Your Bridge to a Clean and Sustainable Energy Future

PROGRAM
ECCE 2014 would like to express our gratitude for the generous support received from the following:

Platinum Supporter
ABB

Gold Supporter
imagination at work

Silver Supporter
Halla
Mechatronics

Exhibit Hall Reception Supporter
Ingersoll Rand
Inspiring Progress™

Media Partners
Bodo’s Power Systems®
e•DRIVE
HOW2POWER.COM
MAGNETICS BUSINESS & TECHNOLOGY
Micronews

Association Partner
SMMA
The Motor & Motion Association
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome Letter</td>
<td>2</td>
</tr>
<tr>
<td>ECCE 2014 Leadership</td>
<td>4</td>
</tr>
<tr>
<td>Downtown Pittsburgh Map</td>
<td>6</td>
</tr>
<tr>
<td>David L. Lawrence Convention Center Floor Plans</td>
<td>7</td>
</tr>
<tr>
<td>Schedule-at-a-Glance</td>
<td>8</td>
</tr>
<tr>
<td>Detailed Schedule</td>
<td>10</td>
</tr>
<tr>
<td>Event Services</td>
<td>22</td>
</tr>
<tr>
<td>General Information</td>
<td>23</td>
</tr>
<tr>
<td>Special Events</td>
<td>24</td>
</tr>
<tr>
<td>Presenter Information</td>
<td>25</td>
</tr>
<tr>
<td>Plenary Session</td>
<td>27</td>
</tr>
<tr>
<td>Townhall Meetings</td>
<td>28</td>
</tr>
<tr>
<td>Tutorials</td>
<td>29</td>
</tr>
<tr>
<td><strong>Technical Program Schedule</strong></td>
<td>32</td>
</tr>
<tr>
<td>Oral Sessions</td>
<td>32</td>
</tr>
<tr>
<td>Poster Sessions</td>
<td>56</td>
</tr>
<tr>
<td>Committee Meetings</td>
<td>70</td>
</tr>
<tr>
<td><strong>Exposition</strong></td>
<td>72</td>
</tr>
<tr>
<td>Exhibit Hall Floor Plan</td>
<td>72</td>
</tr>
<tr>
<td>Exhibitor Listing</td>
<td>73</td>
</tr>
<tr>
<td>Exhibitor Directory</td>
<td>74</td>
</tr>
<tr>
<td>Student Demonstrations</td>
<td>79</td>
</tr>
<tr>
<td><strong>ECCE 2015 Information</strong></td>
<td>80</td>
</tr>
<tr>
<td>Call for Papers</td>
<td>80</td>
</tr>
<tr>
<td>Call for Tutorials</td>
<td>81</td>
</tr>
<tr>
<td>Call for Special Session Organizers</td>
<td>83</td>
</tr>
</tbody>
</table>
Dear friends and colleagues,

Welcome to the city of Pittsburgh, Pennsylvania and the Sixth Annual IEEE Energy Conversion Congress and Exhibition (ECCE 2014), “Your Bridge to a Clean and Sustainable Energy Future”.

Pittsburgh is ranked as America’s “Most Livable City”. Once a center for heavy industry, today Pittsburgh’s skyline has been transformed. Riverfronts are thoughtfully developed, utilized for recreation now more than ever. Businesses look to the environment as an asset, not a challenge. And, best of all, “green” has replaced “smoky” for good. This is very fitting with the ECCE 2014 theme of clean and sustainable energy future. The following words best summarize the magnitude of transformation Pittsburgh has experienced:

“Pittsburgh was a perfect venue for this work (G20 Pittsburgh Summit) ... It serves as a model for turning the page to a 21st century economy, and a reminder that the key to our future prosperity lies not just in New York or Los Angeles or Washington — but in places like Pittsburgh.”
— President Barack Obama remarks at closing G20 press conference, September 25, 2009

The conference venue is the David L. Lawrence Convention Center which raises the bar to a new level for meeting and exhibit space, services and amenities. Located in the hub of Pittsburgh’s cultural, business and entertainment district, the Center effectively blends unparalleled functionality with cutting-edge technology to offer meeting planners, exhibitors and attendees an unforgettable meeting experience.

Pittsburgh has a very strong IEEE section that hosted the highest attended IEEE PES conference, with over 2,300 attendees. Pittsburgh also previously hosted the IAS Annual Meeting in 2002. Pittsburgh is historically the home of Westinghouse Electric and so there is a very strong residual presence of George Westinghouse, Nikola Tesla and the Electrical Engineering field in the city.

Pittsburgh has a strong industry presence in the area of energy conversion including Westinghouse, Eaton, Siemens, and GE Power Conversion. Ansoft/Ansys is also located in Pittsburgh. There is also University of Pittsburgh: Center of Energy, The National Energy Technology Laboratory (NETL) as well as several Renewable Energy Equipment Manufacturers. This city has a broad and very healthy mix of big and small companies as well as national labs and educational institutes that will provide great support to ECCE 2014.

ECCE 2014 received a record number of 1,400 digests. Through the hard and dedicated work of all the volunteer reviewers, topic chairs, vice chairs and last but not least our technical program chairs, the conference will have a strong and diverse technical program.
This year’s conference will build on ECCE 2013 as well as the previous versions of the conference in terms of presenting energy conversion solutions to the community. The conference will have twelve very timely tutorials covering the various areas of energy conversion including electrical machines, power converters, control, semiconductor devices, soft and hard magnetic materials as well as fast-growing applications like subsea electrification. There are four stellar keynote speakers. They will address several of the key trends and challenges in energy conversion including critical materials, effect of renewables in developing countries, battery technologies for transportation electrification and key innovations in high power electronics.

