-Resonant Converter
Hossein Mousavian, Alireza Bakhtshai and Praveen Jain, Queen’s University, Canada

4:45PM | Automotive LED Driver Based On High Frequency Zero Voltage Switching Integrated Magnetics Cuk Converter
Alihossein Sepahvand, Montu Doshi, James Patterson, Vahid Yousefzadeh, Khurram Afridi and Dragan Maksimovic, Vahid Yousefzadeh, Khurram Afridi and Dragan Maksimovic, University of Colorado at Boulder, United States; Texas Instruments, United States

S87 Modeling and Control of AC-DC Converters
Room: 202E
Chairs: Pragases Pillay, Lixiang Wei

3:30PM | Dynamic Response Optimization for Three-phase VIENNA Rectifier with Load Feedforward Control
Xudong Chen, Xiaoyong Ren, Zhiliang Zhang, Qianhong Chen and Xinbo Ruan, Nanjing Univ. of Aeronautics and Astronautics, China

3:55PM | A Compensation Scheme to Reduce Input Current Distortion in GaN Based 450 kHz Three-Phase Vienna Type PFC
Bo Liu, Ren Ren, Edward Andrew Jones, Fred Wang, Daniel Jes Costinett and Zheyu Zhang, The University of Tennessee, United States

4:20PM | Modeling and Analysis for Input Characteristics of Line-Frequency Rectifiers
Xiaolong Yue, Dushan Boroyevich, Rolando Burgos and Fang Zhuo, Xi’an Jiaotong University, Virginia Tech, China; Virginia Tech, United States; Xi’an Jiaotong University, China

4:45PM | Hybrid Damping for Active Front End Converter
Yogesh Patel, Sayed Ahmed Ahmed and Lixiang Wei, Rockwell Automation, United States

S88 Converter Control in Microgrids and Distributed Generation
Room: 203DE
Chairs: Leon M Tolbert, Shu-hung Chung

3:30PM | A Feed-forward Based Harmonic Compensation Approach for Low Switching Frequency Grid Interfacing VSI
Hao Tian and Yun Wei Li, University of Alberta, Canada

3:55PM | An Embedded Voltage Harmonic Compensation Strategy for Current-Controlled DI Interfacing Converters
Zheyu Zhang, Texas Instruments, United States

4:20PM | Analysis and Damping of harmonic propagation in DG-Penetrated distribution networks
Jinghang Lu, Mehdi Savaghebi and Josep Guerrero, Aalborg University, Denmark

4:45PM | Voltage and Current Regulators Design of Power Converters in Islanded Microgrids based on State Feedback Decoupling
Federico de Bosio, Luis Antonio de Souza Ribeiro, Francesco Freijedo, Josep Guerrero and Michele Pastorelli, Politecnico di Torino, Italy; Federal University of Maranhao, Brazil; Ecole Polytechnique Federale de Lausanne, Switzerland; Aalborg University, Denmark
<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Room</th>
<th>Chairs</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>S89</td>
<td>Reliability, Diagnostic and Faults Analysis in Power Converters II</td>
<td>102E</td>
<td>Marco Liserre, Lee Empringham</td>
<td>Markus Andresen, Mike Schloh, Giampaolo Buticchi and Marco Liserre, Christian-Albrechts-University Kiel, Germany</td>
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<td>3:30PM</td>
<td>Computation and Analysis of Dielectric Losses in MV Power Electronic Converter Insulation</td>
<td></td>
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<td>Thomas Guillod, Raphael Faerber, Florian Krismer, Christian M. Franck and Johann W. Kolar, Power Electronic Systems Laboratory (PES), ETH Z, Switzerland; High Voltage Laboratory, ETH Zürich, Switzerland</td>
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<tr>
<td>3:55PM</td>
<td>Computational Light Junction Temperature Estimator for Active Thermal Control</td>
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<td>Markus Andresen, Mike Schloh, Giampaolo Buticchi and Marco Liserre, Christian-Albrechts-University Kiel, Germany</td>
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<td>4:20PM</td>
<td>Fast Fault Diagnosis and Identification Method for Boost Converter Based on Inductor Current Emulator</td>
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<td>Elham Pouzoiki, Alexis De Abreu-Garcia and Yilmaz Sozer, University of Akron, United States</td>
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<tr>
<td>4:45PM</td>
<td>Modeling and Improvement of Thermal Cycling in Power Electronics for Motor Drive Applications</td>
<td></td>
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<td>Ionut Vernica, Ke Ma and Frede Blaabjerg, Aalborg University, Denmark</td>
</tr>
<tr>
<td>S90</td>
<td>Reliability and Fault Tolerance in Multilevel Converters</td>
<td>202B</td>
<td>Sheldon Williamson, Christian Klumpner</td>
<td></td>
</tr>
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<td>3:30PM</td>
<td>Highly Reliable Transformerless Neutral Point Clamped Inverter with Separated Inductors</td>
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<td>Liwei Zhou, Feng Gao, Guang Shen and Mengxing Chen, Shandong University, China; State Grid Rizhao Power Supply Company, China</td>
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<td>3:55PM</td>
<td>Fault Detection and Tolerant Control of Open-circuit Failure in MMC with Full-bridge Sub-modules</td>
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<td>Kai Li, Zhengming Zhao, Lijing Yuan, Sizhao Lu and Ye Jiang, Dept. Electrical Engineering, Tsinghua Univ., China</td>
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<td>4:20PM</td>
<td>Control Strategy of Single Phase Back-to-back Converter for Medium Voltage Drive under Cell Fault Condition</td>
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<td>Yoon-Ro Lee, Jeong-Mock Yoo, Hyun-Sam Jung and Seung-Ki Sul, Seoul National University, Korea (South)</td>
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<td>4:45PM</td>
<td>Fault Tolerance Analysis for the 5-Level Unidirectional T-Rectifier</td>
<td></td>
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<td>Alessandro Lidodzi, Marco Di Benedetto, Luca Solero, Fabio Crescimbini and Petar Grbovic, ROMA TRE University, Italy; Huawei Technologies, Germany</td>
</tr>
<tr>
<td>S91</td>
<td>Electric Machines for Automotive Applications III</td>
<td>102B</td>
<td>Julia Zhang, Jie Shen</td>
<td></td>
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<tr>
<td>3:30PM</td>
<td>Design of a Wound Field Synchronous Machine for Electric Vehicle Traction with Brushless Capacitive Field Excitation</td>
<td></td>
<td></td>
<td>Antonio Di Gioia, Ian P. Brown, Ryan Knappel, Daniel C. Ludos, Yue Nie, Jiejian Dai, Skyler Hagen and Christian Alteheld, Illinois Institute of Technology, United States; University of Wisconsin-Madison, United States; Duesseldorf University of Applied Sciences, Germany</td>
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<td>3:55PM</td>
<td>Design and Development of a MLS Based Compact Active Suspension System, Featuring Air Spring and Energy Harvesting Capabilities</td>
<td></td>
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<td>Nick Ilse Berg, Rasmus Koldborg Holm and Peter Omand Rasmussen, Aalborg University, Denmark</td>
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<td>4:20PM</td>
<td>A Simple Design Method for Surface-mounted PM Machines for Traction Application</td>
<td></td>
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<td>Chao Lu and Gianmarino Pellegrino, Politecnico di Torino, Italy</td>
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<td>4:45PM</td>
<td>Design Optimization of Spoke-Type PM Motors for Formula E Racing Cars</td>
<td></td>
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<td>Alireza Fatemi, Ianonel, Mircea Popescu and Nabeel Demerdash, Marquette University, United States; University of Kentucky, United States; Motor Design Ltd, United Kingdom</td>
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<tr>
<td>S92</td>
<td>PM Machines IV</td>
<td>101A</td>
<td>Leila Parsa, Radu Bojoi</td>
<td></td>
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<tr>
<td>3:30PM</td>
<td>Tolerance Study to Forecast Performances of Permanent Magnet Synchronous Machines Using Segmented Stator for Mass Production</td>
<td></td>
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<td>TaeSik Kim, Mazharul Chowdhury, Mohammad Islam, Abraham Gebregergis and Tony Sebastian, Halla Mechatronics, United States</td>
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<td>4:20PM</td>
<td>Mechanical Design Method for a High-Speed Surface Permanent Magnet Rotor</td>
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<td>Erik Schubert and Bulent Sarlioglu, University of Wisconsin-Madison, United States</td>
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<td>4:45PM</td>
<td>Analysis and Design of Triple-Rotor Axial-Flux Spoke-Array Vernier Permanent Magnet Machines</td>
<td></td>
<td></td>
<td>Rui Zhang, Jian Li, Ronghai Qu and Dawei Li, Huazhong University of Science and Technology, China</td>
</tr>
<tr>
<td>S93</td>
<td>Energy Efficient Motor Drives</td>
<td>101B</td>
<td>Francisco Canales, Dong Jiang</td>
<td></td>
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<tr>
<td>3:30PM</td>
<td>Electrical Loss Minimization Technique for Wind Generators based on a Comprehensive Dynamic Modelling of Induction Machines</td>
<td></td>
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<td>Maria Carmela Di Piazza, Massimiliano Luna and Marcello Pucci, ISSIA-CNR, Italy</td>
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<td>3:55PM</td>
<td>Maximum Efficiency Control Method in 7-phase BLDC Motor by Changing the Number of the Excited Phase Windings</td>
<td></td>
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<td>Sang-Woo Park, Hyung-Seok Park, Jong-Joo Moon, Won-Sang Im and Jang-Mok Kim, LG Electronics, Korea (South); Pusan National University, Korea (South); Lehigh University, United States</td>
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<td>4:20PM</td>
<td>Control Strategy for Dual Three-Phase PMSMs With Minimum Losses in the Full Torque Operation Range Under Single Open-Phase Fault</td>
<td></td>
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<td>Fernando Baneira, Jesus Doval-Gandoy, Alejandro Yepes, Oscar Lopez and Diego Perez-Estevez, University of Vigo, Spain</td>
</tr>
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</table>
4:45PM | A Multi-Pulse Front-End Rectifier System with Electronic Phase-Shifting for Harmonic Mitigation in Motor Drive Applications
Friz Zare, Pooya Davari and Frede Blaabjerg, The University of Queensland, Australia; Aalborg University, Denmark

S94 Sensorless Drives II
Room: 101CD
Chairs: Robert Lorenz, Giacomo Scelba
3:30PM | A Robust Magnetic Polarities Self-Sensing Method for Start-Up of PM Synchronous Machine in Fan-Like System
Wei Sun, Jian-Xin Shen, Meng-Jia Jin and He Hao, Zhejiang University, China
3:55PM | Universal Sensorless Vector Control Applicable to Line-Start Permanent Magnet Synchronous Motors with Dampering Winding
Shu Yamamoto, Hideaki Hirahara, Akira Tanaka and Takahiro Ara, Polytechnic University, Japan; Kanto Polytechnic College, Japan

4:20PM | Improvement of Back-EMF Self-Sensing for Induction Machines when using Deadbeat-Direct Torque and Flux Control (DB-DTFC)
Kang Wang, Noor Baloch and Robert Lorenz, University of Wisconsin – Madison, United States; Yaskawa Electric Corporation, Japan

4:45PM | Sensorless Position Control of PMSM Operating at Low Switching Frequency for High Efficiency Climate Control Systems
Parag Kshirsagar and R. Krishnan, United Technologies Research Center, United States; Virginia Polytechnic and State University, United States

S95 Silicon and WBG Devices
Room: 202C
Chairs: Jerry Hudgins, Enrico Santi
3:30PM | SuperJunction Cascade, a Configuration to Break the Silicon Switching Frequency Limit
Juan Rodriguez, Jaume Roig, Alberto Rodriguez, Ignacio Castro, Diego G. Lamar and Filip Bauwens, Power Supply System Group, University of Oviedo, Spain; Power Technology Centre, ON Semiconductor, Belgium

3:55PM | Maximizing the Performance of 650 V p-GaN Gate HEMTs: Dynamic Ron Characterization and Gate-Drive Design Considerations
Hanxing Wang, Ruiliang Xie, Cheng Liu, Jin Wei, Gaofei Tang and Kevin. J Chen, Hong Kong University of Science and Technology, Hong Kong

4:20PM | 15kV/40A FREEDM Super-Cascade: A Cost Effective SiC High Voltage and High Frequency Power Switch
Xiaqing Song, Alex Huang, Zhang Liqi, Liu Pengkun and Xijun Ni, North Carolina State University, United States; North Carolina State University, United States; Nanjing Institute of Technology, China

4:45PM | A Study of Dynamic High Voltage Output Charge Measurement for 15 kW SiC MOSFET
Li Wang, Qianlai Zhu, Wensong Yu and Alex Q Huang, FREEDM Systems Center, NC State University, United States

S96 Distribution-System Utility Interface Topics
Room: 102A
Chairs: Tsorng-Juu Liang, Deepak Divan
3:30PM | Unbalanced Voltage Compensation in LV Residential AC Grids
Ionut Trintis, Philip Douglass and Stig Munk-Nielsen, Aalborg University, Denmark; Danish Energy Association, Denmark
3:55PM | The Hierarchical Energy Management Control for Residential Energy Harvesting System
Shuang Zhao, Yuzhi Zhang, Joe Moquin and Alan Mantooth, University of Arkansas, United States

4:20PM | Reactive Power Distribution Strategy using Power Factor Correction Converters for Smart Home Application
S M Rakiul Islam, Shawn Maxwell, Md. Kamal Hossain, Sung-Yeul Park and Sungmin Park, University of Connecticut, United States; Hongik University, Korea (South)

4:45PM | Active Voltage Balancing Control for Multi HV-IGBTs in Series Connection
Shi Qi Ji, Zhengming Zhao, Ting Lu, Fred Wang, Leon Tolbert and Hualong Yu, University of Tennessee, United States; Tsinghua University, China

Thursday, September 22nd 8:30AM – 10:10AM

S97 Converter Topologies for Wind Power Systems
Room: 203AB
Chairs: Akshay Kumar Rathore, Yilmaz Sozer
8:30AM | The DOE Next-Generation Drivetrain for Wind Turbine Applications: Gearbox, Generator, and Advanced Si/SiC Hybrid Inverter System
William Erdman and Jonathan Keller, Cinch, Inc., United States; National Renewable Energy Laboratory, United States

8:55AM | Inductorless Boost Rectifier for Small Power Wind Energy Converters
Carlos Lumbraeras, Juan Manuel Guerrero, David Reigosa, Daniel Fernandez and Fernando Briz, AST Ingenieria, Spain; University of Oviedo, Spain; Universidad de Oviedo, Spain

9:20AM | High-frequency Isolated DC-DC Converter for Offshore Wind Energy Systems
Kumar Modepalli, Rohit Suryadovara and Leila Parsa, Rensselaer Polytechnic Institute, United States

9:45AM | A New Three-phase AC/DC High Power Factor Soft-switched Step-up Converter with High Gain Rectifier Modules for Medium Voltage Grid in Wind Systems
Mehdi Abbasi and John Lam, York University, Canada

S98 Energy Storage Systems
Room: 203C
Chairs: Adel Nasiri, Tsai-Fu Wu
8:30AM | A Comparison of Broadband Impedance Measurement Techniques for Lithium-Ion Batteries
Alfred Waligo and Paul Barendse, University of Cape Town, South Africa
9:20AM | A Distributed ESO based Cooperative Current-Sharing Strategy for Parallel Charging Systems Under Disturbances
Zhou Yanhui, Huang Zhiwu, Liu Weirong, Li Heng and Hongtao Liao, Central South University, Changsha, China

9:45AM | A Comprehensive Study on the Degradation of Lithium-Ion Batteries during Calendar Ageing: The Internal Resistance Increase
Daniel Stroe, Maciej Swierczynski, Soren Kaer and Remus Teodorescu, Aalborg University, Dpt. of Energy Technology, Denmark

S99 Power Quality I

Room: 101B
Chairs: Jonathan Kimball, Dao Zhou

8:30AM | Enhanced Power Quality and Minimized Peak Current Control in An Inverter based Microgrid under Unbalanced Grid Faults
Wenzhao Liu, Xiaoguang Guo, Giorgio Sulligoi, Yajuan Guan, Xin Zhao, Baoze Wei, Mehdi Savaghebi and Josep M Guerrero, Aalborg University, Denmark; Yanshan University, China; University of Trieste, Italy

8:55AM | Parallel Interfacing Converters under Unbalanced Voltage: Active Power Oscillation Cancellation with Peak Current Sharing
Farzam Nejabatkhah and Yunwei (Ryan) Li, University of Alberta, Canada

Tung Yueh, Teng-Wei Tsai, Yaow-Ming Chen, Yih-Der Lee and Yung-Ruei Chang, National Taiwan University, Taiwan; Institute of Nuclear Energy Research, Taiwan

9:45AM | Harmonic Mitigation in Interphase Power Controllers Using Passive Filter-Based Phase Shifting Transformer
Mohammad Amin Chitsazan and Andrzej M Trzynadlowski, University of Nevada, Reno, United States

S100 AC Microgrids I: Modelling and Stability

Room: 203DE
Chairs: Adel Nasri, Pedro Rodriguez

8:30AM | Modeling and Stability Analysis of the Small-AC-Signal Droop Based Secondary Control for Islanded Microgrids
Teng Wu, Zeng Liu, Jinjun Liu, Baojin Liu and Shike Wang, Xian Jiaotong University, China

8:55AM | A Small-AC-Signal Injection Based Harmonic Power Sharing Method for Islanded Microgrids
Baojin Liu, Zeng Liu, Jinjun Liu, Teng Wu, Shike Wang and Xin Meng, Xi’an Jiaotong University, China

9:20AM | Improvement of Transient Stability in Inverter-Based AC Microgrid via Adaptive Virtual Inertia
XiaoChao Hou, Hua Han, Chaolu Zhong, Wenbin Yuan, Meijie Yi and Ying Chen, Central South University, China; Central South University, China

9:45AM | Frequency Support Properties of the Synchronous Power Control for Grid-Connected Converters
Weiyi Zhang, Daniel Remon, Joan Rocabert, J. Ignacio Candela, Alvaro Luna and Pedro Rodriguez, Technical University of Catalonia, Spain; Abengoa, Spain

S101 Battery Management for Transportation Electrification I

Room: 102D
Chairs: Yilmaz Sozer, James W. Jiang

8:30AM | A Pack-to-Cell-to-Pack Battery Equalizer with Soft-Switching Based on Buck-Boost and Bidirectional LC Resonant Converters
Zeyuan Li, Yunlong Shang, Bin Duan and Chenghui Zhang, Shandong University, China

9:45AM | A Battery Cell Balancing Control Scheme with Minimum Charge Transfer
Zhiyuan Shen, Handong Gui and Leon Tolbert, Silergy Corp., China; The University of Tennessee, Knoxville, United States

S102 Grid Connected Single-Phase Inverters

Room: 202A
Chairs: Mahshid Amirabadi, Fernando Briz

8:30AM | Double Line Frequency Ripple Cancelling for Single-Phase Quasi-Z-Source Inverter
Yuan Li, Wenqiang Gao, Jiayi Li, Rui Zhang and Fan Fang, Sichuan University, China

9:55AM | Hybrid Control Scheme for the Current Loop of a Grid Connected Inverter Operating with Highly Distorted Grid Voltage
Julio Cesar Viola, Jose Restrepo, Jose Manuel Aller and Flavio Quizhpi, Universidade Estadual Paulista, Brazil; Universidade Estadual Paulista, Colombia; Universidad Simon Bolivar, Venezuela; Universidad Simon Bolivar/Prometeo Project, Venezuela; Universidade Politecnica Salesiana/Prometeo Proj., Ecuador; Universidad Politecnica Salesiana, Ecuador

9:20AM | Single-Phase LLCL-Filter-based Grid-Tied Inverter with Low-Pass Filter Based Capacitor Current Feedback Active Damper
Liu Yuan, Wu Weimin, He Yuanbin, Chung Shu-Hung and Blaabjerg Frede, Shanghai Maritime Univ., China; City Univ. of Hong Kong, Hong Kong; Aalborg Univ., Denmark

9:45AM | A single-phase tri-state integrated Buck-Boost inverter suitable to operate in grid-connected and island modes
Jose Carlos Peña, Cindy Paola Guzman and Carlos Alberto Canesin, Universidade Estadual Paulista, Peru; Universidade Estadual Paulista, Colombia; Universidade Estadual Paulista, Brazil
S103 Modular Multilevel Converters (MMC) I

Room: 202B
Chairs: Jiangchao Qin, Wim van der Merwe

8:30AM | DC Fault Ride Through of Multilevel Converters
Geraint Chaffey, Paul Judge, Michael Merlin, Philip Clemow and Tim Green, Imperial College London, United Kingdom

8:55AM | Reverse Blocking Sub-Module Based Modular Multilevel Converter with DC Fault Ride-Through Capability
Xiaofeng Yang, Yao Xue, Bovei Chen, Zhiqin Lin, Yajie Mu, Trillion Q. Zheng and Seiki Igarashi, Beijing Jiaotong University, China; Fuji Electric Co., Ltd., Japan

9:20AM | Closed-loop Control of the DC-DC Modular Multilevel Converter
Heng Yang and Maryam Saeedifard, Georgia Institute of Technology, United States

9:45AM | New MMC Capacitor Voltage Balancing using Sorting-less Strategy in Nearest Level Control
Mattia Ricco, Laszlo Mathe and Remus Teodorescu, Aalborg University, Denmark

S104 DC-DC Isolated: LLC

Room: 102C
Chairs: Grant Pitel, Vladimir Blasko

8:30AM | A New Tightly Regulated Dual Output LLC Resonant Converter with PFM plus Phase-shift Control
Xun Gao, Hongfei Wu, Yan Xing, Haibing Hu and Yu Zhang, Nanjing Univ. of Aeronautics and Astronautics, China; Shanghai Institute of Space Power-Sources, China

8:55AM | Analytical Model for LLC Resonant Converter with Variable Duty-Cycle Control
Yanfeng Shen, Huai Wang, Frede Blaabjerg, Xiaofeng Sun and Xiaohua Li, Aalborg University, Denmark; Yanshan University, China

9:20AM | Three-Phase LLC Resonant Converter with Integrated Magnetics
Wilmar Martinez, Noah Mostafa, Yuki Itoh, Masayoshi Yamamoto, Jun Imaoka, Kazuhiro Umestani, Kimura Shota, Nanamori Kimihiro and Endo Shun, Shimane University, Japan; Kyushu University, Japan; Okayama University, Japan

9:45AM | Accurate ZVS Boundary in High Switching Frequency LLC Converter
Ren Ren, Liu Bo, Jones Edward Andrew, Wang Fred, Costinett Daniel Jes and Zhang Zheyu, The University of Tennessee, United States

S105 Modeling and Control of Grid Connected Converter I

Room: 202D

8:30AM | A Unified Control of Back-to-Back Converter
Alberto Rodriguez-Cabero, Francisco Huerta Sanchez and Milian Prodanovic, IMDEA Energy Institute, Spain

8:55AM | Control of an Isolated Power-Electronic Converter as an Oscillator
Ricardo Perez, Cesar Silva and Amirraser Yazdani, Universidad Tecnica Federico Santa Maria, Chile; Ryerson University, Canada

9:20AM | Power control for Grid-connected Converter to Comply with Safety Operation Limits during Grid Faults
Shida Gu, Xiong Du, Ying Shi, Yue Wu, Pengju Sun and Heng-Ming Tai, Changqing University, China; University of Tulsa, United States

9:45AM | An Online Measurement Method for Common-mode Impedance in Three-phase Grid-connected Converters
Tuomas Messo, Tomi Roinila, Jukka Vianamaki and Teuvo Suntio, Tampere University of Technology, Finland

S106 Fault Prognosis for Power Devices

Room: 102E
Chairs: Marco Liserre, Juan Rivas-Davila

8:30AM | Remaining Useful Lifetime Estimation For Thermally Aged Power Mosfets With Ransac Denoising Algorithm
Serkan Dusmez, Mehrdad Heydarzadeh, Mehrdad Nourani and Bilal Akin, University of Texas at Dallas, United States

8:55AM | An Analytical Model for False Turn-On Evaluation of GaN Transistor in Bridge-Leg Configuration
Ruiliang Xie, Hanxing Wang, Gaofei Tang, Xu Yang and Kevin. J Chen, Hong Kong University of Science and Technology, Hong Kong; Xi’an Jiaotong University, China

9:20AM | Advanced Condition Monitoring System Based on On-Line Semiconductor Loss Measurements
Tobias Krone, Lan Dang Hung, Marco Jung and Axel Mertens, Leibniz Universitaet Hannover, Germany; Fraunhofer I&WES, Germany

9:45AM | A Comprehensive Study on Variations of Discrete IGBT Characteristics Due to Package Degradation Triggered by Thermal Stress
Syed Huzaf Ali, Serkan Dusmez and Bilal Akin, University of Texas at Dallas, United States

S107 Thermal Analyses of Electric Machines

Room: 102B
Chairs: Bulent Sarlioglu, Patel Bhageerath Reddy

8:30AM | Experimental Calibration in Thermal Analysis of PM Electrical Machines
Sabrina Ayat, Rafał Wrobel, James Goss and David Drury, University of Bristol, Motor Design Ltd, United Kingdom; Motor Design Ltd, United Kingdom; University of Bristol, United Kingdom

8:55AM | Thermal Conductivity Evaluation of Fractional-Slot Concentrated-Winding Machines
Aldo Boglietti, Silvio Veschetto, Marco Cossale and Thiago Dutra, Politecnico di Torino, Italy; University of Santa Catarina, Brazil

9:20AM | Thermal Performance Modeling of Foil Wound Concentrated Coils in Electric Machines
Michael Rios, Giri Venkataramanan, Annette Muetze and Heinrich Eickhoff, University of Wisconsin – Madison, United States; Graz University of Technology, Austria

9:45AM | Experimental Validation in Operative Conditions of Winding Thermal Model for Short-Time Transient
Aldo Boglietti, Silvio Veschetto, Marco Cossale and Thiago Dutra, Politecnico di Torino, Italy; University of Santa Catarina, Brazil
S108 Transverse Flux Machines

Room: 101A
Chairs: Keith Corzine, Daniel Ludois

8:30AM | A Hybrid-Excited Axial Transverse Flux Permanent Magnet Machine
Emrullah Aydin, Ju Hyung Kim, Emin Yildiz, Mehmet Timur Aydemir and Bulent Sarlioglu, Electrical-Electronic Engineering, Gazi Univ., Turkey; Electrical and Computer Engineering, UW-Madison, United States; Electrical-Electronic Engineering, Duzce Univ., Turkey

8:55AM | Reduction of Cogging Torque in Transverse Flux Machines by Stator and Rotor Pole Shaping
Cristofaro Pompermaia, Jamie Washington, Lars Speeberg and Nabeel Ahmed, Hoganas AB, Sweden; Hoganas Great Britian Ltd., United Kingdom; Newcastle University, United Kingdom

9:20AM | Design Considerations of a Transverse Flux Machine for Direct Wind Turbine Applications
Tausif Husain, Iftekhar Hasan, Yilmaz Sozer, Iqbal Husain and Eduard Muljadi, University of Akron, United States; North Carolina State University, United States; National Renewable Energy Lab, United States

9:45AM | Analytical Model Based Design Optimization of a Transverse Flux Machine
Iftekhar Hasan, Tausif Husain, Yilmaz Sozer, Iqbal Husain and Eduard Muljadi, University of Akron, United States; North Carolina State University, United States; National Renewable Energy Lab, United States

S109 Control of Electric Drives II

Room: 101CD
Chairs: Marko Hinkkanen, Pinjia Zhang

8:30AM | A Novel Six-Phase Inverter System for High-Power Synchronous Motor Drives
Yumei Song, Xiaojie You, Xizheng Guo and Jian Wang, Beijing Jiaotong University, China

8:55AM | State-Space Flux-Linkage Control of Bearingless Synchronous Reluctance Motors
Seppo Sarakkala, Maksim Sokolov, Marko Hinkkanen, Jari Kataja and Kari Tammi, Aalto University School of Electrical Eng., Finland; VTT Technical Research Centre of Finland, Finland; Aalto University School of Engineering, Finland

9:20AM | Current Harmonic Compensation for n-Phase Machines With Asymmetrical Winding Arrangement
Alejandro G. Yepes, Jesus Doval-Gandoy, Fernando Baneira, Diego Perez-Estevez and Oscar Lopez, University of Vigo, Spain, Spain

9:45AM | Post-fault Operation Strategy for Single Switch Open Circuit Faults in Electric Drives
Heinrich T. Eickhoff, Roland Seebacher, Annette Muetze and Elias G. Strangas, Graz University of Technology, Austria; Michigan State University, East Lansing, MI, United States

S110 Power Packaging

Room: 202C
Chairs: Douglas C Hopkins, Giuseppe Chimento

8:30AM | A Quasi-online Method of Thermal Network Parameter Identification of IGBT Module
Tengfei Li, Xiong Du, Cheng Zeng, Pengju Sun and Heng-Ming Tai, Chongqing University, China; University of Tulsa, United States

8:55AM | Direct-cooled Power Module with a Thick Cu Heat Spreader Featuring a Stress-suppressed Structure for EV/HEV Inverters
Keiichiro Numakura, Kenta Emori, Yusuke Yoshino, Yasuaki Hayami and Tetsuya Hayashi, Nissan Motor Co., Ltd., Japan

9:20AM | Impact of Poly-Crystalline Diamond within Power Semiconductor Device Modules in a Converter
Mark Robert Sweet, Kalyani Menon and Ekkantad Madathil Sankar Narayanan, University of Sheffield, United Kingdom; Rolls-Royce, United Kingdom

9:45AM | A Novel 3D Structure for Synchronous Buck Converter Based on Nitride Gallium Transistors
Clement Fita, Pierre-Olivier Jeannin, Pierre Lefranc, Edith Clavel and Johan Delaine, G2ELAB, France; G2ELAB, France

S111 Magnetics I

Room: 102A
Chairs: John Siefken, Charles Sullivan

8:30AM | NiCuZn Ferrite Cores by Gelcasting: Processing and Properties
Lanbing Liu, Yi Yan, Khai Ngo and Guo-Quan Lu, Virginia Tech, United States

8:55AM | Low-Capacitance Planar Spiral Windings Employing Inverse Track-Width-Ratio
Samuel Robert Cove and Martin Ordonez, University of British Columbia, Canada

9:20AM | On-Chip Transformers with Shielding Structures for High dv/dt Immunity Isolated Gate Drive
Rongxiang Wu, Jialong Chen, Niteng Liao and Xiangming Fang, Univ of Electron Sci and Tech of China, China; Shenzhen CoilEasy Technologies, Co. Ltd., China

9:45AM | Additive Manufacturing of Toroid Inductor for Power Electronics Applications
Yi Yan, Khai Ngo, Yunhui Mei, Guo-Quan Lu and Jim Moss, Virginia Tech, United States; Tianjin University, China; Texas Instruments, United States

S112 Grid Synchronization

Room: 202E
Chairs: Behrooz Mirafzal, Tsorng-Juu Liang

8:30AM | A New Phase-Locked Loop Method for Three-Phase System
Hongyan Zhao, Trillion Q. Zheng, Yan Li, Hong Li and Shi Pu, Beijing Jiaotong University, China

8:55AM | A New Second-Order Generalized Integrator Based Quadrature Signal Generator With Enhanced Performance
Zhen Xin, Zian Qin, Minhui Lu, Poh Chiang Loh and Fred Biaabjerg, Aalborg University, Denmark

9:20AM | A Modified SRF-PLL for Phase and Frequency Measurement of Single-Phase Systems
Md. Rashiduzzaman, Sami Khorbotly and Jonathan Kimball, Missouri University of Science and Technology, United States; Valparaiso University, United States

9:45AM | Influence Of Double-Line Frequency Power Oscillation In Photovoltaic Generator Efficiency And H-Bridge VSI Performance
Luciano Alves, Montte Vitorino, Marcus Oliveira, Mauricio Correa and Gutemberg Goncalves, Federal University of Campina Grande, Brazil; Tocantins Federal Institute of Technology, Brazil
S113 Electric Machines for Wind Power Systems

Room: 203AB
Chairs: Wei Qiao, Pragasen Pillay

10:30AM | Comparison Analysis of PM Transverse Flux Outer Rotor Machines with and without Magnetic Shunts
Oleksandr Dobzhanskyi, Gouws Rupert and Amin Ebrahim, Doctor, Ukraine; Professor, South Africa; Ass. Professor, United States

10:55AM | A Generator-Converter Design for Direct Drive Wind Turbines
Akanksha Singh and Behrooz Mirafzal, Kansas State University, United States

11:20AM | Gearbox Fault Diagnosis Using Vibration and Current Information Fusion
Yayu Peng, Wei Qiao, Liyan Qu and Jun Wang, University of Nebraska-Lincoln, United States

11:45AM | Bearing Fault Diagnosis of Direct-Drive Wind Turbines Using Multiscale Filtering Spectrum
Jun Wang, Yayu Peng and Wei Qiao, University of Nebraska-Lincoln, United States

S114 Converter Topologies for Energy Storage Systems

Room: 203C
Chairs: Behrooz Mirafzal, Hui Li

10:30AM | Design Considerations of an Isolated GaN Bidirectional DC-DC Converter
Fei Xue, Ruiyang Yu and Alex Q. Huang, North Carolina State University, United States

10:55AM | Flexbattery – Merging Multilevel Power Conversion and Energy Storage
Erik Lemmen, Jorge L. Duarte and Elena A. Lomonova, Eindhoven University of Technology, Netherlands

11:20AM | A Novel Modular Dual Active Bridge (DAB) DC-DC Converter with DC Fault Ride-Through Capability for Battery Energy Storage Systems
Yuxiang Shi and Hui Li, Florida State University, United States

11:45AM | A High Current Bidirectional DC-DC Converter for Concept Demonstration of Grid-Scale SMES Systems
Yu Du, Eddy Aeloiza and VR V. Ramanan, ABB Inc., United States

S115 AC Microgrids II: Sharing and Coordination

Room: 203DE
Chairs: Pedro Rodriguez, Aaron Ayyar

10:30AM | Harmonic power sharing with Voltage Distortion Compensation of Droop Controlled Islanded Microgrids
Hassan Moussa, Jean-Philippe Martin, Serge Pierfederici and Nazih Moubayed, Lorraine University, France; Lebanese University, Lebanon

10:55AM | Novel Active Synchronization Strategy for Multi-Bus Microgrid with Distributed Cooperation Control
Chao Lu Zhong, Yao Sun, Ying Chen, Mi Dong, Ming Liu and Xiaochao Hou, Central South University, China

11:20AM | An Inverter-Current-Feedback based Reactive Power Sharing Method for Parallel Inverters in Microgrid
Qicheng Huang and Kaushik Rajashekar, University of Texas at Dallas, United States

11:45AM | Distributed Voltage Control and Load Sharing for Inverter-Interfaced Microgrid with Resistive Lines
Mohammad S. Golsorkhi, Qobad Shafee, Dylan D.C. Lu and Josep M. Guerrero, School of Electrical and Information Engineering, Australia; Department of Electrical and Computer Engineering, Iran; The Institute of Energy Technology, Aalborg Univ, Denmark

S116 Batteries and Battery Management for Transportation Electrification II

Room: 102D
Chairs: Juan Carlos Balda, Omer Onar

10:30AM | Accurate Battery Parameter Estimation with Improved Continuous Time System Identification Methods
Bing Xia, Xin Zhao, Raymond de Callafon, Hugues Garnier, Truong Nguyen and Chris Mi, San Diego State University, United States; University of California San Diego, United States; University of Lorraine, France

10:55AM | A Real World Technology Testbed for Electric Vehicle Smart Charging Systems and PEV-EVSE Interoperability Evaluation
Theodore Bohn and Hal Glenn, Argonne National Laboratory, United States; 2G Engineering, United States

11:20AM | Modeling of Low-Temperature Operation of a Hybrid Energy Storage System with a Butler-Volmer Equation Based Battery Model
Phillip Kollmeyer, Anantharaghavan Sridhar and Thomas Jahns, University of Wisconsin-Madison, United States

11:45AM | Voltage and Current Signals De-noising with Wavelet Transform Matrix for Improved SOC Estimation of Lithium-ion Battery
Xiang Cheng, Zhouyu Lu, Zhihong Zhang, Dongjie Gu and Yang Yang, Nanjing University of Aeronautics Astronautics, China

S117 Multi-Phase Inverter

Room: 202A
Chairs: Babak Parkhideh, Raja Ayyanar

10:30AM | Improved r-Z-Source Inverter
Zeeshan Aleem and Moin Hanif, University of Cape Town, South Africa; University of Cape Town, South Africa

10:55AM | High-Frequency Six Pulse DC Link Based Bidirectional Three-Phase Inverter without Intermediate Decoupling Capacitor
Vatta Kkuni Kanakesh, Anirban Ghoshal, Dorai Babu Yelavathry, Akshay Kumar Rathore and Ranjit Mahanty, National University of Singapore, Singapore; Concordia University, Montreal, Canada; Indian Institute of Technology, BHU, Varanasi, India

11:20AM | Closed-Form Equations for Analytical Exploration and Comparison of Switching Power Losses in Flying Capacitor Multicell and Active Neutral-Point-Clamped Multilevel Converters
Vahid Dargahi, Arash Khoshkbar Sadigh and Keith Corzine, Clemson University, United States; Extron Electronics, United States

11:45AM | Advanced Three Level Active Neutral Point Converter with Fault Tolerant Capabilities
Ramin Katebi, Weise Nathan, Stark Andrew and He Jiangbiao, Marquette University, United States
### S118 AC-AC Converters I

- **Room:** 202E
- **Chairs:** Pat Wheeler, Mattia Ricco

#### 10:30AM | A Novel Highly Reliable Three Phase Buck-Boost AC-AC Converter
Ashraf Ali Khan and Honnyong Cha, Kyungpook National University, Korea (South)

#### 10:55AM | Hybrid Bidirectional AC/AC Multilevel Converter
Rami Ali Alaei, S. Ali Khajehoddin and Wilsun Xu, University of Alberta, Canada

#### 11:20AM | A Reliable Cascaded AC-AC Converter
Ashraf Ali Khan, Honnyong Cha, Sanghoon Kim and Hafiz Furqan Ahmed, Kyungpook National University, Korea (South)

#### 11:45AM | Parallel AC-AC Three-Phase with Shared-Leg Converters
Edgard Fabbricio, Cursino Jacobina, Nady Rocha, Rodolpho Cavalcante and Mauricio Correa, IFPB, Brazil; UFCG, Brazil; UFPB, Brazil

### S119 Modular Multilevel Converters (MMC) II

- **Room:** 202B
- **Chairs:** Ahmed Sayed-Ahmed, Grain Adam

#### 10:30AM | A Series HVDC Power Tapping Using Modular Multilevel Converters
Binbin Li, Mingyu Guan, Dianguo Xu, Rui Li, Grain Philip Adam and Barry Williams, Harbin Institute of Technology, China; University of Strathclyde, United Kingdom

#### 10:55AM | A Zero-sequence Voltage Injection Control Scheme for Modular Multilevel Converter Under Submodule Failure
Jinke Li, Xuezhi Wu, Xiuyuan Yao, Long Jing, Xinmin Jin, Wen Wu, Xiaoxing Wang and Shuai Wang, Beijng Jiaotong University, China; China Electric Power Research Institute, China

#### 11:20AM | An Interconnected Observer for Modular Multilevel Converter
Mohamed Trabelsi, Malek Ghanes, Omar Ellabban, Haimth Abu-Rub and Lazhar Ben-Brahim, Texas A and M University at Qatar, Qatar; ENSEA, France; Qatar University, Qatar

#### 11:45AM | DC Bus Balancing Control Techniques for the Cascaded Neutral Point Clamped Modular Converter
Meng-Jiang Tsai, Wei-Lun Huang, Hsin-Chih Chen, Ping-Heng Wu and Po-Tai Cheng, National Tsing Hua University, Taiwan

### S120 DC-DC Isolated: Resonant

- **Room:** 102C
- **Chairs:** Ali Mehrizi-Sani, Yan-Fei Liu

#### 10:30AM | Step-Down Impedance Control Network Resonant DC-DC Converter Utilizing an Enhanced Phase-Shift Control for Wide-Input-Range Operation
Jie Lu, Ashish Kumar and Khurrum Afridi, University of Colorado Boulder, United States

#### 10:55AM | Soft-Switching Push-Pull Converter with Parallel Resonant Link and Buck-Boost Capability
Morteza Moosavi and Hamid A. Toliyat, Texas A and M University, United States

#### 11:20AM | Bidirectional Series-Resonant DC-DC Converter with Fault-Tolerance Capability for Smart Transformer
Levy Costa, Giampaolo Buticchi and Marco Liserre, University of Kiel, Germany

#### 11:45AM | Analysis and Design of Planar Inductor and Transformer for Resonant Converter
Yueshi Guan, Na Qi, Yijie Wang, Xiangjun Zhang, Dianguo Xu and Wei Wang, Harbin Institute of Technology, China

### S121 Modeling and Control of Grid Connected Converter II

- **Room:** 202D
- **Chairs:** Jonathan Bird, Matthias Preindl

#### 10:30AM | Combined DC Voltage Control Scheme for Three-port Energy Router Based on Instantaneous Energy Balance
Gaohui Feng, Zhengming Zhao, Liqiang Yuan and Kai Li, Tsinghua University, China

Jarno Kukkola and Marko Hinkkanen, Aalto University, Finland

#### 11:20AM | Current-Mode Boundary Controller with Reduced Number of Current Sensors for a Three-Phase Inverter
He Yuanbin, Chung Shu-hung, Ho Ngai-man and Wu Weimin, City University of Hong Kong, Hong Kong; University of Manitoba, Canada; Shanghai Maritime University, China