As usual, there is the lively and exciting exhibition program, including the popular Industrial Seminars, and student project presentations focused on the area of Emerging Technologies. It is expected that ECCE 2014 will also break the record for number of exhibitors. Special Topics sessions will serve the immediate needs of the practicing engineer with the state of the art solutions. The successful format of Town Hall Meetings that started at ECCE 2013 will continue. There are two exciting sessions covering two very timely topics which are wide bandgap devices and transportation electrification. As can be seen there are several consistent topics and themes that cut across the tutorials, plenary presentations, special sessions and the town hall meetings as well as the technical program.

As always, the technical sessions coalesce around two major thematic areas: those topics that are focused on broad Energy Conversion System solutions, and those that are more specifically focused on the Components and Subsystems solutions. There are smart grids, appliances, and buildings sessions alongside power semiconductor devices sessions, renewable energy systems sessions alongside electric machine sessions, transportation application sessions alongside electric motor drive sessions, telecommunication system sessions alongside power converter sessions, energy harvesting sessions alongside component and sub-component packing sessions.

We have taken advantage of our presence in Pittsburgh and planned an exciting tour to Eaton Power Systems Experience Center (PSEC). This promises to be an outstanding tour. Based on all of this, the ECCE 2014 organizing committee is very proud and excited about the conference program and hope that it will meet your expectations.

I am indebted to the ECCE 2014 organizing committee, the vice chairs and topic chairs of the technical programs committee and the members of the exhibits committee for the hard work and long hours that they have put in voluntarily. Thanks are also due to the officers of the two sponsoring societies, PELS and IAS, for their steadfast support of the conference. A very enthusiastic thank you to the Courtesy Associates team who has supported ECCE since its inception, their assistance has been invaluable.

Finally, I would like to express our gratitude to our sponsors: ABB, our Platinum Partner, GE, our Gold Partner, and Halla Mechatronics our Silver Partner as well as our many other partners and exhibitors. Our mission would be impossible without your continued support.
Organizing Committee

General Chair
Ayman EL-Refaie, GE Global Research, USA

Technical Program Chairs
Nicola Bianchi, University of Padova, Italy
Wen Soong, University of Adelaide, Australia
Pierluigi Tenca, GE Global Research Europe, Germany
Lixiang Wei, Rockwell Automation, USA

Exhibit and Partnership Chair
Steve Sprague, Proto Laminations, USA

Finance Chair
Mark Nelms, Auburn University, USA

Tutorial Chair
Khwaja Rahman, General Motors, USA

Publicity Chair
Shashank Krishnamurthy, United Technologies Research Center, USA

Social Media Chair
Jennifer Vining, Daimler Trucks, USA

Plenary Session Chair
Tomy Sebastian, Halla Mechatronics, USA

Exhibit and Partnership Committee

Sabrina Benzid, OPAL-RT Technologies, Inc., Canada
Ayman EL-Refaie, GE Global Research, USA
Mohammad Islam, Halla Mechatronics, USA
Shashank Krishnamurthy, United Technologies Research Center, USA
Tomy Sebastian, Halla Mechatronics, USA
Kai Sen, Sen Microelectronics, USA
Steve Sprague, Proto Laminations, Inc., USA
Jennifer Vining, Daimler Trucks, USA
Tomy Sebastian, Halla Mechatronics, USA

Program Subcommittees

Renewable and Sustainable Energy Technologies
Pedro Rodriguez (Vice Chair), Abengoa Research, Spain
Yilmaz Sozer (Vice Chair), University of Akron, USA
Bilal Akin, University of Texas at Dallas, USA
Javier Chivite, Ingeteam Power Technology, Spain
Seungdeog Choi, University of Akron, USA
Ahmed Elaissar, GE Global Research, USA
Ion Etxeberria-Otadui, IK4-Ikerlan, Spain
Jesus Lopez, Public University of Navarre, Spain
Alvaro Luna, Technical University of Catalonia, Spain
Behrooz Mirafzal, Kansas State University, USA
Adel Nasiri, University of Wisconsin-Milwaukee, USA
Dezso Sera, Aalborg University, Denmark

Transportation Applications
Ozpineci Burak (Vice Chair), Oak Ridge National Laboratory, USA
Carl Ho (Vice Chair), ABB Switzerland Ltd, Switzerland
Eric Cheng, The Hong Kong Polytechnic University, Hong Kong
Drazen Dujic, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland
Shaahin Filizadeh, University of Manitoba, Canada
Guanghai Gong, ABB Switzerland Ltd., Switzerland
River Li, ABB (China) Limited, China
Udaya Madawala, The University of Auckland, New Zealand

Components, Packaging, Materials and Other Enabling Technologies
Filippo Chimento (Vice Chair), ABB Corporate Research, Sweden
Shashank Krishnamurthy (Vice Chair), United Technologies Research Center, USA
Bram Ferreira, University of Delft, Netherlands
Yehui Han, University of Wisconsin Madison, USA
Jerry Hudgins, University of Nebraska-Lincoln, USA
Jelena Popovic, University of Delft, Netherlands
Angelo Raci, University of Catania, Italy
Juan Rivas-Davila, University of Stanford, USA
Enrico Santi, University of South Carolina, USA
Jean-Luc Schanen, University of Grenoble, France
Adam Skorek, Université du Québec, Canada
Charles Sullivan, Thayer School of Engineering at Dartmouth, USA
Craig Winterhalter (Vice Chair), Rockwell Automation, USA