#### 11:45AM | Positive- and Negative-Sequence Current Controller for Grid-Tied Converters With LCL Filters
Diego Perez-Estevez, Jesus Doval-Gandoy, Alejandro Yepes, Oscar Lopez and Fernando Baneira, University of Vigo, Spain

### S122 Power Quality II

- **Room:** 101B
- **Chairs:** Luca Solero, Maurizio Cirrincione

#### 10:30AM | Realization of Quadrature Signal Generator Using Accurate Magnitude Integrator
Zhen Xin, Changwoo Yoon, Rende Zhao, Poh Chiang Loh and Frede Blaabjerg, Aalborg University, Denmark; China University of Petroleum (Hua dong), China

#### 10:55AM | A New Instantaneous Point on Wave Voltage Sag Detection Algorithm and Validation
Yujia Cui, Ahmed Sayed-Ahmed, Prathamesh Vadhavkar, Brian Seibel and Russel Kerckman, Rockwell Automation, United States

#### 11:20AM | Voltage Quality Enhancement with Minimum Power Injection
Darlan Fernandes, Fabiano Costa, Joao Martins, Alberto Lock, Edison da Silva and Montie Vitorino, Federal University of Paraiba, Brazil; Federal University of Bahia, Brazil; Federal University of Campina Grande, Brazil

#### 11:45AM | A Universal Variable On-time Compensation to improve THD of High-frequency CRM Boost PFC Converter
Zhehui Guo, Xiaoyong Ren, Handong Gui, Yu Wu, Zhiliang Zhang and Qianhong Chen, Nanjing Univ. of Aeronautics and Astronautics, China; The University of Tennessee, United States
S123  Stability in Power Converters I

**Room: 102E**

**Chairs:** Jian Sun, Andrea Formentini

**10:30AM** | **On Impedance Modeling of Single-Phase Voltage Source Converters**

Shahil Shah and Leila Parsa, Rensselaer Polytechnic Institute, United States

**10:55AM** | **Design Consideration of Volt-VAR Controllers in Distribution Systems with Multiple PV Inverters**

Mahsa Ghapandar Kashani, Yonghwan Cho and Subhashish Bhattacharya, North Carolina State University, United States

**11:20AM** | **Extended Stable Boundary of LCL-Filtered Grid-Connected Inverter Based on Grid-Voltage Feedforward Control**

Minghui Lu, Zhen Xin, Xiongfei Wang, Remus Beres and Frede Blaabjerg, Aalborg University, Denmark, Denmark

**11:45AM** | **Allowable Bus Impedance Region for MVDC Distribution Systems and Stabilizing Controller Design Using Positive Feed-Forward Control**

Jonathan Siegers, Silvia Arrua and Enrico Santi, University of South Carolina, United States

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S124  Non-Conventional Machine Configurations I

**Room: 101A**

**Chairs:** D. Lorenz, Ronghai Qu

**10:30AM** | **A Novel Stator-Consequent-Pole Memory Machine**

Yang Hui, Lin Heyun, Zhu Z. Q., Fang Shuhua and Huang Yunkai, Southeast University, China; University of Sheffield, United Kingdom

**10:55AM** | **A Novel Variable Flux Memory Machine with Series Hybrid Magnets**

Hao Hua, Z.D. Zhu, Adam Pride, Rajesh Dedhar and Toshinori Sasaki, University of Sheffield, United Kingdom

**11:20AM** | **On the Feasibility of Carbon Nanotube Windings for Electrical Machines – Case Study for a Coreless Axial Flux Motor**

Vandana Rallabandi, Narges Taran, Dan M. Ionel and John F. Eastham, University of Kentucky, United States; University of Bath, United Kingdom

**11:45AM** | **A Novel Simplified Structure for Single-Drive Bearingless Motor**

Hiroya Sugimoto, Itsuki Shimura and Akira Chiba, Tokyo Institute of Technology, Japan

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S125  Noise and Vibration Issues in Electric Machines

**Room: 102B**

**Chairs:** Junichi Itoh, Ali Bazzi

**10:30AM** | **Stator Vibration and Acoustic Noise Analysis of FSPM for a Low-Noise Design**

Chandan Sikder and Iqbal Husain, NC State University, United States

**10:55AM** | **Current Waveform for Noise Reduction of Switched Reluctance Motor in Magnetically Saturated Condition**

Jihad Furqani, Masachika Kawa, Kyohrei Kyota and Akira Chiba, Tokyo Institute of Technology, Indonesia; Tokyo Institute of Technology, Japan

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S126  Electrical Drives for Aerospace and Traction Applications

**Room: 101CD**

**Chairs:** Gianmario Pellegrino, John Lam

**10:30AM** | **Asymmetrical Twelve-Phase Induction Starter/Generator for More Electric Engine in Aircraft**

Radu Bojoi, Sandro Rubino, Andrea Cavagnino and Silvio Vaschetto, Politecnico di Torino, Italy

**10:55AM** | **Axial Position Estimation of Conical Shaped Motor for Green Taxiing Application**

Sara Roggia, Francesco Cupertino, Michael Galea and Chris Gerada, University of Nottingham, United Kingdom; Politecnico di Bari, Italy

**11:20AM** | **Closed-form Approach for Predicting Overvoltage Transients in Cable-fed PWM Motor Drives for MEA**

Giorgio Pietrini, Davide Barater, Carlo Concari, Michael Galea and Chris Gerada, University of Parma, Italy; The University of Nottingham, United Kingdom

**11:45AM** | **An Open Problem for More Electrical Aircraft (MEA): How Insulation Systems of Actuators Can Be Qualified?**

Giorgio Pietrini, Davide Barater, Giovanni Franceschini, Paolo Mancinelli and Andrea Cavallini, University of Parma, Italy; University of Bologna, Italy

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S127  Magnetics II

**Room: 102A**

**Chairs:** Shuo Wang, Gerard Hurley

**10:30AM** | **High Power Density Impedance Control Network DC-DC Converter Utilizing an Integrated Magnetic Structure**

Ashish Kumar, Jie Lu, Saad Pervaiz, Alihossein Sepahvand and Khurram Afridi, University of Colorado Boulder, United States

**10:55AM** | **Time-Domain Homogenization of Litz-Wire Bundles in FE Calculations**

Korawich Niyomtian, Jeroen Van den Keybus, Ruth Sabariego and Johan Gyselinck, Triphase, ULB, Belgium; Triphase, Belgium; KU Leuven, Belgium; ULB, Belgium

**11:20AM** | **High Frequency Core Coefficient for Transformer Size Selection**

Lucas Mueller and Jonathan Kimball, Missouri University of Science and Technology, United States

**11:45AM** | **Very High Frequency Integrated Voltage Regulator for Small Portable Devices**

Dongbin Hou, Fred Lee and Qiang Li, CPES, Virginia Tech, United States
S128  Device Short Circuit Capability

Room: 202C
Chairs: Yi Deng, Ty McNutt

10:30AM | Robustness in Short-Circuit Mode: Benchmarking of 600V GaN HEMTs with Power Si and SiC MOSFETs
Nasser Badawi, Abdullaiah Awad and Sibylle Dieckerhoff, Technical University of Berlin, Germany

10:55AM | Investigation on the Short Circuit Safe Operation Area of SiC MOSFET Power Modules
Paula Diaz Reigosa, Francesco Iannuzzo, Haoze Luo and Frede Blaabjerg, Aalborg University, Denmark; Aalborg University, Denmark

11:20AM | Short-Circuit Protection of 1200V SiC MOSFET T-type Module in PV Inverter Application
Yuxiang Shi, Ren Xie, Lu Wang, Yanjun Shi and Hui Li, FSU, United States

11:45AM | Prediction of Short-Circuit-Related Thermal Stress in Aged IGBT Modules
Amir Sajjad Bahman, Francesco Iannuzzo, Christian Uhrenfeldt, Frede Blaabjerg and Stig Munk-Nielsen, Aalborg University, Denmark

Thursday, September 22nd  2:00PM – 3:40PM

S129  DFIG Based Wind Power Systems

Room: 203AB
Chairs: Wei Qiao, Behrooz Mirafzal

2:00PM | Flexible PCC Voltage Unbalance Compensation Strategy for Autonomous Operation of Parallel DFIGs
Tao Wang and Heng Nian, Zhejiang University, China

2:25PM | Analysis and Comparison of Super-Synchronous Resonance in Small and Large Scale DFIG System
Yipeng Song, Frede Blaabjerg and Xiongfei Wang, Aalborg University, Denmark

2:50PM | A Super-synchronous Doubly Fed Induction Generator Option for Wind Turbine Applications
Kee Shin and Thomas Lipo, ABB, United States; University of Wisconsin – Madison (WEMPEC), United States

3:15PM | Fault Diagnosis of Wind Turbine Gearbox Using DFIG Stator Current Analysis
Fangzhou Cheng, Chun Wei, Liyan Qu and Wei Qiao, University of Nebraska-Lincoln, United States

S130  Utility Scale Battery Systems

Room: 203C
Chairs: Daniel-Ioan Stroe, Frede Blaabjerg

2:00PM | Controller for Combined Peak-Load Shaving and Capacity Firming Utilizing Multiple Energy Storage Units in a Microgrid
Andrew Hintz, Kaushik Rajashekar and Prasanna Rajagopal, The University of Texas at Dallas, United States

S131  AC Microgrids III: Operation, Control and Energy Management

Room: 203D
Chairs: Sayed Ali Khajehoddin, Juan Manuel Guerrero

2:00PM | Robust Decentralized Voltage and Frequency Control of Generators in Isolated Microgrids Using $\mathbf{S}$-Synthesis
Mohsen Azizi and Sayed Ali Khajehoddin, Michigan Technological University, United States; University of Alberta, Canada

2:25PM | Thyristor Based Short Circuit Current Injection in Isolated Grids
Bjarte Hoff, Pawan Sharma and Trond Ostrem, UiT The Arctic University of Norway, Norway

2:50PM | Optimized Energy Management System to Reduce Fuel Consumption in Remote Military Microgrids
Norma Anglani, Michele Colombini and Giovanna Oriti, University of Pavia, Italy; Generac Mobile Products, Italy; Naval Postgraduate School, United States

3:15PM | Analysis and Improvement of the Energy Management of an Isolated Microgrid in Lencois Island based on a Linear Optimization Approach
Federico de Bosio, Adriana Carolina Luna, Luiz Antonio de Souza Ribeiro, Moises Graelles, Osvaldo Ronald Saavedra and Jose Maria Guerrero, Politecnico di Torino, Italy; Aalborg University, Denmark; Federal University of Maranhao, Brazil; Universitat Politecnica de Catalunya, Spain

S132  Battery Charging for Transportation Electrification

Room: 102D
Chairs: Theodore Bohn, Alireza Khaligh

2:00PM | A Primary Full-Integrated Active Filter Auxiliary Power Module in Electrified Vehicle Applications with Single-Phase Onboard Chargers
Ruoyu Hou and Ali Emadi, McMaster University, Canada

2:25PM | Sensitivity Analysis of a Wireless Power Transfer (WPT) System for Electric Vehicle Application
Madhu sudhan Chinthavali and Zhiqiang Wang, ORNL, United States
2:50PM | Design of a Dual-Loop Controller for In-motion Wireless Charging of an Electric Bus
Reza Tavakoli, Aleksandar Jovicic, Niranjan Chandrappa, Ryan Bohm and Zeliiko Pantic, Utah State University, United States

3:15PM | Design of CRM AC/DC Converter for Very High-Frequency High-Density WBG-Based 6.6kW Bidirectional On-Board Battery Charger
Zhengyang Liu, Bin Li, Fred Lee and Qiang Li, CPES_Virginia Tech, United States

S133 Three-Phase Inverter PWM
Room: 202A
Chairs: Subhashish Bhattacharya, Giacomo Scelba

2:00PM | SiC MOSFET Zero-Voltage-Switching SVM Controlled Three-phase Grid Inverter
Ning He, Yawen Li, Chengdai Du, Chao Liu, Changsheng Hu and Dehong Xu, Zhejiang University, China, China

2:25PM | A Novel Soft-switching Modulation Scheme for Isolated DC-to-three-phase-AC Matrix-based Converter Using SiC Device
Xiaohang Yu, Fanning Jin and Mengqi Wang, University of Michigan-Dearborn, United States

2:50PM | New PWM Technique for Grid-Tie Isolated Bidirectional DC-AC Inverter Based High Frequency Transformer
Mahmoud Sayed, Suzuki Kazuma, Takeshita Takaharu and Kitagawa Wataru, Nagoya Institute of Technology, Japan

3:15PM | Reduction of Input Current Harmonics based on Space Vector Modulation for Three-phase VSI with varied Power Factor
Koroku Nishizawa, Jun-ichi Itoh, Akhiro Odaka, Akio Toba and Hidetoshi Umida, Nagaoka University of Technology, Japan

S134 AC-AC Converters II
Room: 202E
Chairs: Hirofumi Akagi, Matthias Preindl

2:00PM | A Comparison of Indirect Matrix Converter Based Open-End Winding Drives Against State-of-the-Art
Saurabh Tewari and Ned Mohan, MTS Systems Corporation, United States; University of Minnesota, United States

2:25PM | Common Mode Voltage Reduction in Open-End Multi-phase Load System fed Through Matrix Converter
Khaliqur Rahman, Atif Iqbal, Nasser A. Al-Emadi, Rashid M Alammar, Lazaar Ben Brahimi and Hossein Dehganhi Tafti, Qatar University, Qatar; Nanyang Technological University, Singapore

2:50PM | Experimental Comparison of Devices Thermal Cycling in Direct Matrix Converters (DMC) and Indirect Matrix Converters (IMC) using SiC MOSFETs
Andrew Trentin, Liliana de Lillo, Lee Empringham, Pericle Zanchetta, Pat Wheeler and Jon Clare, The University of Nottingham, United Kingdom

Wenjing Xiong, Yao Sun, Mei Su, Jian Yang and Chunsheng Wang, Central South University, China; Central South University, Jiangxi Kangcheng Co., China

S135 Modular Multilevel Converters (MMC) III
Room: 202B
Chairs: Di Zhang, Jiangchao Qin

2:00PM | Design and Implementation of Finite State Machine Decoders for Phase Disposition Pulse Width Modulation of Modular Multilevel Converters
Carlos Teixeira, Yichao Sun, Graeme Holmes and Brendan McGrath, RMIT University, Australia; Southeast University, China

2:25PM | Control of the AC-AC Modular Multilevel Converter Under Submodule Failure
Yang Gichen and Saeedifard Maryam, Georgia Institute of Technology, United States

2:50PM | Control of a Modular Multilevel Converter with Pulsed DC Load
Marija Jankovic, Alan Watson, Alessandro Costabeber and Jon Clare, University of Nottingham, United Kingdom

3:15PM | Short circuit output protection of MMC in Voltage Source Control Mode
Manfred Winkelinkemer, Lukas Schwager, Pawel Blaszczzyk, Mischa Steurer and Dione Soto, ABB Switzerland Ltd., Switzerland, ABB Poland Sp. z o.o., Poland; CAPS Florida State University, United States

S136 DC-DC: Isolated Converters
Room: 102C
Chairs: Sudip Mazumder, Yilmaz Sozer

2:00PM | An Isolated Three-Port DC-DC Converter with High Power Density in 10 cm X 5 cm X 0.8 cm Card Size for Flexible Automotive Systems
Shuntaro Inoue, Kenichi Itoh, Masanori Ishigaki, Takahide Sugiyama and Masanori Sugai, TOYOTA CENTRAL R and D LABS., INC., Japan

2:25PM | Auxiliary power supply based on a modular ISOP Flyback configuration with very high input voltage
Alberto Rodriguez, Maria R. Rogina, Mariam Saeed, Diego G. Lamar, Manuel Arias, Mario Lopez and Fernando Birz, University of Oviedo, Spain

2:50PM | Design Considerations for Series Resonant Converters with Constant Current Input
Hongjie Wang, Tarak Saha and Regan Zane, Utah State University, United States

3:15PM | Galvanically Isolated Switched-Boost-Based DC-DC Converter
Samian A. Gorji, Mehran Ehtesabii, Trung N. Nguyen and Jinchuan Zheng, Swinburne University of Technology, Australia

S137 Modeling and Control of DC-AC converters II
Room: 202D
Chairs: Thomas Jahns, Jon Are Suul

2:00PM | A Triangle Phase-Shift Control Strategy for Interleaved Critical-Mode Power Converters
Lanhua Zhang, Rachael Born, Qingqing Ma, Yu Wei, Xiaonan Zhao and Jih-Sheng Lai, Virginia Polytechnic Institute and State University, United States
2:25PM | Seamless Transition Control between Motoring and Generating Modes of a Bidirectional Multi-Port Power Converter Used in Automotive SRM Drive
Fan Yi, Won Cai and Babak Fahimi, The University of Texas at Dallas, United States

2:50PM | Three-Phase Inverter Modeling using Multifrequency Averaging with Third Harmonic Injection
Xiao Liu and Aaron Cramer, University of Kentucky, United States

3:15PM | Transformation Based Tracking Controller for a GaN Microinverter
Ankit Gupta, Harshit Soni, Sudip Mazumder, Shirish Raizada, Debanjan Chatterjee, Paromita Mazumder and Parijat Bhattacharjee, University of Illinois, United States; Tagore Tech, United States; NextWatt LLC, United States

S139 Stability in Power Converters II
Room: 102E
Chairs: Dusan Borojevic, Leila Parsa

2:00PM | Source-side Series-virtual-impedance Control Strategy to Stabilize the Cascaded System with Improved Performance
Zong Shan, Qian Liu, Chen Hui and Weiyi Li, The University of Nottingham, United Kingdom

2:25PM | Bifurcation Analysis of Photovoltaic-Battery Hybrid Power System with Constant Power Load
Meng Huang, Lijun Wei, Yi Liu, Jianjun Sun and Xiaoming Zha, Wuhan University, China

3:00PM | Voltage Reduction Capability of an Auxiliary CSI used as Switching Ripple Active Filter
Tomoyuki Mannen, Issei Fukasawa and Hideaki Fujita, Tokyo Institute of Technology, Japan

S138 Design Optimization of Power Converters
Room: 202C
Chairs: Yan-hei Liu, Pericle Zanchetta

2:00PM | Efficiency-wise Optimal Design Methodology of LLC Converter for Wide Input Voltage Range Applications
Yang Chen, Hongliang Wang, Zhiyuan Hu, Yan-hei Liu, Jahangir Afsharian and Zhihua (Alex) Yang, Queen’s University, Canada; Murata Power Solutions, Canada

2:25PM | Reliability-Oriented Design of LC Filter in Buck DC-DC Converter with Multi-Objective Optimization
Yi Liu, Meng Huang, Yuexia Liu and Xiaoming Zha, School of Electrical Engineering, Wuhan University, China

S140 Active Power Filters
Room: 101B
Chairs: Luís Moran, Suman Debnath

2:00PM | Multilevel Nine-Leg Converter Universal Active Power Filter
Phelipe Leal Serafim Rodrigues, Cursino Brandao Jacobina and Mauricio Beltrao de Rossiter Correa, DEE UFCG, Brazil

2:25PM | Central Control and Distributed Protection of the DSBC and DSCC Modular Multilevel Converters
Andre Hillers, Hao Tu and Juergen Biela, Laboratory for High Power Electronic Systems, Switzerland; North Carolina State University, United States

3:15PM | A New Control Method of Suppressing DC-Capacitor Voltage Ripples Caused by Third-Order Harmonic Compensation in Three-Phase Active Power Filters
Tomoyuki Mannen, Issei Fukasawa and Hideaki Fujita, Tokyo Institute of Technology, Japan

S141 Non-Conventional Machine Configurations II
Room: 101A
Chairs: Guan-Ren Chen, Nicola Bianchi

2:00PM | Design of Dual Purpose No Voltage Combined Windings for Bearingless Motors
Eric Severson, Robert Nilssen, Tore Undeland and Ned Mohan, University of Minnesota, United States; NTNU, Norway

2:25PM | Synchronous Generator Field Excitation Via Capacitive Coupling Through a Journal Bearing
Jiejian Dai, Skyler Hagen, Daniel Ludois and Ian Brown, University of Wisconsin-Madison, United States; Illinois Institute of Technology, United States

S136 Non-Conventional Machine Configurations I
Room: 101B
Chairs: Pierre Viarouge, Erica Novak

2:00PM | Development of Stator-Magnetless Linear Synchronous Motor for Sensorless Control
Makino Shogo, Kakihara Masanobu, Takase Yoshiyasu, Takaki Mamoru, Shikayama Toru, Ohito Motomichi, Higuchi Toshiyuki and Abe Takashi, Yaskawa Electric Corporation, Japan; Nagasaki University, Japan

3:15PM | Ultralightweight Motor Design Using Electromagnetic Resonance Coupling
Kazuto Sakai and Yuta Sugasawa, Toyo University, Japan