Pittsburgh Local Chair
George Gao, Eaton, USA

Awards Chair
Andy Knight, University of Calgary, Canada

Publications Chair
Alfredo R. Munoz, Ford, USA

Students Activities
Hui (Helen) Li, Florida State University, USA

Townhall Chair
Mohammad Islam, Halla Mechatronics, USA

Government/Industry Chair
Burak Ozpineci, Oak Ridge National Lab, USA

Web Chair
Yoon Ha, USA

ECCE 2013 General Chair
Peter Wung, Regal Beloit, USA

Conference Management
Bobbie Chandler, Courtesy Associates, USA
Lauren Deaton, Courtesy Associates, USA
Ella Greenberg, Courtesy Associates, USA
Tomy Sebastian, Halla Mechatronics, USA

ECCE 2014 Leadership

2014 IEEE ENERGY CONVERSION CONGRESS & EXPOSITION®
Smart Grid & Utility Applications
Khurram Afridi (Vice Chair), University of Colorado Boulder, USA
Luca Solero (Vice Chair), University Roma Tre, Italy
Yang Wang (Vice Chair), United Technologies Research Center, USA
Sandeep Bala, ABB Corporate Research, USA
Rolando Burgos, Virginia Polytechnic Institute and State University, USA
Petar Grbovic, HUAWEI Technologies, Germany
Mahesh Illindala, Ohio State University, USA
Qin Lei, General Electric Global Research Center, USA
Alessandro Lidozzi, University Roma Tre, Italy
Dragan Maksimovic, University of Colorado Boulder, USA
Madhav Manjrekar, University of North Carolina at Charlotte, USA
Omer Onar, Oak Ridge National Laboratory, USA
Zhiguo Pan, ABB Corporate Research, USA
David Perreault, Massachusetts Institute of Technology, USA
Robert Pilawa-Podgurski, University of Illinois at Urbana-Champaign, USA
Miaosen Shen, United Technologies Research Center, USA
Yongsu Suh, Chonbuk National University, Korea
Nadib Zargari, Rockwell Automation, Canada

Power Converter Topologies
Faisal Khan (Vice Chair), University of Utah, USA
Grant Ptitel (Vice Chair), Magna-Power Electronics, USA
Marcello Pucci (Vice Chair), ISSIA-CNR, Italy
Pericle Zanchetta (Vice Chair), University of Nottingham, UK
Norma Anglani, University of Pavia, Italy
Sandeep Bala, ABB Corporate Research, USA
Jürgen Biela, ETH Zurich, Switzerland
Stefano Bifaretti, University of Roma Tor Vergata, Italy
Rudolf Bojoi, Politecnico di Torino, Italy
Sarlioglu Bulent, University of Wisconsin-Madison, USA
David Cortes, ETH Zurich, Switzerland
Braz Cardoso filho, Dep.to de Engenharia Elétrica, Brasil

Control and Applications of Power Converters
Brian Welckho (Vice Chair), General Motors Company, USA
Luca Zarrì (Vice Chair), University of Bologna, Italy
Masoud Amirabdollah, University of Illinois at Chicago, USA
Frederico Barrero, University of Sevilla, Spain
Daniel Costinett, University of Tennessee, USA
David Diaz Reigosa, University of Oviedo, Spain
Dong Jiang, United Technologies Research Center, USA
Madhav Manjrekar, The University of North Carolina at Charlotte, USA
Sébastien Mariéthoz, ETH Zurich, Switzerland
Antonio Marques Cardoso, University of Beira Interior, Portugal
Rosa Anna Mastromauro, Technical University of Bari, Italy
Michele Mengoni, University of Bologna, Italy
Miliana Odcic, University of Sheffield, UK
Jaedo Park, University of Colorado Denver, USA
Sung Yeul Park, University of Connecticut, USA

Electrical Machines
Emmanuel Agamloh (Vice Chair), Advanced Energy, USA
Andy Knight (Vice Chair), University of Calgary, Canada, Canada
Jonathon Bird, UNC Charlotte, USA
Andrea Cavagnino, Politecnico di Torino, Italy
Akira Chiba, Tokyo Institute of Technology, Japan
Jessica Cotton, Boulder Wind Power, USA
Francesco Cupertino, Politecnico di Bari, Italy
Giovanni De Donato, Universita di Roma, La Sapienza, Italy
Abraham Ghebrelegisz, Halla Mechatronics, Australia
Greg Heins, Regal Beloit, Australia
Ed Lovelace, XL Hybrids, USA
Ronghai Qu, Huazhong University of Science and Technology, China
Jagadeesh Tanguu, United Technologies, USA
Rajeev Vyas, GM, USA
Rafał Wrobel, Bristol University, UK
Thomas Wu, University of Central Florida, USA
Julia Zhang, Oregon State University, USA
Pinjia Zhang, GE, USA

Computer and Telecommunication Applications
Ozpineci Burak (Vice Chair), Oak Ridge National Laboratory, USA
Carl Ho (Vice Chair), ABB Switzerland Ltd., Switzerland
Ka-Hong Loo, The Hong Kong Polytechnic University, Hong Kong
Grover Torrico-Bascope, Huawei Technologies Sweden AB, Sweden