2:25PM | Using Design by Optimization for Reducing the Weight of a SiC Switching Cell
Mylene Delhommais, Gnmidu Dadanema, Yvan Avenas, Jean-Luc Schanen, François Costa and Christian Vollenaire, GZELab, France; Satie, France; Ampere, France

2:50PM | Central Control and Distributed Protection of the DSBC and DSCC Modular Multilevel Converters
Andre Hillers, Hao Tu and Juergen Biela, Laboratory for High Power Electronic Systems, Switzerland; North Carolina State University, United States
S142 Magnetic Gears
Room: 102B
Chairs: Siavash Pakdelian, Kan Akatsu

2:00PM | A Novel Reluctance Magnetic Gear for High Speed Motor
Kohei Aiso and Kan Akatsu, Shibaura institute of technology, Japan; Shibaura Institute of Technology, Japan

2:25PM | Analysis of a Magnetically Geared Lead Screw
Mojtaba Bahrami Kouhshahi and Jonathan Bird, Portland State University, United States

2:50PM | Design Comparison of NdFeB and Ferrite Radial Flux Magnetic Gears
Matthew Johnson, Matthew C. Gardner and Hamid A. Toliyat, Texas A and M University, United States

3:15PM | Power Transferring of Magnetic-Geared Permanent Magnet Machines
Leilei Wu, Ronghai Qu, Dawei Li and Yuting Gao, Huazhong University of Science and Technology, China

S143 High Speed and Direct Drives
Room: 101CD
Chairs: Mazharul Chowdhury, Rukmi Dutta

2:00PM | Robust Control of an Open-Ended Induction Motor Drive With a Floating Capacitor Bridge over a Wide Speed Range
Michele Mengoni, Albino Amerise, Luca Zani, Angelo Tani, Giovanni Serra and Domenico Casadei, University of Bologna, Italy

2:25PM | High Speed Operation of Permanent Magnet Machine Position Sensorless Drive Using Discretized EMF Estimator
Shih-Chin Yang and Guan-Ren Chen, National Taiwan University, Taiwan

2:50PM | DC Voltage Regulated PWM Inverter for High-Speed Electrical Drives
Vito Giuseppe Monopoli, Maria Concetta Poliseno, Maria Chiara Stomati and Francesco Cupertino, Politecnico di Bari, Italy; GE Avio srl, Italy

3:15PM | Variable Time Step Control with Synchronous PWM in Low Frequency Modulation Index for AC Machine Drive
Sungho Jung, Jaeyong Park, Euihoon Chung and Jung-Ik Ha, Seoul National University, Korea (South)

S144 Power Assemblies
Room: 102A
Chairs: Jelena Popovic, Yvan Avenas

2:00PM | Implementation and Performance of a Current Sensor for Laminated Bus Bar
Yoshikazu Kuwabara, Keiji Wada, Jean-Michel Guichon, Jean-Luc Schanen and James Roudet, Tokyo Metropolitan University, Japan; G2Elab, Univ. Grenoble Alps, France

2:25PM | Busbar Design for SiC-Based H-Bridge PEBB using 1.7 kV, 400 A SiC MOSFETs Operating at 100 kHz
Niloofar Rashidi Mehrabadi, Igor Cvetkovic, Jun Wang, Rolando Burgos and Dushan Boroyevich; CPES- Virginia Tech, United States

2:50PM | Ultra-low Inductance Design for a GaN HEMT Based 3L-ANPC Inverter
Emre Gurpinar, Francesco Iannuzzo, Yongheng Yang, Alberto Castellazzi and Frede Blaabjerg, University of Nottingham, United Kingdom; Aalborg University, Denmark

3:15PM | Layout Study of Contactless Magnetoresistor Current Sensor for High Frequency Converters
Mehrdad Biglarbegian, Shahriar Jalal Nibir, Hamidreza Jafarian, Johan Enslin and Babak Parkhideh, University of North Carolina at Charlotte, United States; Energy Production and Infrastructure Center, United States
Monday, September 19th  5:30PM – 7:00PM

Renewable and Sustainable Energy Applications

**Room: Exhibit Hall A**

**Chairs:** Euzeli Santos Jr., Johan Enslin

**P101 |** Modeling, Parameterization, and Benchmarking of a Lithium Ion Electric Bicycle Battery  
Weizhong Wang, Pawel Malysz, Khalid Khan, Lucia Gauchia and Ali Emadi,  
ECE Department, McMaster University, Canada; ECE Department, Michigan Tech University, United States

**P102 |** Performance Evaluation of a Hybrid Thermal-Photovoltaic Panel  
Cristina Moscatiello, Chiara Boccaletti, Adelito Neto Alcaso, Carlos A. Figueiredo Ramos and Antonio J. Marques Cardoso, Sapienza University of Rome, CISE, Italy; Politehnica Institute of Guarda, CISE, Portugal; University of Beira Interior, CISE, Portugal

**P103 |** On-line Wind Speed Estimation in IM Wind Generation Systems by Using Adaptive Direct and Inverse Modelling of the Wind Turbine  
Angelo Accetta, Maurizio Cimmione, Gianfranco Cimmione and Marcello Pucci, ISSIA CNR, Italy; University of South Pacific (USP), Fiji, Fiji; University of Picardie, Jules Verne, France

**P104 |** Passivity-Based and Standard PI Controls Application to Wind Energy Conversion System [#1701]  
Rui Gao, Rafael Cisneros, Iqbal Hussein and Romeo Ortega, North Carolina State University, United States; Laboratoire des Signaux et Systèmes, France

**P105 |** Evaluation of Circulating Current Suppression Methods for Parallel Interleaved Inverters [#760]  
Ghanshyamshinh Gohil, Lorand Bede, Remus Teodorescu, Tamas Kerekes and Frede Blaabjerg, Aalborg University, Denmark

Smart Grid & Utility Applications

**Room: Exhibit Hall**

**Chairs:** Johan Enslin, Martin Ordonez

**P301 |** A Fast Dynamic Unipolar Switching Control Scheme for Single Phase Inverters in DC Microgrids  
Nicola Hildebrandt, Mandip Pokharel, Carl Ngai-Man Ho and Yuanbin He, Fraunhofer-Institut fur Solare Energiesysteme, Germany; University of Manitoba, Canada; City University of Hong Kong, Hong Kong

**P302 |** A Novel Method of Optimizing Efficiency in Hybrid Photovoltaic-Grid Power System  
Liangliang Ren, Ke Jin, Ling Gu and Zhengshuo Wang, Nanjing University of Aeronautics and Astronautics, China

**P303 |** A Novel Autonomous Control Scheme for Parallel, LCL-Based UPS Systems  
Mohammad Bani Shameh, Atsuo Kawamura and Teruo Yoshino, Yokohama National University, Japan; Toshiba Mitsubishi-Electric Industrial Systems, Japan

**P304 |** Harmonic Components Based Protection Strategy for Inverter-Interfaced AC Microgrid  
Chen Zhi, Pei Xuejun and Peng Li, Huazhong University of Science and Technology, China

**P305 |** Adaptive Virtual Inertia Control of Distributed Generator for Dynamic Frequency Support in Microgrid  
Jianhui Meng, Yi Wang, Chao Fu and Hui Wang, North China Electric Power University, China

**P306 |** Interleaved Hybrid Boost Converter with Simultaneous AC and DC Outputs for Microsource Applications  
Amrita Sharma, Pranod Bura, R. K. Singh and Ranjit Mahanty, Indian Institute of Technology (BHU), India

**P307 |** Robust Inverter Control Design in Islanded Microgrids Using S$^3$-Synthesis  
Mohsen Azizi and S. Ali Khajehoddin, Michigan Technological University, United States; University of Alberta, Canada

**P308 |** Economic Analysis of a Regional Coordinated Microgrids System Considering Optimal PEVs Allocation  
Liangle Xiao, Changsong Chen, Shanxu Duan, Hua Lin, Yawei Wang and Guozhen Hu, Huazhong University of Science and Technology, China; Hubei Polytechnic University, China

**P309 |** Design of a Cooperative Voltage Harmonic Compensation Strategy for Islanded Microgrids Combining Virtual Admittances and Repetitive Controllers  
Cristian Blanco, Francesco Tardelli, David Diaz, Pericle Zanchetta and Fernando Briz, University of Oviedo, Spain; University of Nottingham, United Kingdom

Transportation Electrification Applications

**Room: Exhibit Hall**

**Chairs:** Jin Wang, Yaosuo “Sonny” Xue

**P501 |** EMI Reduction Technology in 85 kHz Band 44 kW Wireless Power Transfer System for Rapid Contactless Charging of Electric Bus  
Tetsu Shijo, Kenichiro Ogawa, Masatoshi Suzuki, Yasuhiro Kanekiyo, Masaaki Ishida and Shuichi Obayashi, Toshiba Corporation, Japan

**P502 |** Design and Characterization of a Meander Type Dynamic Inductively Coupled Power Transfer Coil  
Uguraz Iuretagoyena, Irma Villar, Haritza Camblong, Asier Garcia-Bediaga and Luis Mir, IK4-Ikerlan, Spain; University of the Basque Country, Spain

**P503 |** Design of S/P Compensated IPT System Considering Parameter Variations in Consideration of ZVS Achievement  
Yusheng Zhang, Qianhong Chen, Xiaoyong Ren, Siu-Chung Wong, Zhiliang Zhang and Wei Hua, Nanjing University of Aero. and Astro., China; Hong Kong Polytechnic University, Hong Kong; Southeast University, China

**P504 |** Coasting Control of EV Motor Considering Cross Coupling Inductance  
Heekwang Lee, Bonkil Koo and Kwanghee Nam, POSTECH, Korea (South)

**P505 |** Analysis and Comparison of Single Inverter Driven Series Hybrid System  
Yongjae Lee, Kahyun Lee and Jung-Ik Ha, Seoul National University, Korea (South)

**P506 |** Control Strategy for a Modified Cascade Multilevel Inverter with Dual DC Source for Enhanced Drivetrain Operation  
Maciej Bendyk and Patrick Chi Kwong Luk, Cranfield University, United Kingdom
Power Converter Topologies

P07 | An Investigation of DC-Link Voltage and Temperature Variations on EV Traction System Design
Nan Zhao, Rong Yang, Nigel Schofield and Ran Gu, McMaster University, Canada

P08 | Compact and High Power Inverter for the Cadillac CT6 Rear Wheel Drive PHEV
Mohammad Anvar, Mehrdad Teimor, Peter Savagian, Ryuichi Saito and Takeshi Matsuo, General Motors, United States; Retired from General Motors, United States; Hitachi Automotive, Japan

Control, Modelling and Optimization of Power Converters

E Room: Exhibit Hall
Chairs: Pericle Zanchetta, Luca Solero

P901 | Dual Sequence Current Control Scheme Implemented in DSRF with Decoupling Terms Based on Reference Current Feed-Forward
Sizhan Zhou, Jinjun Liu and Zhang Yan, Xi'an Jiaotong University, China

P902 | Injecting 3rd Harmonic into the Input Current to Improve the Power Factor of DCM Buck PFC Converter
Xufeng Zhou, Kai Yao, Hui Li, Fei Yang and Mingcai Kang, Nanjing University of Science and Technology, China; Nanjing University of Science and Technology, China

P903 | Investigation of Reducing the Influence of Digital Control Delay to LCL-Type Grid-Connected Inverter
Guoshu Zhao, Junyang Ma, Liuliu Huang and Yu Tang, Jinling Institute of Technology, China; NUAA, China
P904 | Repetitive Control for Grid Connected Inverters with LCL Filter Under Stationary Frame
Yi Xiao, Gan Wei, Xueguang Zhang, Qiang Gao and Dianguo Xu, Harbin Institute of Technology, China

P905 | Direct Instantaneous Ripple Power Predictive Control for Active Ripple Decoupling of Single-Phase Inverter
Baoming Ge, Xiao Li, Haiyu Zhang, Yushan Liu, Robert S. Balog and Haitham Abu-Rub, Texas A and M University, United States; Texas A and M University at Qatar, Qatar

P906 | Input-Output Feedback Linearization Based Control for Quasi-Z-Source Inverter in Photovoltaic Application
Hong Gong, Yuan Li, Yuhong Wang and Rui Zhang, Sichuan University, China

P907 | A Novel Neutral Point Potential Control for the Three-Level Neutral-Point-Clamped Converter
Hsin-Chih Chen, Meng-Jiang Tsai, Yao-Bang Wang and Po-Tai Cheng, National Tsing Hua University, Taiwan

P908 | Phase Leading Input Current Compensation for CRM Boost PFC Converter
Chengdong Zhao, Junming Zhang and Xinke Wu, Zhejiang University, China; Zhejiang University, China

P909 | Paralleled Inverters with Zero Common-Mode Voltage
Dong Jiang and Zewei Shen, Huazhong University of Science and Technology, China

P910 | A Voltage Clamp Circuit for the Real-Time Measurement of the On-State Voltage of Power Transistors
Lei Ren, Qian Shen and Chunying Gong, College of Automation Engineering Nanjing Univer, China

P911 | Error-Voltage Based Open-Switch Fault Diagnosis Strategy for Matrix Converters with Model Predictive Control Method
Hui Deng, Tao Peng, Hanbing Dan, Mei Su and Jingrong Yu, Central South University, China

P912 | Instrumented Diode Dedicated to Semiconductor Temperature Measurement in Power Electronic Converters
Ibrahim Ka, Yvan Avenas, Laurent Dupont, Mickael Petit, Raha Vafaei, Benoit Thollin and Jean-Christophe Crebier, Univ. Grenoble Alpes, G2Elab, F-38000 Grenoble, France; CNRS UMR 8029, SATIE, ENS, 94230 Cachan, France

P913 | Reliability Odometer of Power Semiconductor Device Used for High Performance High Power Amplifiers
Fei Xu, Juan Antonio Sabate, Xi Lu, Ruixi Wang, Louis Martin Frigo, Margaret Ann Wiza, Syedsaad Asif Ali and Melissa Jean Freeman, GE Global Research, China; GE Global Research, United States; GE Healthcare Systems, United States; GE Healthcare Systems, United States

P914 | Energy and Computational Efficient Estimation of Battery Intrinsic Parameters
Chun Sing Cheng, Ricky Wing Hong Lau, Henry Shu Hung Chung and N.K. Rathi, City University of Hong Kong, Hong Kong; Premier Technologies Ltd, Hong Kong

P915 | Snubber Capacitors Optimization for Super-Junction MOSFET in the ZVS Full-Bridge Inverter
Yenan Chen, Guangyuan Liu, Changsheng Hu and Dehong Xu, Zhejiang University, China

P1010 | A Computational Technique for Iron Losses in Electrical Machines
Omar Bottesi, Luigi Alberti, Ruth V. Sabariego and Johan Gyselinck, Free University of Bozen-Bolzano, Italy; Katholieke Universiteit Leuven (KU Leuven), Belgium; Universite Libre de Bruxelles (ULB), Belgium

P1011 | Saliency Harmonic Induction Motor Speed Estimation Using Artificial Neural Networks
Abdulrah Alkhoroif and Donald Zinger, Northern Illinois University, United States

P1012 | Reclosing Transients in Standard and Premium Efficiency Induction Machines in the Presence of Voltage Unbalance
Tunelo Gabaraane, Paul Barendse and Azeem Khan, Masters Student, South Africa; Supervisor, South Africa; Co-supervisor, South Africa

P1013 | Parameter Sensitivity of Large Electric Machines
Jemimah Akiror, Pragased Pillay and Arezki Merkhouf, Concordia University, Canada; Hydro Quebec, Canada

P1014 | A Computationally Efficient Method for Calculation of Strand Eddy Current Losses in Electric Machines
Alireza Fatemi, Dan Ionel, Nabeel Demerdash, David Staton, Rafal Wrobel and Chong Yew Chuan, Marquette University, United States; University of Kentucky, United States; Motor Design Limited, United Kingdom; University of Bristol, United Kingdom
P1114 | Core Loss Estimation in Electric Machines with Flux Controlled Core Loss Tester
Burak Tekgöz, Yilmaz Sozer, Igor Tsukerman, Parag Upadhyay and Steven Englebertson, University of Akron, United States; ABB, United States

P1115 | Thermal Analysis of a Three-Phase 24/16 Switched Reluctance Machine Used in HEVs
Michael Kasprzak, James W. Jiang, Berker Bilgin and Ali Emadi, McMaster Automotive Resource Centre (MARC), Canada

P1116 | Pre-Drive Test of an Implemented Novel Radial-Gap Helical Rotor Lin Machine
Christophe Cyusa, Simba and Yasutaka Fujimoto, Yokohama National University, Japan

P1117 | Hybrid Excitation Topologies of Synchronous Generator for Direct Drive Wind Turbine
Maxime Ployard, Ammar Aymen, Gilon Frederic, Vido Lionel and Laloy Daniel, Ecole Centrale de Lille, France; JEUMONT Electric, France; Universite de Cergy Pontoise, France; EC Lille, France

P1118 | Resonant Based Backstepping Direct Power Control Strategy for DFIG Under Both Balanced and Unbalanced Grid Conditions
Xiaohe Wang, Dan Sun and Ziqiang Zhu, Zhejiang University, China; University of Sheffield, England

P1119 | Design and Analysis of a New Five-Phase Brushless Hybrid-Excitation Fault-Tolerant Motor for Electric Vehicles
Li Zhang, Ying Fan, Ronghua Cui, ChenXue Li and Ming Cheng, Southeast University, China

P1120 | Multi-objective Design Optimisation and Pareto Front Visualisation of Radial-flux Eddy Current Coupler for Wind Generator Drive Train.
Abram Stephanus Erasmus and Maarten Kamper, Stellenbosch University, South Africa

P1121 | Reducing Estimated Parameters of a Synchronous Generator for Microgrid Applications
Mohammad Rasouli and Reza Sabzehgar, Penn State Behrend, United States; San Diego State University, United States

P1122 | Brushless Dual-Electrical-Port, Dual Mechanical Port Machines Based on the Flux Modulation Principle
Dawei Li, Ronghai Qu, Jian Li, Dong Jiang, Xiang Ren and Yuting Gao, Huazhong University of Science and Technology, China

Electric Drives

P1301 | An Equivalent Dual Three-Phase SVPWM Realization of the Modified 24-Sector SVPWM Strategy for Asymmetrical Dual Stator Induction Machine
Kun Wang, Xiaojie You, Chenchen Wang and Minglei Zhou, Beijing Jiaotong University, China

P1302 | A Speed Estimation Method for Free-Running Induction Motor with High Inertia Load in the Low Speed Range
Toshie Kikuchi, Yasushi Matsumoto and Akira Chiba, Fuji Electric, Japan; Tokyo Institute of Technology, Japan

P1303 | Design Optimization and Performance Investigation of Novel Linear Switched Flux PM Machines [20]
Qinfen Lu, Yihua Yao, Jiamei Shi, Xiaoyan Huang, Youfang Fang, Yunyue Ye and Wei Xu, Zhejiang University, China; Huazhong University of Science and Technology, China

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

S Room: Exhibit Hall
Chairs: Giovanni Oriti, Enrico Santi

P1501 | The Impact of Triangular Defects on Electrical Characteristics and Switching Performance of 4H-SiC PiN Diodes
Yeganeh Bonvadi, Peter Gammon, Roobeh Bonvadi, Olayiwola Alatise, Ji Hu, Steven Hindmarsh and Philip Mawby, University of Warwick, United Kingdom

P1502 | Performance Evaluation of Series Connected 15 kV SiC IGBT Devices for MV Power Conversion Systems
Kasunaidu Vechalapu, Abhay Negi and Subhashish Bhattacharya, North Carolina State University, United States

P1503 | Comparative Performance Evaluation of Series Connected 15 kV SiC IGBT Devices and 15 kV SiC MOSFET Devices for MV Power Conversion Systems
Kasunaidu Vechalapu, Abhay Negi and Subhashish Bhattacharya, North Carolina State University, United States

P1504 | Equivalent Circuit Models and Model Validation of SiC MOSFET Oscillation Phenomenon
Tianjiao Liu, Runtao Ning, Thomas Wong and Z. John Shen, Illinois Institute of Technology, United States

P1505 | Enabling DC Microgrids with MV DAB Converter Based on 15 kV SiC IGBT and 15 kV SiC MOSFET
Avneesh Tripathi, Krishna Mainali, Sachin Madhusoodhanan, Kasunaidu Vechalapu, Ritwik Chattopadhyay and Subhashish Bhattacharya, North Carolina State University, United States

Emerging Technologies and Applications

S Room: Exhibit Hall
Chairs: Xiaoran Lu, Pericle Zanchetta

P1701 | An LC Compensated Electric Field Repeater for Long Distance Capacitive Power Transfer
Hua Zhang, Fei Lu, Heath Hofmann, Weiguo Liu and Chris Mi, Northwestern Polytechnical University, China; University of Michigan, United States; San Diego State University, United States