Other Energy Conversion Related Topics
Dan Ionel (Vice Chair), Regal Beloit Corp., USA
Yan-fei Liu (Vice Chair), Queen’s University, Canada
Yao Duan, FMC Technologies, USA
Gerry Moschopoulos, Western University, Canada
Ahmed Sayed-Ahmed, Rockwell Automation, USA
Peng Zhang, General Motors R&D, USA
Zhilan Zhang, Nanjing University of Aeronautics and Astronautics (NUAA), China

Special Session Organizers
Frede Blaabjerg, Aalborg University, Denmark
Ozpineci Burak, Oak Ridge National Laboratory, USA
Mircea Popescu, Motor Design Ltd., UK
Pedro Rodriguez, Abengoa Research, Spain
Krishna Shenai, Argonne National Laboratory, USA

Electric Drives
Fernando Briz (Vice Chair), University of Oviedo, Spain
Mahesh Swamy (Vice Chair), Yaskawa America, Inc., USA
Ali M. Bazzi, University of Connecticut, USA
Vladimir Blasko, UTRC, USA
Radu Bojoi, Politecnico di Torino, Italy
Bimal Bose, University of Tennessee, USA
Robert Cuzner, DRS, USA
Uday Deshpande, IR, USA
David Diaz-Reigosa, University of Oviedo, Spain
Tobias Geyer, ABB, Switzerland
Lei Hao, GM, USA
Thomas Jahns, U Wisconsin-Madison, USA
Sanjib Kumar Panda, Nat. Univ. of Singapore, Singapore
Qin Lei, GE, USA
Peter Liu, Toshiba, USA
Elena Lomonova, TU Eindhoven, Netherlands
A. J. Marques Cardoso, Univ. of Beira Interior, Portugal
Mario Pacas, University of Siegen, Germany
Zach Pan, ABB, USA
Gianmarino Pellegrino, Politecnico di Torino, Italy
Akshay Rathore, NUS Singapore, Singapore
Giocomo Sciliba, University of Catania, Italy
Stefan Schroeder, GE, Germany
Jui-Ki Seok, Yeungnam University, South Korea
Gui-Jia Su, Oak Ridge Nat. Lab., USA
Long Wu, John Deere, USA

Power Converter Subcommittees (Continued)
### Sunday, September 14

**Exhibit Hall C**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am – 7:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00 am – 9:40 am</td>
<td>Oral Sessions <strong>10:20 am – 12:00 pm</strong></td>
</tr>
<tr>
<td>10:20 am – 12:00 pm</td>
<td>Tutorials Group 1 <strong>8:00 am – 12:00 pm</strong></td>
</tr>
<tr>
<td>12:00 pm – 1:00 pm</td>
<td>Lunch on Own</td>
</tr>
<tr>
<td>1:30 pm – 3:35 pm</td>
<td>Oral Sessions <strong>1:30 pm – 3:35 pm</strong></td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>5:00 pm – 6:30 pm</td>
<td>Poster Session I</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
</tbody>
</table>

**Tutorials Group 1 • 8:00 am – 12:00 pm**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am – 9:40 am</td>
<td>Oral Sessions <strong>10:20 am – 12:00 pm</strong></td>
</tr>
<tr>
<td>12:00 pm – 1:00 pm</td>
<td>Lunch on Own</td>
</tr>
<tr>
<td>1:30 pm – 3:35 pm</td>
<td>Oral Sessions <strong>1:30 pm – 3:35 pm</strong></td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>4:00 pm – 6:30 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>5:00 pm – 6:30 pm</td>
<td>Poster Session I</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
</tbody>
</table>

**Town Hall Meetings • 10:00 am – 12:00 pm**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 pm – 2:00 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00 pm – 1:15 pm</td>
<td>Presentation by SMMA – the Motor and Motion of Association</td>
</tr>
<tr>
<td>2:00 pm – 2:30 pm</td>
<td>Powerex, Inc. Industrial Seminar</td>
</tr>
<tr>
<td>2:30 pm – 3:00 pm</td>
<td>Keysight Technologies Industrial Seminar</td>
</tr>
<tr>
<td>3:00 pm – 3:30 pm</td>
<td>Ford Motor Company Industrial Seminar</td>
</tr>
<tr>
<td>3:30 pm – 5:00 pm</td>
<td>Poster Session III</td>
</tr>
</tbody>
</table>

### Monday, September 15

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am – 10:20 am</td>
<td>Plenary Session</td>
</tr>
<tr>
<td>10:00 am – 10:20 am</td>
<td>AM Break</td>
</tr>
<tr>
<td>11:00 am – 12:00 pm</td>
<td>Lunch on Own</td>
</tr>
<tr>
<td>12:00 pm – 1:00 pm</td>
<td>Lunch on Own</td>
</tr>
</tbody>
</table>

### Tuesday, September 16

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am – 6:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00 am – 9:40 am</td>
<td>Oral Sessions <strong>8:00 am – 9:40 am</strong></td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
</tbody>
</table>