P1702 | A Selection Method of Mutual Inductance Identification Models Based on Sensitivity Analysis for Wireless Electric Vehicle Charging
Fang Liu, Zhengming Zhao, Yingming Zhang, Kainan Chen, Fanbo He and Liqiang Yuan, Tsinghua University, China
**P1703 | Short-Circuit Protection of Power Converters Using SiC Current Limiters**  
Mahmood Alwash, Mark Sweet, Ekkanath Madathil Sankara Narayanan and Graham Bruce, University of Sheffield, United Kingdom; Rolls-Royce plc, United Kingdom

**P1704 | Impedance Measurement of Three-Phase Grid-Connected Systems in DQ-Domain: Applying MIMO-Identification Techniques**  
Tom Roinila, Tuomas Messo and Aapo Aapro, Tampere University of Technology, Finland

**P1705 | A New Design Methodology for a 1-Meter Distance, 6.78MHz Wireless Power Supply System for Telemetries**  
Lee Seung-Hwan, Lee Jun-Ho and Yi Kyong-Pyo, University of Seoul, Korea (South); Korea Railroad Research Institute, Korea (South)

**P1706 | Modeling and Investigation of 4-Coil Wireless Power Transfer System with Varying Spatial Scales**  
Lu Chen, Fuxin Liu, Xinhao Ruan and Xuling Chen, Nanjing Unv. of Aeronautics and Astronautics, China

**P1707 | Vehicular Integration of Wireless Power Transfer Systems and Hardware Interoperability Case Studies**  
Omer Onar, Steven Campbell, Larry Seiber, Cliff White and Madhu Chinthavali, Oak Ridge National Laboratory, United States

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**Tuesday, September 20th 11:00AM – 12:30PM**

### Renewable and Sustainable Energy Applications

**Room: Exhibit Hall**  
**Chairs:** Johan Enslin, Narid Zargari

**P1901 | Power Balance Control and Circulating Current Suppression for MMC based EV Integration System Considering Users Requirement**  
Meiqin Mao, Tinghuan Tao, Yong Ding, Luchen Chang and Nikos Hatziargyriou, Hefei University of Technology, China; University of New Brunswick, Canada; National Technical University of Athens, Greece

**P1902 | Optimal Sizing of Energy Storage for PV Power Ramp Rate Regulation**  
Qian Zhao, Kunra Wu and Ashwin M Khandakone, Experimental Power Grid Centre, Singapore

**P1903 | Model-Based Adaptive Control of a Hydraulic Wind Power System**  
Masoud Vaezi and Afshin Izadian, Purdue School of Engineering and Technology, United States

**P1904 | Sensorless Speed Control of a Small Wind Turbine Using the Rectifier Voltage Ripple**  
Juan Manuel Guerrero, Carlos Lumberas, David Reigosa, Cristian Blanco and Fernando Briz, University of Oviedo, Spain; AST Ingenieria, Spain; Universidad de Oviedo, Spain

**P1905 | Maximum Power Point Tracking (MPPT) of Sensorless PMSG Wind Power System**  
Yu Zou and Jianguo He, Saginaw Valley State University, United States; GE Global Research, United States

**P1906 | Current/Voltage Sensor Fault Detection and Isolation in Wind Energy Conversion Systems Based on Power Balance**  
Haibo Li, Liyan Qu, Wei Qiao and Chun Wei, University of Nebraska-Lincoln, United States

**P1907 | Quasi-Z-Source-Based Multilevel Inverter for Single-Phase Photo Voltaic Applications**  
Aida Gorgani, Malik Elbuluk, Yilmaz Sozer and Haitham Abu-Rub, The University of Akron, United States; Texas A and M University at Qatar, Qatar

**P1908 | Dual Buck Based Power Decoupling Circuit for Single Phase Inverter/Rectifier**  
Xiao Li, Shunlong Xiao, Haiyu Zhang, Robert S. Balog and Baoming Ge, Texas A and M University, United States

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### Smart Grid & Utility Applications

**Room: Exhibit Hall**  
**Chairs:** Johan Enslin, Narid Zargari

**P2011 | Design and Development of a True Decentralized Control Architecture for Microgrid**  
Abedalsalam Bani-Ahmed, Adel Nasiri and Hosseini Hossein, UW-Milwaukee, United States

**P2012 | Modeling and Control of a Synchronous Generator in an AC Microgrid Environment**  
Luke Weber, David Hyppio, William Dittman and Adel Nasiri, University of Wisconsin Milwaukee, United States; Regal Belmont Marathon, United States

**P2013 | State Estimation of Power Systems with Interphase Power Controllers Using the WLS Algorithm**  
Mohammad Amin Chitsazan and Andrej M Trzynadlowski, University of Nevada, Reno, United States

**P2014 | A Novel T-Type Half-Bridge Cell for Modular Multilevel Converter with DC Fault Blocking Capability**  
Fangzhou Zhao, Guochun Xiao, Daoshu Yang, Min Liu, Xiaoli Han and Baojin Liu, Xi An Jiaotong University, China

**P2015 | A Distributed Control Method for Power Module Voltage Balancing of Modular Multilevel Converters**  
Yongjie Luo, Yaohua Li, Zikun Li and Ping Wang, State Grid Si Chuan Electric Power Research Institute, China; Key Laboratory of Power Electronics and Electric, China

**P2016 | Control Method of Single-Phase Inverter Based Power Grounding System in Distribution Networks**  
Wen Wang, Yan Lingjie, Xiangjun Zeng, Zhao Xin, Wei Baoze and Guerrero Josep M., Changsha University of Science and Technology, China; Aalborg University, Denmark

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### Transportation Electrification Applications

**Room: Exhibit Hall**  
**Chairs:** Jin Wang, Yaosuo “Sonny” Xue

**P2301 | A Novel Energy Balanced Variable Frequency Control for Input-Series-Output-Parallel Modular EV Fast Charging Stations**  
Qi Tian, Hua Bai, HuangAlex, Teng Hui and Lu Juncheng, North Carolina State University, United States; Kettering University, United States

**P2302 | An Adaptive Charging Control Strategy For Ultracapacitor Light Rail Vehicles**  
Zhou Rong, Huang Zhiwu, Li Heng, Wu Zhihui and Peng Jun, Central South University, China

**P2303 | A High Power Density Drivetrain-Integrated Electric Vehicle Charger**  
Usama Anwar, Hyoekjin Kim, Hua Chen, Robert Erickson, Dragan Maksimovic and Khurram Afridi, University of Colorado Boulder, United States
**Power Converter Topologies**

**Room: Exhibit Hall**

**Chairs:** Pradeep S. Shenoy, Leon M Tolbert

**P2501 | A ZVS Integrated Single-Input-Dual-Output DC/DC Converter for High Step-up Applications**
Ming Shang and Wang Haoyu, ShanghaiTech University, China

**P2502 | A Survey on Voltage Boosting Techniques for Step-Up DC-DC Converters**
Mojtaba Forouzesh, Yam P. Siwakoti, Saman A. Gorji, Frede Blaabjerg and Brad Lehman, University of Guilan, Iran; Aalborg University, Denmark; Swinburne University of Technology, Australia; Northeastern University, United States

**P2503 | Analysis and Design of a Current fed Non-isolated Buck-Boost DC-DC Converter**
Ashok Kumar, Roja Peri and Parthasarathi Sensarma, Indian Institute of Technology, Kanpur, India

**P2504 | Impulse Commutated Current-fed Three-phase Modular DC/DC Converter for Low Voltage High Current Applications**
Akshay Rathore and Radha Sree Krishna Moorthy, Concordia University, Montreal, Canada; National University of Singapore, Singapore

**P2505 | Comparative Evaluation of Capacitor-coupled and Transformer-coupled Dual Active Bridge Converters**
Parikshith Channegowda and Giri Venkataramanan, University of Wisconsin-Madison, United States

**P2506 | Planar Transformer Winding Technique for Reduced Capacitance in LLC Power Converters**
Mohammad Ali Saket Tokaldani, Navid Shafiei and Martin Ordonez, University of British Columbia, Canada

**P2507 | Topology and Controller of an Isolated Bi-Directional AC-DC Converter for Electric Vehicle**
Beham Koushki, Praveen Jain and Alireza Bekhshi, Queen’s University, Canada

**P2508 | High Efficiency LLC DCX Battery Chargers with Sinusoidal Power Decoupling Control**
Dong-Jie Gu, Zhihong Zhang, Yaqi Wu, Dong Wang, Handong Gu and Li Wang, Nanjing Univ. of Aeronautics and Astronautics, China; The University of Tennessee, United States

**P2509 | PWM Strategies with Duality between Current and Voltage Source AC/DC Converters for Suppressing AC Harmonics or DC Ripples**
Junpei Isozaki, Kazuma Suzuki, Wataru Kitagawa and Takaharu Takeshita, Nagoya Institute of Technology, Japan

**P2510 | Analytical Expression for Harmonic Spectrum of Regular Sampled Space Vector Modulated Rectifier Connected to IPM Generator**
Jian Zhang, XuHui Wen, JinLong Li, Youlong Wang and WenShan Li, Institute of Electrical Engineering, CAS, China

**P2511 | A Systematic Topology Generation Method for Dual-Buck Inverters**
Li Zhang, Tao Zhu, Lin Chen and Kai Sun, Hohai University, China; Tsinghua University, China

**P2512 | Analysis and Control of Decentralized PV Cascaded Multilevel Modular Integrated Converters**
David Scholten, Nesimi Ertugrul and Wen Soong, The University of Adelaide, Australia

**P2513 | Experimental Study of a SiC MOSFET Based Single Phase Inverter in UPS Applications**
Cheng Luo, Xinyu Wang, Tianyang Jiang, Richard Feng, Huiting Xin and Han Li, Eaton Corporate Research and Technology, China

**P2514 | Performance Analysis of a Flexible Multi-level Converter for High Voltage Photovoltaic Grid-connected Power System**
Lu Zhou, Li Wuhua, Hu Senjun, Luo Haoze, He Xiangning, Cao Fengwen, Zhang Chaoshan and Du Juyuan, Zhejiang University, China; Aalborg University, Denmark; Suzhou Vocational University, China; XiAn Kai Tian Power Electronics Technical Co, China

**P2515 | Circulating Current Control for Carrier-Based Discontinuous Modulation in Inverters with Parallel Legs**
Andre Nicolini, Antonio Ricciotti, Fernanda Carneilutti and Humberto Pinheiro, Federal University of Santa Maria, Brazil; Federal University of Rondonia, Brazil

**P2516 | A Phase-Shift PWM-Controlled ZVS Boost Full-Bridge AC-AC Converter for High-Frequency Induction Heating Applications**
Shuichi Sakamoto, Tomokazu Mishima and Chiaki Ide, Kobe University, Japan; Fuji Electronics Industry Company, Japan

**P2517 | Paper not in the database**

**P2518 | Control Approach for a Class of Modular Multilevel Converter Topologies**
Dennis Karwatzki and Axel Mertens, Leibniz Universitaet Hannover, Germany

**P2519 | Maximum Boost Space Vector Modulated Three-Phase Three-Level Neutral-Point-Clamped Quasi-Z-Source Inverter**
Prasanth Sundararajan, Mohamed Sathik Mohamed Halick, Aaron Alexander Ayu, Tan Chuan Seng and Suresh Kumar K. S., Nanyang Technological University, Singapore; National Institute of Technology, India
Control, Modelling and Optimization of Power Converters

P2701 | Digital Autotuning Controller for Point-of-Load Converter Based on Non-Intrusive Start-up Transient Observer
M. Ali, K. H. Loo and Y. M. Lai, The Hong Kong Polytechnic University, Hong Kong

P2702 | Control of D-STATCOM During Unbalanced Grid Faults Based on DC Voltage Oscillation and Peak Current Limitations
Arash Khoshoieh, Javad Moghani, Jafar Milimonfared, Alvaro Luna, Ignacio Candela and Pedro Rodriguez, Amirkabir University of Technology, Iran; Technical University of Catalonia, Spain; Technical University of Catalonia / Abengoa Reze, Spain

P2703 | Staircase Modulation of Modular Multilevel Converters with Minimal Total Harmonic Distortion and Maximal Number of Output Voltage Levels
Sufei Li, Yi Deng and Ronald Harley, Georgia Institute of Technology, United States

P2704 | FPGA Implementation of Model Predictive Direct Current Control
Joel Vallone, Tobias Geyer and Eduardo Rath Rohr, EPFL, Switzerland; ABB Corporate Research, Switzerland

P2705 | Active Damping of LC Resonance for Paralleled Indirect Matrix Converter Based on Cascaded Control
Yang Xiao, Zheng Wang, Shuai You, Ming Cheng and Liang Xu, Southeast University, China; Aviation Key Laboratory of Science and Technology, China

P2706 | Virtual Circuit Design of Grid-Connected Half-Bridge Converters with Higher-Order Filters
Korawich Niyomsatian, Piet Vanассche, Bruno Hendrickx, Peter Tant, Jeroen Van den Keybus and Johan Gyselinck, Triphase, Universite Libre de Bruxelles, Belgium; Triphase, Belgium; Universite Libre de Bruxelles, Belgium

P2707 | Commutation Technique for High Frequency Link Inverter without Operational Limitations and Dead Time
Minjooong Kim and Robert S. Balog, Texas A and M University, United States

P2708 | Research on the Current Control method of N-paralleled Converter System for the High-Power Inductor Test
Cheng Nie, Wanjun Lei, Huajia Wang, Mingfeng Chen and Yue Wang, Xian Jiaotong University, China; STATE GRID Electric Power Research Institute, China

P2709 | Modeling and Bifurcation Analysis of Converters with Power Semiconductor Filter
Wing-to Fan and Shu-hung Chung, City University of Hong Kong, Hong Kong

P2710 | Suppression of Circulating Current in Paralleled Inverters with Isolated DC-link
Hyun-Sam Jung, Jeong-Mock Yoo, Seung-Ki Sul, Hak-Jun Lee and Chanook Hong, Seoul National University, Korea (South); LSIS Co., Ltd., Korea (South)

P2711 | Small-Signal Model for the ISOP DC-DC Converters in the 5-Level T-Rectifier
Marco Di Benedetto, Alessandro Lidozzi, Luca Solero, Fabio Crescimbini and Petar Grbovic, ROMA TRE University, Dept. of Engineering, Italy; Roma TRE University, Dept. of Engineering, Italy; Huawei Energy Competence Center Europe (HECCE), Germany

P2712 | DC Bus Splitting Voltage Feedforward Injection Method for Virtually-Grounded Three-Phase Inverter
He Yuanbin, Chung Shu-hung, Ho Ngai-man, Wu Weimin and Fan Wing-to, City University of Hong Kong, Hong Kong; University of Manitoba, Canada; Shanghai Maritime University, China

P2713 | High Performance SiC Power Block for Industry Applications
Xu She, Rajib Datta, Maja Hafman Todorovic, Gary Mandrusiak, Jian Dai, Tony Frangieg, Philip Cioffi, Brian Rowden and Frank Mueller, GE Global Research, United States

P2714 | Switching Angles Generation for Selective Harmonic Elimination by Using Artificial Neural Networks and Quasi-Newton Algorithm
Kehu Yang, Jun Hao and Yubo Wang, China Univ. of Mining and Tech., Beijing, China

P2715 | Minimum RMS Current Operation of the Dual-Active Half-Bridge Converter using Three Degree of Freedom Control
Shiladi Chakraborty, Shailesh Tripathy and Souvik Chattopadhyay, Electrical Engineering Department, IIT Kharagpur, India; Electrical Engineering Department, NIT Rourkela, India

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Electrical Machines

P2901 | Comparison of Torque Characteristics in Permanent Magnet Synchronous Machine with Conventional and Herringbone Rotor Step Skewing Techniques
Weizhong Fei, Patrick Chi Kwong Luk and Wenyi Liang, Cranfield University, United Kingdom

P2902 | Six-Leg Dc-Link Rectifier/Inverter for Two-Phase Machines
Nayaran Brandao de Freitas, Cursino Brandao Jacobina and Alexandre Cunha Oliveira, Federal University of Campina Grande, Brazil

P2903 | RSM-DE-ANN Method for Sensitivity Analysis of Active Material Cost in PM Motors
Alireza Fatemi, Dan Ionel, Nabeel Demerdash, Steve Stretz and Thomas Jahns, Marquette University, United States; University of Kentucky, United States; Regal Beloit Corporation, United States; University of Wisconsin-Madison, United States

P2904 | Modeling, Simulation and Performance Evaluation of Caged Permanent Magnet Motors Fed by Variable Speed Drives (VSDs)
Sara Ahmned, Darren Tremelling, Zi-Ang (John) Zhang, Nicolas Frank, Robert McElveen and Kim Hongrae, GE Global Research and Institute and State Universities, United States; ABB Inc., United States; Binghamton University-SUNY, United States; Baldor Electric company, United States

P2905 | An Improved Conformal Mapping Aided Field Reconstruction Method for Modeling of Interior Permanent Magnet Synchronous Machines
Lei Gu, Mehdi Moallem, Shiliang Wang, Devendra Patil and Babak Fahimi, University of Texas at Dallas, United States; Isfahan University of Technology, Iran

P2906 | Hybrid Excited Vernier PM Machines with Novel DC-Biased Sinusoidal Armature Current
Shaojeng Jia, Ronghui Wu, Jian Li, Dawei Li and Haiyang Fang, Huazhong University of Science and Technology, China
P2907 | Calculating the Electromagnetic Field and Losses in the End Region of Large Synchronous Generators under Different Operating Conditions with Three-Dimensional Transient Finite Element Analysis
SuFei Li, Noris Gallandat, J. Rhett Mayor and Ronald Harley, Georgia Institute of Technology, United States

P2908 | Electrical Propulsion System Design of Chevrolet Bolt Battery Electric Vehicle
Faizul Momen, Khwaja Rahman, Yochan Son, Bonho Bae and Peter Savagian, General Motors Corporation, United States

P2909 | Optimizing PM Coverage Ratio in Flux Concentrating Axial Flux Machine
Minhyeok Lee, Kwanghee Nam and JaeHong Kim, POSTECH, Korea, Republic of; Chosun University, Korea, Republic of

P2910 | Detailed Analytical Modelling of Fractional-Slot Concentrated-Wound Interior Permanent Magnet Machines for Prediction of Torque Ripple
Mohammad Farshadnia, Muhammad Ali Masood Cheema, Rukmi Dutta, John Fletcher and Muhammad Fazlur Rahman, University of New South Wales, Australia

P2911 | A Compact And Light-weight Generator for Backpack Energy Harvesting
Siavash Pakdelian, University of Massachusetts Lowell, United States

P2912 | Suspension Loss Measurement and its Reduction in Single-Drive Bearingless Motor
Itsuki Shimura, Hiroya Sugimoto and Akira Chiba, Tokyo Institute of Technology, Japan

P2913 | A Compact Single-Phase Adjustable-Voltage-Ratio Magnetoelectric Transformer
Haosen Wang, Liya Qu and Wei Qiao, University of Nebraska-Lincoln, United States

P2914 | Analysis of Common Mode Circuit of BDFG-Based Ship Shaft Power Generation System
Hongbin Yang, Hua Lin, Xingwei Wang and Guangzhi Yao, Huazhong University of Science and Technology, China

P2915 | Replacing SPM by PMARel Machines in Low-speed High-torque Applications
Nicola Bianchi, Alessandro Castagnini, Giulio Secondo and Pietro Savio Termini, Dept of Industrial Eng., University of Padova, Italy; ABB, Discrete Automation and Motion Division, Italy

P2916 | Rotor Eddy-Current Loss Minimization in High-Speed PMSMs
Haiyang Fang, Ronghai Qu, Jian Li and Bao Song, Huazhong University of Science and Technology, China

P2917 | Design and Analysis of Rotating Diode Rectifier for Wound-Rotor Synchronous Starter/Generator
Pang Ji, Weiqiu Lu, Chenghao Sun, Jixiang Wang, Yan Zhang and Yu Jiang, Northwestern Polytechnical University, China; AVIC SHAANXI AERO ELECTRIC CO., LTD, China

P2918 | Stator Tooth and Rotor Pole Shaping for Low Pole Flux Switching Permanent Magnet Machines to Reduce Even Order Harmonics in Flux linkage
Dheeraj Bobba, Gerd Bramerdorfer, Yingjie Li, Timothy A. Burruss and Bulent Sarlioglu, University of Wisconsin-Madison, United States; Johannes Kepler University Linz, Austria; Oak Ridge National Laboratory, United States

P2919 | Optimization of PM Volume in a PM-assisted Claw-Pole Motor for ISG Applications
Bonkil Ko, Jeongki Kwon and Kwanghee Nam, POSTECH, Korea (South); Hyundai MOBIS, Korea (South)

Electric Drives

P3010 | Improved Model Predictive Current Control of Permanent Magnet Synchronous Machines with Fuzzy Based Duty Cycle Control
Amir Masoud Bozorgi, Mehdi Farasat and Seyedmahadi Jafarshiadeh, Louisiana State University, United States

P3012 | A Universal Restart Strategy for Induction Machines
Kibok Lee, Sara Ahmed and Srdjan Lukic, North Carolina State University, United States; ABB, United States