**Town Hall Meetings • 10:00 am – 12:00 pm**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 pm – 2:00 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00 pm – 1:15 pm</td>
<td>Presentation by SMMA – the Motor and Motion of Association</td>
</tr>
<tr>
<td>2:00 pm – 2:30 pm</td>
<td>Powerex, Inc. Industrial Seminar</td>
</tr>
<tr>
<td>2:30 pm – 3:00 pm</td>
<td>Keysight Technologies Industrial Seminar</td>
</tr>
<tr>
<td>3:00 pm – 3:30 pm</td>
<td>Ford Motor Company Industrial Seminar</td>
</tr>
<tr>
<td>3:30 pm – 5:00 pm</td>
<td>Poster Session III</td>
</tr>
</tbody>
</table>

### Wednesday, September 17

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am – 7:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00 am – 9:40 am</td>
<td>Oral Sessions <strong>8:00 am – 9:40 am</strong></td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
</tbody>
</table>

**Town Hall Meetings • 10:00 am – 12:00 pm**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 pm – 2:00 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00 pm – 1:15 pm</td>
<td>Presentation by SMMA – the Motor and Motion of Association</td>
</tr>
<tr>
<td>2:00 pm – 2:30 pm</td>
<td>Powerex, Inc. Industrial Seminar</td>
</tr>
<tr>
<td>2:30 pm – 3:00 pm</td>
<td>Keysight Technologies Industrial Seminar</td>
</tr>
<tr>
<td>3:00 pm – 3:30 pm</td>
<td>Ford Motor Company Industrial Seminar</td>
</tr>
<tr>
<td>3:30 pm – 5:00 pm</td>
<td>Poster Session III</td>
</tr>
</tbody>
</table>

**Wednesday, September 17**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am – 7:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00 am – 9:40 am</td>
<td>Oral Sessions <strong>8:00 am – 9:40 am</strong></td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:00 am – 6:00 pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
<tr>
<td>10:00 am – 11:30 am</td>
<td>Poster Session II</td>
</tr>
</tbody>
</table>

**Town Hall Meetings • 10:00 am – 12:00 pm**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 pm – 2:00 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00 pm – 1:15 pm</td>
<td>Presentation by SMMA – the Motor and Motion of Association</td>
</tr>
<tr>
<td>2:00 pm – 2:30 pm</td>
<td>Powerex, Inc. Industrial Seminar</td>
</tr>
<tr>
<td>2:30 pm – 3:00 pm</td>
<td>Keysight Technologies Industrial Seminar</td>
</tr>
<tr>
<td>3:00 pm – 3:30 pm</td>
<td>Ford Motor Company Industrial Seminar</td>
</tr>
<tr>
<td>3:30 pm – 5:00 pm</td>
<td>Poster Session III</td>
</tr>
<tr>
<td>Tuesday, September 16 (Continued)</td>
<td>PM Break</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Wednesday, September 17</td>
<td>7:00 am – 7:00 pm</td>
</tr>
<tr>
<td>Oral Sessions • 8:00 am – 9:40 am</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 10:00 am – 11:40 am</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 1:30 pm – 3:10 pm</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 8:00 am – 9:40 am</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 10:00 am – 11:40 am</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 3:00 pm – 5:10 pm</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 10:00 am – 11:40 am</td>
<td>323</td>
</tr>
<tr>
<td>Oral Sessions • 1:30 pm – 3:10 pm</td>
<td>323</td>
</tr>
</tbody>
</table>
## Sunday, September 14

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Room: 323</th>
<th>Room: 324</th>
<th>Room: 325</th>
<th>Room: 326</th>
<th>Room: 327</th>
<th>Room: 328</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am – 7:00 pm</td>
<td>Registration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:00 am – 7:00 pm</td>
<td>Tutorials Group 1 • 8:00 am – 12:00 pm</td>
<td>T1-1: Design Challenges of High-power Converters with Low Switching Frequencies</td>
<td>T1-2: Predictive Control — a Simple and Powerful Method to Control Power Converters and Drives</td>
<td>T1-3: The Technology and Market Issues of Magnetic Materials</td>
<td>T1-4: Electromechanical Power Loss Analysis in Design and Optimisation of Electrical Machines: Practical Aspects of Accurate Loss Estimation and Mitigation Techniques</td>
<td>T1-5: Power Semiconductor Modules: Design, Applications, Manufacturing &amp; Reliability</td>
<td>T1-6: Electrification of Subsea Process Plants, Why and How</td>
</tr>
<tr>
<td>12:00 pm – 1:00 pm</td>
<td>Lunch on Own</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:00 pm – 5:00 pm</td>
<td>Newcomers Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00 pm – 7:00 pm</td>
<td>Opening Reception</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:00 am – 7:00 pm</td>
<td>Registration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Monday, September 15

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Room: 323</th>
<th>Room: 324</th>
<th>Room: 325</th>
<th>Room: 326</th>
<th>Room: 327</th>
<th>Room: 328</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:20 am – 10:45 am</td>
<td>Oral Sessions • 10:20 am – 12:00 pm</td>
<td>S1: Maximum Power Point Tracking for Multiple Photovoltaic Modules using Root-finding Methods</td>
<td>S2: Low-voltage Ride through Capability of 3-phase Grid-connected Photovoltaic Inverters with Slim Film Capacitors</td>
<td>S3: Dual Sequence Current Controller without Current Sequencing Implemented on DRSF for Unbalanced Grid Voltage Conditions</td>
<td>S4: Model of Capacitor Degradation in LC Filters for AC Drives</td>
<td>S5: High-efficient Super-compact 3.3kW/120V/380V AC-DC Transformer</td>
<td>S6: A Generalised Natural Balance Model and Balance Booster Filter Design for Three-Level Neutral Point Clamped Inverters</td>
</tr>
</tbody>
</table>

### Room Locations:
- **Nesco Foyer**
- **Spirit of Pittsburgh Ballroom**
- **4th Floor North Terrace**
## Detailed Schedule (Continued)

### Oral Sessions • 10:20 am – 12:00 pm

<table>
<thead>
<tr>
<th>Room: 323</th>
<th>Room: 324</th>
<th>Room: 325</th>
<th>Room: 326</th>
<th>Room: 327</th>
<th>Room: 328</th>
<th>Room: 329</th>
<th>Room: 330</th>
<th>Room: 333</th>
<th>Room: 334</th>
<th>Room: 335</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S1:</strong> MPPT for Solar PV Systems</td>
<td><strong>S2:</strong> Power Converters for Photovoltaic Applications</td>
<td><strong>S3:</strong> Microgrid Control I</td>
<td><strong>S4:</strong> Widebandgap Devices I</td>
<td><strong>S5:</strong> Reliability and Diagnostics in Grid Converters</td>
<td><strong>S6:</strong> Telecom Power Supplies</td>
<td><strong>S7:</strong> Modulation for Power Converters</td>
<td><strong>S8:</strong> Control and Modulation of Multilevel Converters I</td>
<td><strong>S9:</strong> Assorted Issues Electric Drives I</td>
<td><strong>S10:</strong> Induction Machines</td>
<td><strong>S11:</strong> Flux-switching Machines</td>
</tr>
</tbody>
</table>

11:10 am – 11:35 am

- PV Generation Enhancement with a Virtual Inertia Emulator to Provide Inertial Response to the Grid
- Control Approach to Achieve Burst-Mode Operation with DC-link Voltage Control in Single-phase Two-stage PV Inverters
- Plug-and-Play Nonlinear Droop Construction Scheme to Optimize Microgrid Operations
- Avoiding Si MOSFET Avalanche and Achieving True Zero-voltage-switching for Cascade Device
- Improved Dual Second-order Generalized Integrator PLL for Grid Synchronization under Non-ideal Grid Voltages including DC Offset
- Modeling the Output Impedance of 3-phase Uninterruptible Power Supply in D-Q Frame
- A Dead-time Compensation Method for Parabolic Current Control with Improved Current Tracking Precision
- Capacitor Voltage Balancing of a Five-level Diode-clamped Converter using Minimum Loss SVPWM Algorithm for Wide Range Modulation Indices
- Dynamic Effects of Mismatched Time Constants in DC-DC Converters with Inductor DCR Current Sensing
- A 5-phase Induction Machine Model using Multiple DQ Planes Considering the Effect of Magnetic Saturation
- Reduced Rare-earth Flux Switching Machines for Traction Applications

11:35 am – 12:00 pm

- Using MPPT in Multi-pulse Converters for Photovoltaic Cogeneration
- Optimized Control of Isolated Residential Power Router for Photovoltaic Applications
- Transient Droop for Improved Transient Load Sharing in Microgrids
- Characterization and Modeling of a Gallium Nitride Power HEMT
- Single Phase Synchronous Reference Frame Power Control of Grid Connected Multi Level Inverter
- A Series-Stacked Architecture for Highly-efﬁciency Data Center Power Delivery
- Investigation into the Control Methods to Reduce the DC-link Capacitor Ripple Current in a Back-to-back Converter
- A New Control Scheme of Five-level Active NPC Converters for Common Mode Voltage Mitigation in Medium Voltage Drives
- Insulated Signal Transmission System using Planar Resonant Coupling Technology for High Voltage IGBT Gate Driver
- Analysis of Non-intrusive Efﬁciency Estimation of Induction Machines Compared to the IEEE 1128 and IEC 34-2-1 Standards
- Investigation of On-loaded Performances of Hybrid-excitation Flux-switching Brushless Machines for HEV/EV Applications

12:00 pm – 1:00 pm

- Lunch on Own

### Oral Sessions • 1:30 pm – 3:35 pm

<table>
<thead>
<tr>
<th>Room: 323</th>
<th>Room: 324</th>
<th>Room: 325</th>
<th>Room: 326</th>
<th>Room: 327</th>
<th>Room: 328</th>
<th>Room: 329</th>
<th>Room: 330</th>
<th>Room: 333</th>
<th>Room: 334</th>
<th>Room: 335</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S12:</strong> Power Converters for Transportation Applications I</td>
<td><strong>S13:</strong> Control of Power Converters in Renewable Energy</td>
<td><strong>S14:</strong> Utility-scale Battery Systems</td>
<td><strong>S15:</strong> Widebandgap Devices II</td>
<td><strong>S16:</strong> Modular Multilevel Converters for HVDC</td>
<td><strong>S17:</strong> Control of 3-phase Converters</td>
<td><strong>S18:</strong> AC-AC Converters</td>
<td><strong>S19:</strong> Single-phase PFC Converter</td>
<td><strong>S20:</strong> Ernesto Weidenbrug Memorial Session: Diagnostics of Electric Machines</td>
<td><strong>S21:</strong> Inductive Power Transfer I</td>
<td><strong>S22:</strong> US Government Power Electronics and Electric Motors Research for Electric Motors</td>
</tr>
</tbody>
</table>