P3013 | Active Disturbance Rejection Control of Linear Induction Motor
Francesco Alonge, Maurizio Cinccione, Filippo D’ippolito, Marcello Pucci and Antonino Sferlazza, DEIM – University of Palermo, Italy; University of South Pacific, Fiji; ISSIA-CNIR, Italy

P3014 | Super-Twisting Algorithm Based Sliding-Mode Observer with Online Parameter Estimation for Sensorless Control of Permanent Magnet Synchronous Machine
Donglai Liang, Jian Li and Ronghai Qu, Huazhong University of Science and Technology, China

P3015 | High Dynamic Sensorless Control for PMSMs Based on Decoupling Adaptive Observer
Yongke Miao, Jiaqiang Yang, Tao Wang, Dejun Yin and Yangsheng Chen, Zhejiang University, China; Nanjing University of Science and Technology, China

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

P3016 | Position Sensorless Control of Switched Reluctance Motor Based on a Numerical Method
Fei Peng, Jin Ye and Ali Emadi, McMaster University, Canada; San Francisco State University, United States

P3017 | Operating-Envelope-Expandable Control Strategy for Switched Flux Hybrid Magnet Memory Machine
Hui Yang, Heyun Lin, Z. Q. Zhu, Erxing Zhuang, Shuhua Fang and Yunkai Huang, Southeast University, China; University of Sheffield, United Kingdom

P3018 | Modelling the Closely Coupled Cascode Switching Process
Pablo F. Miaja, Sheng Jiang, Keen-Boon Lee, Peter A. Houston, Ivar Guiney, David J. Wallis, Colin J. Humphreys and Andrew J. Forsyth, University of Manchester, United Kingdom; University of Sheffield, United Kingdom; University of Cambridge, United Kingdom

P3019 | A 700-V Class Reverse-Blocking IGBT for Large Capacity Power Supply Applications
David Hongfei Lu, Hiromu Takubo, Hiroki Wakimoto, Toru Muramatsu and Haruo Nakazawa, Fuji Electric Co., Ltd., Japan

P3020 | Efficiency and Electromagnetic Interference Analysis of Wireless Power Transfer for High Voltage Gate Driver Application
Jianyu Pan, Feng Qi, Haiwei Cai and Longya Xu, The Ohio State University, United States
P3304 | Single Chip Enabled High Frequency Link Based Isolated Bias Supply for Silicon Carbide MOSFET Six-Pack Power Module Gate Drives
Rui Gao, Li Yang, Wensong Yu and Iqbal Husain, North Carolina State University, United States

P3305 | Reliability Assessment of SiC Power MOSFETs From The End Users Perspective
Vasilios Dimitris Karaventzas, Muhammad Nawaz and Francesco Iannuzzo, Dept. of Energy Technology, Aalborg University, Denmark; ABB Corporate Research, Sweden

P3306 | Investigation of Collector Emitter Voltage Characteristics in Thermally Stressed Discrete IGBT Devices
Syed Huzaif Ali, Serkan Dusmez and Bilal Akin, University of Texas at Dallas, United States

## Emerging Technologies and Applications

**Room:** Exhibit Hall  
**Chairs:** Jin Wang, Yaosuo “Sonny” Xue

P3501 | Transmission Characteristics Analysis of a Three-Phase Magnetically Coupled Resonant Wireless Power Transfer System
Jiang Chong, Liu Fuxin, Ruan Xinbo and Chen Xueling, Nanjing Unv. of Aeronautics and Astronautics, China

P3502 | Synthesis of Buck Converter Based Current Sources
Soumya Shubhra Nag and Santanu Mishra, Indian Institute of Technology Kanpur, India

P3503 | A Model for Coupling Under Coil Misalignment for DD Pads and Circular Pads of WPT Systems
Guangjie Ke, Qianhong Chen, Ligang Xu, Siu-Chung Wong and Chi.K. Tse, Nanjing University of Aeron. and Astro., China; Nanjing University of Aero. and Astro., China; Hong Kong Polytechnic University, Hong Kong

P3504 | Comprehensive Dynamic Modeling of a Solid-state Transformer Based Power Distribution System
Md Tanvir Arfat Khan, Alireza Afiat Milani, Aranya Chakrabortty and Iqbal Husain, North Carolina State University, United States

P3505 | Capability, Compatibility, and Usability Evaluation of Hardware-in-the-Loop Platforms for DC-DC Converter
Shawn Maxwell, S M Flakul Islam, Md. Kamal Hossain and Sung Yeul Park, University of Connecticut, United States

P3506 | A Single Stage AC/DC Converter for Low Voltage Energy Harvesting
Liang Yu and Haoyu Wang, ShanghaiTech University, China

## Renewable and Sustainable Energy Applications

**Room:** Exhibit Hall  
**Chairs:** Euzeli Santos Jr., Johan Enslin

P3701 | Dynamic Battery Operational Cost Modeling for Energy Dispatch
Qian Zhao, Aniq Ahsan, Ashwin M. Kambadkone and Meng Hwee Chia, Experimental Power Grid Center, Singapore; Oxford University, United Kingdom; National University of Singapore, Singapore

P3702 | A Low Voltage Ride Through Control Strategy for Energy Storage Systems
Yeongyu Bak, June-Seok Lee and Kyo-Beum Lee, Ajou University, Korea (South); KRRI, Korea (South)

P3703 | Experimental Validation of the Solid State Substation with Embedded Energy Storage Concept
Christian Klumpner, Mohamed Rashed, Dipankar De, Chintan Patel, Ponggorn Kuljangcharoen and Greg Asher, University of Nottingham, United Kingdom

P3704 | Understanding Dynamic Model Validation of a Wind Turbine Generator and a Wind Power Plant
Eduard Muljadi, Yingchen Zhang, Vahan Gevorgian and Dmitry Kosterev, National Renewable Energy Laboratory, United States

P3705 | A Brushless Doubly-fed Generator Based on Permanent Magnet Field Modulation for Wind Power Generation
Yongjiang Jiang, Jianzhong Zhang, Shuai Xu and Xing Hu, Southeast University, China

P3706 | Robust Sliding Mode Control for Permanent Magnet Synchronous Generator-Based Wind Energy Conversion Systems
Patrick Gu, Xin Wang and Max Reitz, Southern Illinois University Edwardsville, United States

P3707 | A Partially-Rated Active Filter Enabled Power Architecture to Generate Oscillating Power from Wave Energy Converter
Samir Hazra, Prathamesh Katam and Subhashish Bhattacharya, North Carolina State University, United States

P3708 | Hybrid Energy Storage System Comprising of Battery and Ultra-capacitor For Smoothing of Oscillating Wave Energy
Samir Hazra and Subhashish Bhattacharya, North Carolina State University, United States

## Smart Grid & Utility Applications

**Room:** Exhibit Hall  
**Chairs:** Johan H Enslin, Euzeli Santos Jr.

P3901 | A Series-LC-Filtered Active Trap Filter for High Power Voltage Source Inverter
Haofeng Bai, Xiongfei Wang, Poh Chiang Loh and Frede Blaabjerg, Aalborg University, Denmark

P3902 | Constant DC-Capacitor Voltage-Control-Based Strategy for Harmonics Compensation of Smart Charger for Electric Vehicles in Single-Phase Three-Wire Distribution Feeders with Reactive Power Control
Fuka Ikeda, Kei Nishikawa, Horiako Yamada, Toshihiko Tanaka and Masayuki Okamoto, Yamaguchi University, Japan; National Institute of Technology, Ube College, Japan

P3903 | A Series Active Damper with Closed-loop Control for Stabilizing Single-phase Power-Electronics-Based Power System
Dapeng Lu, Xiongfei Wang, HaoFeng Bai and Frede Blaabjerg, Aalborg University, Denmark

P3904 | A Grid-Interfaced Test System for Modeling of NiMH Batteries in a Battery-Buffered Smart Load Application
Ahmed Zurfi and Jing Zhang, University of Arkansas at Little Rock, United States

P3905 | Impedance-Based Stability Analysis of DFIG
Tianyi Wang, Yi Xiao, Xueguang Zhang and Dianguo Xu, Harbin Institute of Technology, China
P3906 | Online Variation of Wind Turbine Controller Parameters for Mitigation of SSR in DFIG based Wind Farms
Selam Chernet, Massimo Bongiorno, Gert Karmisholt Andersen, Torsten Lund and Philip Carne Kjaer, Chalmers University of Technology, Sweden; Vestas Wind Systems A/S, Denmark

P3907 | Three-Phase Single Stage Boost Inverter for Direct Drive Wind Turbines
Akanksha Singh and Behroz Mirafzal, Kansas State University, United States

P3908 | Secondary Side Modulation of a Single-stage Isolated High-frequency Link Microinverter with a Regenerative Flyback Snubber
Nareshkumar Kummmari, Shiladri Chakraborty and Souvik Chattopadhyay, Electrical Engineering Department, IIT Kharagpur, India

P3909 | Frequency Characterization of Type-IV Wind Turbine Systems
Nicolas Espinoza, Bongiorno Massimo and Carlson Ola, Chalmers University of Technology, Sweden

Datacenters and Telecommunication Applications

Room: Exhibit Hall
Chairs: Jin Wang, Yaosuo “Sonny” Xue

P4101 | Reliability Assessment of Fuel Cell System – A Framework for Quantitative Approach
Shinae Lee, Dao Zhou and Huai Wang, Norwegian University of Science and Technology, Norway; Aalborg University, Denmark

P4102 | New Soft-Switched Multi-Input Converters with Integrated Active Power Factor Correction for Hybrid Renewable Energy Applications
Sanjida Mouy, John Lam, Vineet Srivastava and Church Ron, York University, Canada; Cistel Technology Inc., Canada

P4103 | FPGA Based Implementation of Control for Series Input Boost Pre-regulator Under Unequal Loading
Anwesha Mukhopadhyay and Santantu Mishra, Indian Institute of Technology, Kanpur, India

Power Converter Topologies

Room: Exhibit Hall
Chairs: Pradeep S. Shenoy, Leon M Tolbert

P4501 | An Interleaved 1-to-6 Step-Up Resonant Switched-Capacitor Converter Utilizing Split-Phase Control
Andrew Stillwell, Derek Heeger, Christopher Meyer, Sarah Bedair and Robert Pilawa-Podgurski, University of Illinois at Urbana-Champaign, United States; Army Research Laboratory, United States

P4502 | Boost Composite Converter Design Based On Drive Cycle Weighted Losses in Electric Vehicle Powertrain Applications
Hyoseok Kim, Hua Chen, Robert Erickson and Maksimovic Dragan, University of Colorado at Boulder, United States

P4503 | Design of a Four-Phase Interleaved Boost Circuit with Closed-Coupled Inductors
Daigoro Ebisumoto, Masataka Ishihara, Shotya Kimura, Wilmar Martinez, Noah Mostafa, Masayoshi Yamamoto and Jun Imaoka, Shimane University, Japan; Shimane University, Colombia; Kyushu University, Japan

P4504 | Hybrid DC-DC Buck Converter with Active Switched Capacitor Cell and Low Voltage Gain
Mauricio Dalla Vecchia and Telles Lazzarin, Federal University of Santa Catarina – UFSC, Brazil

P4505 | High Gain Resonant Boost Converter For PV Micro-Converter System
Sachin Jain, Swami Satish Bhetta and Jih-Sheng (Jason) Lai, NIT Warangal, India; Virginia Polytechnic Institute, United States

P4506 | Design of Two-Switch Flyback Power Supply Using 1.7 kV SiC Devices for Ultra-Wide Input-Voltage Range Applications
Gabriele Rizzoli, Jun Wang, Zhixu Shen, Rolando Burgos, Dushan Boroyevich and Luca Zarri, University of Bologna, Italy; CPES-Virginia Tech, United States

P4507 | A Single-Stage Interleaved LLC PFC Converter
Rao Saasa, Wilson Eberle and Mohammed Agamy, The University of British Columbia, Canada; GE Global Research Center, United States

P4508 | Medium Voltage AC-DC Rectifier for Solid State Transformer (SST) Based on an Improved Rectifier Topology
Qianlai Zhu, Li Wang, Xijun Ni, Liqi Zhang, Wensong Yu and Alex Q. Huang, North Carolina State University, United States; Nanjing Institute of Technology, China

P4509 | Microcontroller-Based MHz Totem-Pole PFC with Critical Mode Control
Zhengrong Huang, Zhengyang Liu, Qiang Li and Fred Lee, CPES, Virginia Tech, United States

Transportation Electrification Applications

Room: Exhibit Hall
Chairs: Jin Wang, Yaosuo “Sonny” Xue

P4301 | Separating Key Less Well-Known Properties of Drive Profiles that Affect Lithium-ion Battery Aging by Applying the Statistical Design of Experiments
Ruxiu Zhao, Larry Juang, Robert Lorenz and Thomas Jahns, University of Wisconsin-Madison, United States; Undisclosed, United States

P4302 | Performance Degradation of Thermal Parameters during Cycle Ageing of NMC-based Lithium Ion Battery Cells
Tiberiu Stanciu, Daniel Stroe, Maciej Swierczynski, Nerea Nieto, Jon Gastelurrutia Roteta, Jean-Marc Tiemmermans and Remus Teodorescu, Aalborg University, Denmark; IKT Kharagpur, India

P4303 | Investigation of Current Sharing and Heat Dissipation in Parallel-Connected Lithium-Ion Battery Packs
Yichao Zhang, Ruxiu Zhao, Jacob Dubie, Larry Juang and Thomas Jahns, University of Wisconsin Madison, United States; Undisclosed, United States

P4304 | A Cooperative Charging Strategy for Onboard Supercapacitors of Catenary-Free Trams
Heng Li, Jun Peng, Rong Zhou, Zhihui Wu, Zhiwu Huang and Jianping Pan, Central South University, China; University of Victoria, Canada

P4305 | A High Frequency Zero-Voltage-Transition (ZVT) Synchronous Buck Converter for Automotive Applications
Chenhao Nan and Raja Ayyanar, Arizona State University, United States

P4306 | The Dual-Channel Magnetically Integrated Chargers for Plug-in Electric Vehicles
Bochen Liu, Zheng Wang, Yue Zhang, Ming Cheng and Liang Xu, Southeast University, China; Aviation Key Laboratory, China

P4307 | Power-Line Impedance Modeling of Tractor- Trailer System
Iftekhar Hasan, Aparna Saha, Mohammad Abul Elmutalab, Ibrahim Amt, Philip Kasper, Yilmaz Sozer and Marv Hamdan, University of Akron, United States; Bendix CVS, United States
P4510 | Three-Phase Isolated DCM SEPIC Converter for High Voltage Applications
Gabriel Tibola, Erik Lemmen and Ivo Babic, Eindhoven University of Technology, Netherlands; Federal University of Santa Catarina, Brazil

P4511 | Single Phase Precharge Control Method for Active Front End Rectifier
Lixiang Wei, Zeljko Jankovic, Yogesh Patel and Jianguang Hu, Rockwell Automation, United States

P4512 | Adaptive Controlled-type Zero-voltage-switching Inverters with Bandwidth Limitation
Dehua Zhang, Jiali Wang and Zhengyu Lv, Zhejiang University, China

P4513 | Half Bridge NPC Inverter and Its Three Phase Application with Constant Common Mode Voltage
Liwei Zhou, Feng Gao, Chongsheng Jia and Tao Xu, Shandong University, China; State Grid Jinan Li Cheng Power Supply Company, China

P4514 | Interleaved Auxiliary Resonant Snubber for High-Power, High-Density Applications
Rachael Born, Lanhua Zhang, Yu Wei, Qingqing Ma and Jason (Jih-Sheng) Lai, Virginia Tech Future Energy Electronics Center, United States

P4515 | Three-Phase Four-Wire Inverters Based on Cascaded Three-Phase Converters with Four and Three Legs
Joao Paulo Ramos Agra Mello, Cursino Bradoa Jacobina and Mauricio Beltrao Rossiter Correa, Universidade Federal de Campina Grande, Brazil

P4516 | Optimal Switching Counts Modulation of H7 Current Source Inverter
Weiqi Wang, Feng Gao, Lei Zhang, Chen Mengxing and Liwei Zhou, Shandong University, China; Shandong Electric Power Research Institute, China

P4517 | Cuk-Based Universal Converters in Discontinuous Conduction Mode of Operation
Mahshid Amirabadi, Northeastern University, United States

P4518 | Neutral Points Voltage Balancing Control of a Four-level pi-type Converter
Bosen Jin and Xibo Yuan, University of Bristol, United Kingdom

P4519 | A Novel Three-Phase Multilevel Diode-Clamped Inverter Topology with Reduced Device Count
Aparna Saha, Ali Elrayyah and Yilmaz Sozer, University of Akron, United States; Qatar Environmental and Energy Research Inst, Qatar

P4520 | Maximum Boost Space Vector Modulated Three-Phase Three-Level Neutral-Point-Clamped Quasi-Z-Source Inverter
Prasanth Sundararajan, Mohamed Sathik Mohamed Halick, Aaron Alexander Ayu, Tan Chuan Seng and Suresh Kumar K. S., Nanyang Technological University, Singapore; National Institute of Technology, India

Control, Modelling and Optimization of Power Converters

Room: Exhibit Hall
Chairs: Pericle Zanchetta, Luca Solero

P4701 | High Dynamic and Static Performance FCS-MPC Strategy for Static Power Converters
Rodrigo Mendez, Daniel Sbarbaro and Jose Espinoza, Concepcion University, Chile

P4702 | New Logic-Form-Equation Based Active Voltage Control for Four-Level Flying Capacitor Multicell (FCM) Converter
Arash Khoshkbar Sadigh, Vahid Dargahi and Keith Corzine, Extron Electronics, United States; Clemson University, United States

P4703 | Minimum RMS Current Operation of the Dual-Active Half-Bridge Converter using Three Degree of Freedom Control
Shiladi Chakraborty, Shailesh Tripathy and Souvik Chattopadhyay, Electrical Engineering Department, IIT Kharagpur, India; Electrical Engineering Department, NIT Rourkela, India

P4704 | Experimental Evaluations of Thinned-Out and PDM Controlled Class-E Rectifier
Akane Iwasaki, Tomoharu Nagashima and Hiroo Sekiya, Chiba University, Japan

P4705 | Variable Slope External Ramp to Improve the Transient Performance in Constant-On-Time Current Mode Control
Syed Bari, Brian Cheng, Qiang Li and Fred Lee, CPES, Virginia Tech, United States; Texas Instruments, United States

P4706 | PWM Methods for High Frequency Voltage Link Inverter Commutation
Minjeong Kim, Mostafa Mosa and Robert S. Balog, Texas A and M University, United States

P4707 | Switching Pattern of a Modular Voltage Balancing Circuit for Battery Cells
Atrin Tavakoli, Sayed Ali Khajehoddin and John Salmon, University of Alberta, Canada

P4708 | Steady State Impedance Estimation of a Weak Grid to Assist Optimal Current Injection for Minimal Power Losses
Akraka Khan, Azeem Khan and Michel Malemna, University of Cape Town, South Africa; University of Cape Town, South Africa

P4709 | A Single-phase Unified Power Quality Conditioner with An Enhanced Repetitive Controller
Dang-Minh Phan, Cong-Long Nguyen and Hong-Hee Lee, University of Ulsan, Korea (South)

P4710 | Single-Phase Universal Active Power Filter Based on AC/AC Converters
Phelipe Leal Seraphin Rodrigues, Cursino Brandao Jacobina and Mauricio Beltrao de Rossiter Correa, DEE UFCG, Brazil

P4711 | Circulating Resonant Current Between Integrated Half-Bridge Modules with Capacitor for Inverter Circuit Using SiC-MOSFET
Takashi Hirao, Keiji Wada and Toshihisa Shimizu, Tokyo Metropolitan University, Japan

P4712 | Computationally Efficient Event-Based Simulation of Switched Power Systems and AC Machinery
Christopher Wolf and Michael Degner, Ford Motor Company, United States

P4713 | Design Optimisation and Trade-offs in Multi-kW DC-DC Converters
James Scoitlock, Gerardo Calderon-Lopez, Yiren Wang and Andrew Forsyth, University of Manchester, United Kingdom

P4714 | Switching frequency optimization for a Solid State Transformer with Energy Storage Capabilities
Pablo Garcia, Sarah Saeed, Hannes Schneider, Angel Navarro-Rodriguez and Jorge Garcia, University of Oviedo, Spain; University of Stuttgart, Germany

P4715 | Lag-Free Terminal Voltage Sensing in Low-Pass Filtered PWM Converters
Adam Shea and Thomas Jahns, University of Wisconsin – Madison, United States
Electrical Machines

S Room: Exhibit Hall
Chairs: Bruno Lequesne, Mohammad Islam

P4901 | Cogging Torque Minimization with Rotor Tooth Shaping in Axial Flux-Switching Permanent Magnet Machine
Ju Hyung Kim, Yingjie Li, Emrah Cetin and Bulent Sarlioglu, University of Wisconsin-Madison, United States

P4902 | A 3D Printed Fluid Filled Variable Elastance Electrostatic Machine Optimized with Conformal Mapping
Baoyun Ge, Daniel Ludois and Ghule Aditya, University of Wisconsin-Madison, United States

P4903 | Effects of External Field Orientation on Permanent Magnet Demagnetization
Peng Peng, Han Xiong, Julia Zhang, Wanfeng Li, Franco Leonardi, Michael Degner, Chuabing Rong, Feng Liang and Leyi Zhu, Oregon State University, United States; Ford Motor Company, United States

P4904 | Analytical Approach for Determining Inductance Matrix, Harmonic Voltage and Torque Ripple of Slotless PM Motors
Kahyun Lee and Jung-ik Ha, Seoul National University, Korea (South)

P4905 | Cogging Torque Minimization in Transverse Flux Machines
Tausif Husain, Ittekhbar Hasan, Yilmaz Sozer, Iqbal Husain and Eduard Muljadi, University of Akron, United States; North Carolina State University, United States; National Renewable Energy Lab, United States

P4906 | Torque Ripple Reduction in a Flux-Switching Permanent Magnet Machine Targeted at Elevator Door Applications by Minimizing Space Harmonics
Hongsik Hwang, Dongjae Kim, Jin Hur and Cheewoo Lee, Pusan National University, Korea (South)

P4907 | On Saliency Enhancement of Salient Pole Wound Field Synchronous Machines
Wenbo Liu and Thomas A Lipo, University of Wisconsin-Madison, United States

P4908 | Fast and Accurate Analytical Calculation of the Unsaturred Phase Inductance Profile of 6/4 Switched Reluctance Machines
Sufei Li, Shen Zhang, Thomas Habetler and Ronald Harley, Georgia Institute of Technology, United States

P4909 | An Analytical Approach for Determining Harmonic Cupss and Torque Dips in Line Start Synchronous Reluctance Motors
Amir Naghadan, Vivek M. Sundaram and Hamid A. Toliyat, Texas A&M University, United States

P4910 | Multi-Objective Design and Optimization of Generalized Switched Reluctance Machines with Particle Swarm Intelligence
Shen Zhang, Sufei Li, Jie Dang, Ronald G. Harley and Thomas G. Habetler, Georgia Institute of Technology, United States; Faraday Future, Inc., United States

P4911 | Design and Comparison of Concentrated and Distributed Winding Synchronous Reluctance Machines
Bastian Lehner and Dieter Gerling, Universität der Bundeswehr München, Germany

P4912 | Reduction in Torque and Suspension Force Ripples of an Axial-Gap Single-Drive Bearingless Motor
Junichi Asama, Kazumasa Takahashi, Takaaki Ono and Akira Chiba, Shizuoka University, Japan; Tokyo Institute of Technology, Japan

P4913 | Advancements in High Power High Frequency Transformer Design for Resonant Converter Circuits
Ashraf Said Atalla, Mohammed Agamy, Mark Dame, Liwei Hao, Gary Dwayne Mandrusiak, Konrad Weeber and Yan Pan, GE Global Research Center, United States

P4914 | Active Damping of Ultra-fast Mechanical Switches for Hybrid AC and DC Circuit Breakers
Chang Peng, Landon Mackey, Iqbal Husain, Alex Huang, Bruno Lequesne and Roger Briggs, North Carolina State University, United States; E-Motors Consulting, LLC, United States; Energy Efficiency Research, LLC, United States

P4915 | A Diagnosis Procedure in Standalone Mode for Inter Turn Short Circuit Faults of PMSMs through Modified Self-Commissioning
Yuan Qi, Mohsen Zafarani and Bilal Akin, University of Texas at Dallas, United States

P4916 | Improved Condition Monitoring of the Faulty Blower Wheel Driven by Brushless DC Motor in Air Handler Unit (AHU)
Chen Jiang, Thomas Habetler and Wen-Ping Cao, Georgia Institute of Technology, United States; Aston University, United Kingdom

P4917 | Mitigation Method of the Shaft Voltage According to Parasitic Capacitances of the PMSM
Jun-Kyu Park, Thushitha Wellawatta, Sung-Jin Choi and Jin Hur, University of Ulssan, Korea, Republic of; Incheon National University, Korea, Republic of

P4918 | 3-D Equivalent Magnetic Circuit Network for Precise and Fast Analysis of PM-assisted Claw-Pole Synchronous Motor
Jae-Han Sim, Dong-Gyun Ahn, Doo-Young Kim and Jung-Pyo Hong, Automotive Engineering, Hanyang University, Korea (South)

P4919 | Superconducting and Conventional Electromagnetic Launch System for Civil Aircraft Assisted Take-off
Luca Bertola, The University of Nottingham, United Kingdom

P4920 | Design of Integrated Radial and Dual Axial-Flux Ferrate Magnet Synchronous Machine
Shoji Shimomura and Takatoshi Sunaga, Shibaura Institute of Technology, Japan

Plenary Poster Session: Power Semiconductor Devices, Passive Components, Packaging, Integration, and Materials

S Room: Exhibit Hall
Chairs: Giovanna Oriti, Enrico Santi

P5101 | Comprehensive Evaluation of a Silicon-WBG Hybrid Switch
Amol Deshpande and Fang Luo, The Ohio State University, United States; The Ohio State University, United States

P5102 | Characterization of Power Capacitors on Practical Current Condition Using Capacitor Loss Analyzer
Hironori Nagasaki, Pin-Yu Huang and Toshihisa Shimizu, Tokyo Metropolitan University, Japan; Tokyo Metropolitan University, Taiwan
P5103 | A Practical Liquid-Cooling Design Method for Magnetic Components of EMI Filter in High Power Motor Drives
Jing Xue and Fred Wang, University of Tennessee, United States

P5104 | Efficiency Modeling of Wireless Power Transfer ASICs Accounting for Layout Parasitics
Rosario Pagano, Siamak Abedinpour, Angelo Raciti and Salvatore Musumeci, Analog and Power Division, Integrated Device Tec, United States; DIEEI, University of Catania, Italy

P5105 | Direct Voltage Balancing for Series Connected IGBTs
Xueqiang Zhang, Jin Zhang and Patrick Palmer, University of Cambridge, United Kingdom

Energy Efficiency Systems and Applications

P5301 | Mitigation of Harmonics in Drilling Rigs using Shunt Active Power Filters
Muhammed Fasil Tp, Abdul R Beig, Rajashekharreddy Chilipi, Sai Kirshna Kanukollu, Najii Al Sayari and Khalifa Al Hosani, The Petroleum Institute, United Arab Emirates

P5302 | Variable Switching Frequency Algorithm for Optimal Tradeoff between Switching Losses and Total Demand Distortion in Grid-Tied Three-Phase Voltage-Source Inverters
Hamzeh Jamal, Saher Albutran and Issam Smadi, Jordan University of Science and Technology, Jordan

P5303 | A Hybrid Model Predictive Charging Control Strategy for Ultracapacitors of Urban Rail Vehicles
Yuanjun Chen, Xiaoyong Zhang, Zhixiu Huang, Jun Peng, Zheng Xu and Yanhui Zhou, Central South University, China

P5304 | A Universal-Input Single-stage AC-DC Converter for Twin-Bus Type High-Power LED applications
Hongbo Ma, Gang Chen, Yi Junhong, Meng Qingwei and Sha Deshang, Southwest Jiao tong University, China; Beijing Institute of Technology, China

P5305 | Control IC for TRIAC Dimming LED Driver with Quasi-Resonant Flyback Converter
Tsong-Juu Liang, Shih-Wen Tsai, Kai-Hui Chen and Ta-Wei Huang, National Cheng Kung University, Taiwan

Emerging Technologies and Applications

P5501 | Mutual Inductance Measurement for Power Device Package Using Time Domain Reflectometry
Kazunori Hasegawa, Keiji Wada and Ichiro Omura, Kyushu Institute of Technology, Japan; Tokyo Metropolitan University, Japan

P5502 | Synchronized Triple Bias-flip Circuit for Piezoelectric Energy Harvesting Enhancement Operation Principle and Experimental Validation
Yuheng Zhao and Junrui Liang, Shanghai Tech University, China

P5503 | Approaching Repetitive Short Circuit Tests on MW-Scale Power Modules by means of an Automatic Testing Setup
Paula Diaz Reigosa, Hui Wang, Francesco Iannuzzo and Frede Blaabjerg, Aalborg University, Denmark; Aalborg University, Denmark

P5504 | Cascaded Operation of SiC JFETs in Medium Voltage Solid State Circuit Breakers
Aref Moradkhani Roshandeh, Zhenyu Miao, Zaki Ahmad Daniyal, Yanjun Feng and Zheng John Shen, Illinois Institute of Technology, United States

P5505 | Hybrid Algorithm for Fault Locating in Looped Microgrids
Siavash Behehtaein, Mehdi Savaghebi, Juan Carlos Vasquez and Josep Guerrero, Aalborg University, Denmark
## Alphabetical Listing by Exhibitor Name

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Booth Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>5S Components Inc.</td>
<td>520</td>
</tr>
<tr>
<td>ABB Inc.</td>
<td>323</td>
</tr>
<tr>
<td>Abstract Power Electronics.</td>
<td>226</td>
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<tr>
<td>Advanced MotorTech</td>
<td>412</td>
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<td>Altair</td>
<td>406</td>
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<td>ANSYS, Inc.</td>
<td>324</td>
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<tr>
<td>Cambridge University Press</td>
<td>224</td>
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<tr>
<td>Cramer Coil &amp; Transformer</td>
<td>622</td>
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<td>CURENT - Center for Electric Power</td>
<td>313</td>
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<tr>
<td>Danfoss Drives</td>
<td>315</td>
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<td>Eaton Corporation</td>
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<td>HBM Test and Measurement</td>
<td>311</td>
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<td>How2Power.com</td>
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<td>Teledyne LeCroy</td>
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<td>Wolong Electric Group Co. Ltd.</td>
<td>229</td>
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## Numerical Listing by Booth Number

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**5S Components Inc.**

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Danfoss Drives is one of the largest companies in the drives industry, offering a large portfolio of VLT® and VACON® variable frequency drives. We are driven by a passion to develop, manufacture and sell the most versatile AC drives in the world. Backed by a unique depth of application knowledge, our drives are equipped with the newest innovation and can adapt to any motor technology. Learn how Danfoss Drives is engineering a better tomorrow at www.danfossdrives.com.

**Eaton Corporation**

Eaton is a power management company with 2015 sales of $20.9 billion. Eaton provides energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power more efficiently, safely and sustainably. Eaton has approximately 97,000 employees and sells products to customers in more than 175 countries. For more information, visit www.eaton.com.

**ELANTAS PDG, Inc.**

ELANTAS PDG, Inc. is the global leader in liquid electrical insulation products, including magnet wire enamel, insulating resins, potting compounds, conformal coatings, insulating films and a wide range of specialty resin systems and adhesives. ISO 9001, TS 16949. A Heritage of Innovation since 1919.

**Electronic Concepts, Inc**

Electronic Concepts is the recognized leader in film capacitor design and manufacture. Our vertical integration and innovative design capability offers the flexibility to meet your most demanding requirements and applications. Our latest development is on our LH3 Series with ESL less than 10 nH and film capacitors operating at 125°C, 150°C and 175°C.

**EMWorks Inc.**

EMWorks is a CAD embedded EM simulation software provider. Our EMS product allows engineers to study the performance of electro-mechanical components like motors, transformers, actuators, high power switches, sensors. Our HFWorks product helps improve the designs of RF and microwave components.

**EPCOS Inc.**

EPCOS brand devices are part of the extensive product portfolio of TDK Corporation, one of the largest manufacturers of electronic components, modules, systems, and devices in the world. The broad range of passive components supports power electronics, which includes active and passive filtering devices for improved power efficiency and quality, capacitors, inductors, high-frequency components and modules, piezo and protection devices, and sensors.
GaN Systems

1145 Innovation Dr., Suite 101
Ottawa, ON K2K 3G8
Canada
613-686-1996
gpatterson@gansystems.com
www.gansystems.com

GaN Systems is the first place systems designers go to realize all of the benefits of gallium nitride in their power conversion and control applications. To overcome silicon’s limitations in switching speed, temperature, voltage, and current, the Company develops the most complete range of gallium nitride power switching solutions for a variety of markets. Its unique Island TechnologyTM addresses today’s cost, performance, and manufacturability-related challenges of gallium nitride resulting in devices that are approximately four times smaller, four times more efficient, and one quarter the cost of traditional design approaches.

General Motors

777 Joslyn Ave
Pontiac, MI 48340
USA
248-496-8501
khwaja.rahman@gm.com
www.gm.com

General Motors (GM) is a global automotive company. From electric mini-cars to heavy-duty full-size trucks, General Motors provides a complete range of vehicles that meets the needs and expectations of drivers on a truly global scale. There are 9 distinctive automotive brands under the General Motors corporate umbrella: Chevrolet, Buick, GMC, Cadillac, Opel, Vauxhall, Holden, Baojun and Wuling and Jiefang. Historically, General Motors technology has always been on the forefront. GM continues to excel in propulsion system development, and strive to push exciting advancements in alternative energy and purposeful vehicle design. A key focus of GM’s customer-first approach is to seek creative and innovative solutions for the environment. GM consistently adopt policies and develop technologies that focus of GM’s customer-first approach is to seek creative and innovative solutions for the environment. GM consistently adopt policies and develop technologies that promote a cleaner planet from supply chain to manufacturing to the vehicles GM put on the road.

GMW Associates

955 Industrial Road
San Carlos, CA 94070
USA
650-802-8292
ben@gmw.com
www.gmw.com

We are a Distributor and Integrator of Sensors, Transducers, Instruments and Systems based on magnetics. Products and support are provided for: non-contact, isolated sensing of mechanical position and magnetic material; magnetic field and magnetic property measurement; electric current measurement and control; magnetic field generation and control; particle beam control and acceleration.

HBM Test and Measurement

19 Bartlett Street
Marlborough, MA 01752
USA
608-443-9785
mike.hoyer@hb.com
www.hbm.com

For over 65 years, HBM has stood for reliability, precision and innovation. With offices all around the world, HBM develops and manufactures products for an extensive range of measurement applications in many industries. These products include strain gauges, data acquisition systems, sensors and transducers, as well as software for structural durability investigations, tests and analysis. HBM offers real time power measurement solutions with advanced analysis for optimizing electric machines and inverters including accelerated motor mapping and Clarke and Park Transformations. Clients rely on HBM to guide their design, development, production and maintenance, to optimize their product life cycles and improve efficiency.

How2Power.com

www.how2power.com

HOW2POWER.COM: • A free power electronics website for engineers, students, and instructors.
Great source of practical power design information. Sign up for our free monthly newsletter, How2Power Today, which presents in-depth articles on power supply toponologies, control methods, circuits, magnetics, SiC & GaN developments, and much more.

HVR Advanced Power Components Inc.

2090 Old Union Rd.
Cheektowaga, NY 14227
USA
716-693-4700
enrialthoff@hvrapc.com
www.hvrapc.com

HVR provides cost-effective engineered solutions for high-stress resistor applications. Application areas include: Industrial, T&D, High Voltage Pulsed Power, Research, Transportation, and Medical. Our solid composition resistors provide a solution for high voltage, non-inductive and high peak power resistive applications. We utilize our decades of experience and unique materials approach to engineer a low-cost application-specific solution.

IEEE ECCE

www.ieeeecce.org

IEEE ECCE is the foremost IEEE conference in the field of electrical and electromechanical energy conversion, co-sponsored by the IEEE Power Electronics Society (PELS) and the IEEE Industrial Applications Society (IAS). ECCE has steadily grown in scope, quality, and number of technical papers, attendance, and involvement of the industry. It provides engineers, researchers, and professionals a perfect blend of state of the art, technical prowess and commercial opportunities in one attractive location.

IEEE Industry Applications Society (IAS)

445 Hoes Lane
Piscataway, NJ 08854
USA
732-465-5804
ias-administrator@ieee.org
www.ias.ieee.org

For more information, please visit our website.
The Industry Applications Society supports the advancement of the theory and practice of electrical and electronic engineering in the development, design, manufacture and application of electrical systems, apparatuses, devices and controls to the processes and equipment of industry and commerce; the promotion of safe, reliable and economical installations; industry leadership in energy conservation and environmental health and safety issues; the creation of voluntary engineering standards and recommended practices; and the professional development of its membership.

IEEE Power Electronics Society (PELS)  
BOOTH 623

445 Hoes Lane
Piscataway, NJ 08854
USA
732-465-6480
pels-staff@ieee.org
www.ieee-pels.org

The Power Electronics Society is one of the fastest growing technical societies of the Institute of Electrical and Electronics Engineers (IEEE). For over 20 years, 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 toward efficient conversion, control and condition of electric power. Our 7,000 members include preeminent researchers, practitioners, and distinguished award winners. IEEE PELS publishes the IEEE Transactions on Power Electronics, a top referenced journal among all IEEE publications.

The Power Electronics Society is dedicated to:
- Upholding the vital scientific and educational aspects of power electronics and its applications.
- Keeping its members around the globe up to date on state-of-the-art technological developments and advances in power electronics research.

In striving to build knowledge and awareness of the latest technologies and other advances in power electronics, the Power Electronics Society’s goal is to keep members current and competitive in the workplace, and provide them with the tools necessary to help them grow both personally and professionally. We invite you to join us, and benefit from a world of invaluable information and support.

Infineon Technologies Americas Corp.  
BOOTH 328

101 N. Sepulveda Blvd.
El Segundom, CA 90245
USA
310-726-8149
maria.guardiola@infineon.com
www.infineon.com

Infineon modules are the premier choice for industrial/general purpose drives, high-voltage transmission systems, uninterruptible power supplies and renewable energy applications. A recognized technology leader in IGBT products, Infineon offers a comprehensive portfolio in different voltage and current classes; offered as bare dies, discretes components, power modules and complete stack solutions.

Infolytica Corporation is the developer of MagNet 2D/3D, the leading electromagnetic field simulation software, and ElecNet 2D/3D for electric fields. Some typical design applications include transformers, motors, DC-DC converters, sensors/NDT and much more.

Keysight Technologies  
BOOTH 527

550 Clark Drive
Budd Lake, NJ 07852
973-448-7153
celeste-jenkins@keysight.com
www.keysight.com

Keysight solutions cover your needs for selecting the right power components, designing for efficient power conversion, validating power conversion device performance, and final device test.

LEM USA Inc.  
BOOTH 321

11665 W. Bradley Rd.
Milwaukee, WI 53224
USA
414-353-0711
jam@lem.com
www.lem.com

LEM is an innovative global leader in the design and manufacture of Current and Voltage Transducers. With their unique ability to design custom ASIC’s, LEM has upgraded their Open Loop and Closed Loop transducer portfolio for maximum performance.

MagneForce Software Systems, Inc.  
BOOTH 322

5655 South Park Ave
Hamburg, NY 14075
USA
716-646-8577
pbaldassari@magneforcess.com
www.magneforcess.com

Software for design and simulation of rotating electric machinery. MagneForce products combine Finite Element techniques together with various time based circuit models to provide a total electric machine design environment. Analysis of both the machine and the drive/load circuitry allows MagneForce to compute directly all machine performance parameters.

MathWorks  
BOOTH 514

3 Apple Hill Drive
Natick, MA 01760
USA
508-647-7000
jennifer.rose@mathworks.com
www.mathworks.com

The MATLAB and Simulink product families are fundamental applied math and computational tools adopted by more than 5000 universities and colleges. MathWorks products help prepare students for careers in industry, where the tools are widely used for data analysis, mathematical modeling, and algorithm development in collaborative research and new product development.
Mersen
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978-462-6662
ann.sicard@mersen.com
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Mersen integrates its extensive expertise in cooling and heatsink technology, laminated bus bar design and semiconductor fuses in your power electronics applications to make them safe, reliable and profitable. With industrial operations in major economic regions of the globe, Mersen’s engineering teams provide local customer support with innovative best-fit solutions!

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Germany
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www.mesago.de

PCIM Europe is the international leading exhibition and conference for power electronics and its fields of application. Industry experts amongst others from industrial and automotive electronics, focus on this specialist field. The exhibition covers the entire supply chain: from the component up to drive electronics, packaging and the final intelligent system.

Myway Plus Corporation
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Don’t hesitate C programing and FPGA for your control. Introducing seamless connection between PE-Expert4 and PE-Inverter, the cost effective, scalable and all-in-one universal platform with the latest digital technology, supporting over 100 gate control and integrated power analyzer. This comes with visualized software development bench for easy C programing. Feel free to drop by our booth to see our demo.

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Canada
514-935-2323
vanessa.brocoll@opal-rt.com
www.opal-rt.com

OPAL-RT TECHNOLOGIES is a leading developer of open, real-time digital simulators and Hardware-In-the-Loop testing equipment for electrical, electro-mechanical and power electronics systems. Our validation and test benches are used by engineers and researchers at leading manufacturers, utilities and universities worldwide. Our technological approach integrates parallel, distributed computing with commercial-off-the-shelf technologies.