1:30 pm – 1:55 pm

- Comparison of Multi-port Converter Topologies with Bi-directional Energy Flow for Automotive Applications
- Analysis and Design of Grid-current-feedback Active Damping for LCL, Resonance in Grid-connected Voltage Source Converters
- Centralized Control of Large Capacity Parallel Connected Power Conditioning System for Battery Energy Storage System in Microgrid
- Investigating the Reliability of SiC MOSFET Diodes using Fourier Series Modelling
- Control of Hybrid HVDC Transmission System with LCC and FB-MMC
- Power Converter Control Framework for Agile Research and Development
- Single-phase AC-AC Double-star Chopper-cells (DSC) Converter without Common DC-link Capacitor
- A Single-stage Three-level Isolated PFC Converter
- Advanced Rotor Assessment of Motors Operating under Variable Load Conditions in Mining Facilities
- A Dual-side Controlled Inductive Power Transfer System Optimized for Large Coupling Factor Variations
- Advanced Power Electronics and Electric Motors Overview

1:55 pm – 2:20 pm

- An Asymmetrical I2-source Hybrid Power Converter with Space Vector Pulse-width Modulation
- Investigation on Series Active Filter Compensated High Power Grid-connected Voltage Source Inverters with LCL Filter
- Performance Analysis of LifePO4 Battery Energy Storage for Utility-scale PV System
- 10 kV – 15 kV Silicon Carbide Power MOSFETs for Next-generation Energy Conversion and Transmission Systems
- A Switching Frequency Reduction and a Mitigation of VoltageFluctuation of Modular Multilevel Converter for HVDC
- Grid Frequency Tracking Control Strategy without PLL for 3-phase Inverter
- A Novel Single-phase Cascaded Multilevel AC-AC Converter without Commutation Problem
- A Ripple-free Input Current PFC using Power Semiconductors Filter
- PM Synchronous Machine Drive Response to Asymmetrical Short-circuit Faults
- Magnetic Integration of LLC Compensated Resonant Converter for Inductive Power Transfer Applications
- WBG Power Electronics for Electric Vehicles

2:20 pm – 2:45 pm

- Design of a Solid-state DC Circuit Breaker for Light Rail Transit Power Supply Network
- Input Current Ripple Cancellation of Current-fed Switched Inverter
- Optimization of Power Dispatch to Minimize Battery Storage Capacity in Wind Farm
- 15-kV 100-kA Single-bias All-optical SC Emitter Turn-off Thyristor
- Maximum Modulation Index for Modular Multilevel Converter with Circulating Current Control
- An Improved Direct Power Control of PWM Rectifier with Active Power Ripple Minimization
- Evaluation of a Maximum Power Density Design Method for Matrix Converter using SiC-MOSFET
- A Family of Single-phase Hybrid Step-down PFC Converters
- Online Broadband Insulation Spectroscopy of Induction Machines using Signal Injection
- A 3.5kW Wireless Charger for Electric Vehicles with Ultra High Efficiency
- Thermal Management for Electric Vehicles
### Monday, September 15 (Continued)

<table>
<thead>
<tr>
<th>Oral Sessions</th>
<th>1:30 pm – 3:35 pm (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S12</strong>: Power Converters for Transportation Applications I</td>
<td><strong>S13</strong>: Control of Power Converters in Renewable Energy</td>
</tr>
<tr>
<td><strong>S14</strong>: Utility-scale Battery Systems</td>
<td><strong>S15</strong>: Widebandgap Devices II</td>
</tr>
<tr>
<td><strong>S16</strong>: Modular Multilevel Converters for HVDC</td>
<td><strong>S17</strong>: Control of 3-phase Converters</td>
</tr>
<tr>
<td><strong>S18</strong>: AC-AC Converters</td>
<td><strong>S19</strong>: Single-phase PFC Converters</td>
</tr>
<tr>
<td><strong>S21</strong>: US Government Power Electronics and Electric Motors Research for Electric Motors</td>
<td></td>
</tr>
</tbody>
</table>

#### 2:45 pm – 3:10 pm
- Design of Coupled Inductor for Minimum Inductor Current Ripple in Rapid Traction Battery Charger Systems
- Advanced Techniques for Integration of Energy Storage and Photovoltaic Generator in Renewable Energy Systems
- Resilience Optimization and Implementation of the Retained HEV Battery with a Hybrid Microgrid Testbed
- Physics-based Electro-thermal Saber Model and Parameter Extraction for High-voltage SiC Buffer IGCTs
- Modulation and Control of MMC based Multiterminal HVDC
- Capacitor Voltage Balancing Control of a Fully Integrated Three-level Isolated AC-DC PFC Converter for Reliable Operations
- Several-hundred-kHz Single-phase to Commercial Frequency 3-phase Matrix Converter using Delta-sigma Modulation with Space Vector
- A Bridgedesic Hybrid-resonant PWM Zero Voltage Switching Boost AC-DC Power Factor Corrected Converter
- Evaluation of the Influence of Rotor Magnetic Anisotropy on Condition Monitoring of 2-Pole Induction Motors
- Loosely Coupled Inductive Wireless Power Transfer Systems with Class-E Power Converter and Multiple Receivers
- Electric Motors for Electric Vehicles