Payton America Inc
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Deerfield Beach, FL 33442
USA
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Payton is the world leader in the design and manufacturing of planar magnetics for SMPS’s. Designs in 24 hours and samples in few weeks from few watts to over 100kW, from 20kHz to 5MHz. Production and designs centers in US, Israel, UK, China & Philippines.

Plexim, Inc
5 Upland Rd, Suite 4
Cambridge, MA 02140
USA
617-209-2121
eberle@plexim.com
www.plexim.com

Plexim provides solutions for the design and test of power electronic systems. PLECS is a simulation software tool for developing such systems and their associated controls. Plexim also now offers its own hardware-in-the-loop (HIL) platform and a processor-in-the-loop (PIL) tool for developing, testing, and validating embedded controls, and a web-based simulator (WBS) for educational and marketing purposes.

Powerex, Inc
173 Pavilion Lane
Youngwood, PA 15697
USA
724-925-7272
kbandiermonte@pwrx.com
www.pwrx.com

Powerex is a leading supplier of discrete devices, modules and integrated high power semiconductor solutions. Its broad product line includes IGBTs (Insulated Gate Bipolar Transistors), HVIGBTs, IPMs (Intelligent Power Modules), rectifiers, thyristors, custom power modules and assemblies.

Powersim Inc.
2275 Research Blvd., Suite 500
Rockville, MD 20850
USA
301-841-7445
schlesley@powersimtech.com
www.powersimtech.com

PSIM is a power electronics simulation tool that empowers engineers to accelerate the pace of innovation with the fastest, most reliable and easy-to-use solution. PSIM provides expert technical support and delivers systems-level solutions that integrate smoothly with other popular engineering platforms. PSIM is trusted by academics and professionals alike in over 70 countries to test hypotheses early and easily, and get from design to implementation accurately and quickly.
Typhoon HIL, Inc. is the market and technology leader in the rapidly-growing ultra-high-fidelity controller-Hardware-in-the-Loop (cHIL) for power electronics, microgrids, and distribution networks which provides industry-proven, vertically integrated test solutions along with the highest-quality customer support. The company was founded in 2008 and since then has been creating products distinguished by the ultimate ease of use, unrivaled performance, leading-edge technology, and affordability. With a growing list of global clients in industries including renewables, industry automation, oil and gas, energy storage, and automotive, Typhoon HIL has emerged as the industry leader in automated test and verification of power electronics control systems.

VisiIC Technologies

VisiIC was established in 2010 to be a provider of high-voltage (650V and above), high-volume GaN transistors and switches to the ever-growing and rapidly changing power conversion market. VisiIC’s technical team had over 20 years of cumulative experience in design, manufacture and application of GaN-based RF devices when they incorporated VisiIC. Applying their in-depth understanding of the core materials and associated physics of GaN-based devices, they have created a true GaN Metal-Insulator-Semiconductor High Electron Mobility Transistor (MISHEMT) that is normally-OFF in its native mode. VisiIC Technologies has demonstrated worldwide record with performance of its Half Bridge demonstration board, achieving better than 99.3% peak efficiency at 200 kHz in a hard-switched topology providing 2.5KW output.

Wolong Electric Group Co. Ltd.

Wolong Electric is one of the largest motor and drive manufacturers in the world. It focuses on innovation and new technology development. Our products are widely used in various of industries, such as home appliances, HVACs, industrial drives, oil and gas, mining, nuclear and power generation, etc. Through strategic acquisitions, Wolong Group includes some of the most valuable and experienced motor manufactures and brands in the world, such as ATB, Brook Crompton, Schorch, Laurence Scott, Morley, CNE (China Nanyang Explosion-Proof Motors), Haier Motor, Rongxing Drive, QJEM etc. We are proud of our heritage and confidence in our products which are acknowledged in the market, Wolong was a part of world’s leading companies in the industry. For more information, visit our website at wolong.com.

ZES ZIMMER Inc.

ZES ZIMMER is a German maker of precision power analyzers and accessories, with proprietary and invaluable advantages for measuring inverters, frequency converters and other PWM applications. DC - 10MHz, advanced filtering, easy waveform display/export, automated CE harmonics/flicker test and intuitive UI. Up to 8 channels (elements) and speed/torque inputs.
**Product and Services Sessions**

**Monday, September 19th | Room 103C | 12:30PM – 3:30PM**

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**HBM Test and Measurement**

**Speaker:** Mike Hoyer, Applications/Marketing Engineer  
mike.hoyer@hb.com

**12:30PM | Rapid Electric Motor and Drive Efficiency Mapping, Going Beyond A Typical Power Analyzer.** Motor efficiency testing has become extremely important. Testing with a typical power analyser only offers inadequate numerical results. Instead, all electrical and mechanical signals must be acquired and analysed simultaneously at high sample rates with fast transfer to automation systems for accurate and rapid electric motor and drive efficiency mapping.

---

**EPCOS Inc.**

**Speaker:** Matt Reynolds, Field Applications Engineering Manager, Industrial Market  
debbie.martin@epcos.com

**1:30PM | CeraLink™ Compact Solution for Fast-Switching and Snubber Applications.** To achieve the goal of higher efficiencies, smaller size and lower cost, power electronics continue to demand capacitor technologies with much higher resonant frequencies. Paramount is a requirement for both very low inductance and low effective series resistance for the purposes of integration into semiconductor modules that require higher temperature stability, unwavering reliability and overall longer useful life. CeraLink™, is offered as a solution for these new technical requirements. Join our 30-min seminar as we demonstrate the high-performance benefits of this new technology.

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**MathWorks**

**Speaker:** Tony Lennon, Motor & Power Applications  
jennifer.rose@mathworks.com

**1:30PM | Model-Based Design for Motor and Power Control Applications.** Simulation helps engineers apply power electronics and advance control design to electric vehicles, renewable energy, and motor control. Model-Based Design with MATLAB and Simulink offers an environment that enables developers to explore advanced control concepts, capture requirements, design and validate using simulation, and implement ideas for production. This session will examine the scope of MathWorks solution for Model-Based Design.

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**VisIC Technologies**

**Speaker:** Dr. Tamara Baksh, CEO  
anna@visic-tech.com

**1:00PM | GaN HEMT: Design for Efficiency.** VisIC Technologies will present its GaN components enabling a new generation of power conversion systems to deliver the Long standing GaN promise of high efficiency and low system cost.

Based on novel GaN die design and attention to the requirements for system integration, VisIC’s ALL-Switch components switch at high speed without oscillation using readily available off-the-shelf drivers with a minimum of external components. VisIC has demonstrated greater than 99% efficiency on power system building blocks in hard switching at 200kHz, and will demonstrate switching on multiple building blocks at ECCE.

The VisIC’s GaN devices are optimized to deliver high efficiency switching on high and low loads, making these devices especially attractive for data servers power supplies and other applications working on partial load most of the time.

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**Keysight Technologies**

**Speaker:** Monika Little, Application Engineer  
monika.little@keysight.com

**2:30PM | KNOW THY POWER: Power Analysis for Energy Conversion Devices.** Proper evaluation of a product’s efficiency depends on accurate power measurements. There are a variety of ways to measure power. Since some are more accurate than others, choosing the right method to characterize and evaluate any power conversion device design, whether it is DC or AC, single or three phase system, is critical for success of the design project.

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**Eaton Corporation**

**3:00PM**

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**Wolong Electric Group Co. Ltd.**

**Speaker:** Zheng Zhang Ph.D., Fellow IEEE  
zhangzheng@wolong.com

**3:30PM | Wolong Electric – A dynamic company growing with innovation and global operation.** In the past decade, through the global acquisition, Wolong rapidly becomes a multiple national company, the fourth largest electrical machine manufacturer in the world. This presentation will be an opportunity to introduce the company’s core products, manufacturing capability and the strategies how to grow our business with innovation and the synergy in global operation.
In this event, 17 university student teams will demonstrate their hardware or video of hardware operations. The objective of this student demo program is to show the prototype built by the students to the industry participants and provide an opportunity for potential technology transfer from academic research to industry products. Student demonstrations will take place in Exhibit Hall A during the following times:

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Demonstrator</th>
<th>Advisor</th>
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<tbody>
<tr>
<td>Smart Battery Condition Monitoring and Diagnostics System</td>
<td>Ralph Chang</td>
<td>Henry Chung</td>
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<tr>
<td>City University of Hongkong</td>
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<td>Advanced Cell-level Control for Extending Electric Vehicle Battery Pack Lifetime</td>
<td>Muneeb Rehman</td>
<td>Regan Zane</td>
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<tr>
<td>Utah State University</td>
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<td>SA Compact Capacitive Power Transfer System for Electric Vehicle Charging Application</td>
<td>Fei Lu</td>
<td>Heath Hoffman</td>
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<td>University of Michigan</td>
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<tr>
<td>Product Oriented Design of Open Winding PMSM Drives for E-Bike</td>
<td>Hanlin Zhan</td>
<td>Z.Q. Zhu</td>
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<td>The University of Sheffield</td>
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<tr>
<td>Ultra-high Power Density GaN Inverters</td>
<td>He Li</td>
<td>Jin Wang</td>
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<td>The Ohio State University</td>
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<td>Comparing Common Mode Noise and the Impact of Transformers in Both GaN and Si Photovoltaic Inverters</td>
<td>Bailey Hall</td>
<td>Mark Scott</td>
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<td>Miami University</td>
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<tr>
<td>2-kVA High Power Density and High Efficiency Inverter for Google Little Box Challenge</td>
<td>Xiaonan Zhao</td>
<td>Jason Lai</td>
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<td>Virginia Tech</td>
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<td>Novel SiC Power Device and Power Module for High Frequency, High Voltage Application</td>
<td>Xiaoqing Song</td>
<td>Alex Huang</td>
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<td>North Carolina State University</td>
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<td>On Reactive Power Injection Control of Distributed Grid-tied AC-Stacked PV Inverter Architecture</td>
<td>R Hamid Jafarian</td>
<td>Babak Parkhideh</td>
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<td>University of North Carolina at Charlotte</td>
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<td>Dynamic Matching System for Radio-Frequency Plasma Generation</td>
<td>Anas Al Bastami</td>
<td>Dave Perreault</td>
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<td>MIT</td>
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<td>High Power Density Impedance Control Network DC-DC Converter Utilizing an Integrated Magnetic Structure</td>
<td>Ashish Kumar</td>
<td>Khurram Afridi</td>
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<td>University of Colorado Boulder</td>
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<td>Development and Investigation of a Battery-Buffered Smart Load</td>
<td>Ahmed Zurfi</td>
<td>Jing Zhang</td>
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<td>University of Arkansas at Little Rock</td>
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**Monday, September 19th**

4:10PM – 6:30PM
A 2kW Single-Phase Inverter with a Power Density of 216 W/in³ for the Google Little Box Challenge

Demonstrator: Shibin Qin
University of Illinois Urbana-Champaign
Advisor: Robert Pilawa

An 800 V GaN-based, 3.1 kW, 13-Level Inverter for Electric Aircrafts with a 1.4 MHz Effective Ripple Frequency

Demonstrator: Thomas Foulkes
University of Illinois Urbana-Champaign
Advisor: Robert Pilawa

Synchronous Generator Field Excitation Via Capacitive Coupling Through a Journal Bearing

Demonstrator: Jiejian Dai
University of Wisconsin
Advisor: Dan Ludois

A 3D Printed Fluid Filled Variable Elastance Electrostatic Machine Optimized with Conformal Mapping

Demonstrator: Baoyun Ge
University of Wisconsin
Advisor: Dan Ludois
The Ninth Annual IEEE Energy Conversion Congress and Exposition (ECCE 2017) will be held in Cincinnati, OH, on October 1 - 5, 2017. ECCE 2017 is the pivotal international conference and exposition event on electrical and electromechanical energy conversion field. ECCE 2017 will feature both industry-driven and application-oriented technical sessions and seminars, as well as exhibitions. ECCE 2017 will bring together practicing engineers, researchers and industry professionals for interactive and multidisciplinary discussions on the latest advances in various areas related to energy conversion.

Technical papers are solicited on any subject pertaining to the scope of the conference that includes, but is not limited to, the following major topics:

**Energy Conversion Systems and Technologies**
- Renewable and alternative energy systems
- Smart grids, micro grids and utility applications
- Electrical energy storage systems.
- Energy conversion systems for Information Technology and communication systems
- Technologies and systems for energy harvesting
- Energy efficiency for residential, commercial and industrial applications
- Wireless power transfer (WPT)
- Systems for Transportation Electrification
- High power/voltage power converters and applications
- High voltage isolation and lightning strike protection
- Lighting Applications and Displays

**Components and Subsystems for Energy Conversion**
- Power electronic devices (Si and Wide band-gap) and applications
- Power conversion topologies, modulation, and control
- Rotating/linear electro-mechanical devices and drive systems
- Passive components and associated material technology
- Power electronic packaging and integration
- Modelling of energy conversion components, converters and systems
- Reliability, diagnostics, prognostics, and health management
- Measurement techniques and EMC

**Paper Submission Guideline:** Prospective authors are requested to submit a digest no longer than five (5) pages, single column, single spaced, summarizing the proposed paper. The digest should include key equations, figures, tables and references as appropriate, but no author names or affiliations. **Deviations from these essential requirements will be grounds for immediate rejection.** The digests must clearly state the objectives of the work, its significance in advancing engineering or science, and the methods and specific results in sufficient detail. The digests will be reviewed using a double-blind peer review process to ensure confidentiality and fair review. Please refer to the conference website for a detailed list of technical topics and the digest submission method.

**IMPORTANT DATES**

- **January 15, 2017**
  Digest submitted via the website
- **May 1, 2017**
  Notification of acceptance or rejection
- **June 30, 2017**
  Final papers with IEEE copyright forms

**CALL FOR PAPERS**

**ABOUT CINCINNATi**
Located on the Ohio River, Cincinnati is a unique blend of a vibrant, fun, sophisticated and business oriented city with rich culture, exquisite architecture, entertainment, cuisine and shopping. The city is located in the southwestern corner of Ohio with its environs spreading towards two neighboring states - Kentucky and Indiana. Cincinnati is home to major companies involved in manufacturing, energy, information technology and finance. The city proudly serves as the headquarters for several international Fortune 500 companies. Cincy is easily accessible with direct flights from major cities worldwide. ECCE 2017 will be held in the Duke Energy Convention Centre, known for its ultramodern facilities and award-winning environmental sustainability performance through its STEP UP plan.

**ECCE 2017 Technical Program Chairs**
Emmanuel Agamloh  
**Advanced Energy, USA**
David Dorrell  
**University of KwaZulu Natal, South Africa**
Ryan Li  
**University of Alberta, Canada**
Mircea Popescu  
**Motor Design Ltd., U.K**
Pat Wheeler  
**University of Nottingham, U.K**

Please visit [http://www.ieee-ecce.org/2017](http://www.ieee-ecce.org/2017) for more information or contact the ECCE 2017 Technical Program Chairs at ecce2017tpc@gmail.com. For exhibiting at ECCE 2017, please contact Exhibition Chair, Jennifer Vining at ecce2017expo@gmail.com. For more about Cincinnati and its surrounding areas, please visit [http://www.cincyusa.com](http://www.cincyusa.com).
The Ninth Annual IEEE Energy Conversion Congress and Exposition (ECCE 2017) will be held in Cincinnati, OH, on October 1 – 5, 2017. The conference will bring together practicing engineers, researchers and other professionals for interactive discussions on the latest advances in various areas related to energy conversion. ECCE is the foremost technical conference and exposition for people looking for energy conversion solutions; solutions that are timely, practical, customer focused, market sensitive, and cost effective. Engineers from throughout the energy conversion industry's broad spectrum come to ECCE specifically to take advantage of the concentrated brain trust assembled annually in one very special location to do business in a convivial and innovative atmosphere, a perfect blend of state of the art technical prowess and commercial opportunities under one roof.

The ECCE organizing committee invites proposals for half-day tutorials to be presented on Sunday October 1, 2017. The organizing committee is particularly interested in tutorials that are of value to the practicing engineer, with an emphasis on solutions to practical problems. Tutorials are solicited on any subject pertaining to the scope of the conference that includes, but is not limited to, the major topics listed below.

Energy Conversion Systems and Technologies
- Renewable and alternative energy systems
- Smart grids, micro grids and utility applications
- Electrical energy storage systems.
- Energy conversion systems for Information Technology and communication systems
- Technologies and systems for energy harvesting
- Energy efficiency for residential, commercial and industrial applications
- Wireless power transfer (WPT)
- Systems for Transportation Electrification
- High power/voltage power converters and applications
- High voltage isolation and lightning strike protection
- Lighting Applications and Displays

Components and Subsystems for Energy Conversion
- Power electronic devices (Si and Wide band-gap) and applications
- Power conversion topologies, modulation, and control
- Rotating/linear electro-mechanical devices and drive systems
- Passive components and associated material technology
- Power electronic packaging and integration
- Modelling of energy conversion components, converters and systems
- Reliability, diagnostics, prognostics, and health management
- Measurement techniques and EMC

Tutorials accepted for presentation will receive one conference registration together with an honorarium for $1000. Note that publication of a technical paper at the conference will still require a full paid registration.

**Tutorial Proposal Submission Guidelines:** Tutorial proposals should be submitted as a digest summarizing the content of the tutorial. Please follow the attached tutorial proposal form as the tutorial submission guideline.

**IMPORTANT DATES**

**February 17, 2017**
Submission of completed one-page Tutorial Proposal Form

**March 27, 2017**
Notification of acceptance. Accepted tutorials will be advertised by the committee after this date.

**June 30, 2017**
Full tutorial materials must be submitted for publication in the tutorials book.

**ECCE 2017**
Tutorials Chair
Julia Zhang
Oregon State University

Please submit the completed Tutorial Proposal Form and any questions regarding this call directly to the Tutorials Chair, Julia Zhang via email at zhangjul@eecs.orst.edu
1. Title of Tutorial

2. Abstract
(No more than 500 words. If the tutorial is accepted, this abstract will be published on the conference website, program, and proceedings)

3. Outline of Tutorial
(Outline would only define the topics and the subtopics that would be covered. No detailed descriptions should be included in the proposal)

4. Lead Instructor
(Name, affiliation, and contact information)

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5. Other Instructor(s) if applicable
(Name, affiliation, and contact information)

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6. Instructor Bios: ~150 Words
(Please provide a brief biography for each instructor, describing the qualifications for presenting the proposed tutorial, including the work and publications that are most relevant to the proposal)

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The Ninth Annual IEEE Energy Conversion Congress and Exposition (ECCE 2017) will be held in Cincinnati, OH, on October 1 – 5, 2017. ECCE 2017 is the pivotal international conference and exposition event on electrical and electromechanical energy conversion field. ECCE 2017 will feature both industry-driven and application-oriented technical sessions, as well as industry expositions and seminars. ECCE 2017 will bring together practicing engineers, researchers and other professionals for interactive and multidisciplinary discussions on the latest advances in various areas related to energy conversion. ECCE has grown to become the foremost technical conference and exposition around electrical and electromechanical energy conversion. It focuses on solutions that are industrially oriented. People from a broad spectrum of the energy conversion industry and academia gather yearly at ECCE to interact in a convivial and innovative atmosphere, a perfect blend of state of the art, technical prowess and commercial opportunities in one attractive location.

The ECCE organizing committee invites organizers interested in organizing Special Sessions. Such sessions consist of oral presentations only, without written papers and are strongly oriented towards the latest industrial interest as well as the latest collaboration opportunities between industry and academia. Presentations may be a more commercial nature than those related to the papers in the standard technical sessions, and the organization of the sessions are more malleable and could be in the form of panel discussions. Audience participation and open source brainstorming sessions on focused topics are welcomed. Papers presented in special sessions are not subject to peer review and will not be made available in the conference proceedings. Presenters are encouraged to distribute their presentations through the conference mobile app.

Presentations are solicited on any subject pertaining to the scope of the conference described in its Call for Papers (obtainable from www.ieee-ecce.org/2017). Those that will address the following aspects of growing interest and innovation are encouraged:

- Standard development for power electronics systems / products
- Power Supply on Chip (PwrSoC) and related technology
- High Efficiency, flicker free LED light fixtures
- DC Microgrid: trend, requirement, and technologies
- Innovative materials for improved components and/or systems in electrical and electromechanical energy conversion
- Components and systems for electrical applications in the oil & gas and mining sectors.
- Technologies and systems for large, cycle-efficient and cycle-intensive energy storage.
- Modelling of materials oriented to improve the estimation of the energy efficiency in the components and systems using them.
- Reliability, diagnostics and prognostics of components and modular systems.

**IMPORTANT DATES**

**March 31, 2017**
Special Session proposal submissions deadline (maximum five pages)

**May 1, 2017**
Notification of session acceptance

For more about Cincinnati and its surrounding areas, please visit http://cincyusa.com

For submission and information regarding the ECCE 2017 Special Sessions, please contact the ECCE Special Session Chair peter.wung@ge.com

**FOR MORE CONFERENCE INFORMATION, PLEASE VISIT**
http://www.ieee-ecce.org/2017