#### 3:10 pm – 3:35 pm
- Asymmetric Interleaving in Low-voltage CMOS Power Management with Multiple Supply Rails
- Analysis and PWM Control of 3-phase Boost-derived Hybrid Converter
- A Hybrid Wind-solar-storage Energy Generation System Configuration and Control
- High-efficiency 3-phase Inverter with SiC MOSFET Power Modules for Motor-drive Applications
- A Peak Current Limit Control Technique in Low-voltage Ride through Operation of the Star-connected Cascaded H-bridges Converter
- Discrete Time Modelling, Implementation and Design of Current Controllers
- The Impact of Switching Frequency on Input Filter Design for High Power Density Matrix Converter
- Design and Evaluation of GaN-based Dual-phase Interleaved MHz Critical Mode PFC Converter
- Electrical Discharge and Its Impact on Drivetrains of Wind Turbines
- Transformer Coupled Asymmetrical Half Bridges for Voltage Balancing of Floating Capacitor Converters
- CM/Li Rare Earth Magnets

### Tuesday, September 16

#### 7:00 am – 6:00 pm
- Registration
-  
#### Oral Sessions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S22</strong>: Wind Energy: Control and Operation I</td>
<td><strong>S23</strong>: Power Converters for Smart Grid and Utility Applications</td>
<td><strong>S24</strong>: Grid Stability</td>
<td><strong>S25</strong>: Widebandgap Devices II</td>
<td><strong>S26</strong>: Modular Multilevel Converters I</td>
<td><strong>S27</strong>: Resonant Control in Power Converters</td>
<td><strong>S28</strong>: Switched-capacitor Converters</td>
<td><strong>S29</strong>: Voltage Control Issues in Electric Drives</td>
<td><strong>S30</strong>: Prof. D. Howe Memorial Session: Synchronous Machines</td>
<td><strong>S31</strong>: Inductive Power Transfer II</td>
<td><strong>S32</strong>: Losses in Electrical Machines</td>
</tr>
</tbody>
</table>

#### 8:00 am – 8:25 am
- Reduced Cost of active Power in Doubly Fed Induction Generator Wind Turbine System with Optimized Grid Filter
- Development of the Active Capacitor Converter for PFC Converters
- Sub-Synchronous Resonance Analysis in SF-based Wind Farms: Mitigation Methods — TCSC, GSC, and DFIG Controllers — Part II
- SIC MOSFET based Split Output Half Bridge Inverter: Current Commutation Mechanism and Efficiency Analysis
- Branch Energy Control for the Modular Multilevel Direct Converter Hexverter
- Selective Harmonic Control for Power Converters
- A High Step-up Converter based on Switched-capacitor Voltage Accumulator
- An Optimal Solution for Operating a 3-phase Variable Frequency Drive from a Single-phase AC Source
- PM/Magnets with Optimized MF Resistant using High Frequency Signal Injection
- Methods for Reducing Leakage Electric Field of a Wireless Power Transfer System for Electric Vehicles
- Combined Experimental and Numerical Method for Loss Separation in Permanent Magnet Brushless Machines
- Single-chip Data Sheets and Circuit Models — Do We Have Them Right for WBG Devices?

#### 8:25 am – 8:50 am
- Direct Power Control for DFIG under Unbalanced and Harmonically Distorted Grid Voltage in Stationary Frame
- An Improved DPFM Method for Reduction of Reactive Problem in the Inverter
- Impedance Matching based Stability Criteria for AC Microgrids
- Dynamic Behavior and Characterization of a Cascode Rectifier based on a Normally-on SiC JFET
- Realization of a Conceptual Approach for Power VLS using Integrated Full-bridge Cells in Modular Multilevel Converters
- Reduced Order Generalized Integrators based Selective Harmonic Compensation Current Controller for Shunt Active Power Fillers
- Analysis of Coupled Microinductors for Power-supply-on-chip Applications
- Hexagon Voltage Control (HVC) for AC Motor Drives Operating at Voltage Limits
- Comparison of Different Methods for Incipient Fault Diagnosis in PMSMs with Contactless Insulated Windings
- Reducing Leakage Flux in IPT Systems by Modifying Pad Ferrite Structures
- WBG Usage in Automotive: Do Challenges Outweigh Advantages?
### Tuesday, September 16 (Continued)

#### Oral Sessions • 8:00 am – 9:40 am

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S22:</strong> Wind Energy: Control and Operation I</td>
<td><strong>S23:</strong> Power Converters for Smart Grid and Utility Applications</td>
<td><strong>S24:</strong> Grid Stability</td>
<td><strong>S25:</strong> Wide Bandgap Devices III</td>
<td><strong>S26:</strong> Modular Multilevel Converters I</td>
<td><strong>S27:</strong> Resonant Control in Power Converters</td>
<td><strong>S28:</strong> Switched-capacitor Converters</td>
<td><strong>S29:</strong> Voltage Control Issues in Electric Drives</td>
<td><strong>S30:</strong> Prof. D. Howe Memorial Session: Synchronous Machines</td>
<td><strong>S31:</strong> Inductive Power Transfer II</td>
<td><strong>S32:</strong> Losses in Electrical Machines</td>
<td><strong>S33:</strong> Wide Band Gap (WBG) Power Switch Modules — Requirements and Challenges</td>
</tr>
</tbody>
</table>

#### 8:50 am – 9:15 am

| **S22:** Impacts of Providing Inertial Response on Dynamic Loads of Wind Turbine Drivetrains | **S23:** Extremely Sparse Parallel AC-Link Universal Power Converters | **S24:** A Review of Low Voltage Ride-through Techniques for Photovoltaic Generation Systems | **S25:** Evaluation of Switching Performance of SiC Devices in PWM Inverter Fed Induction Motor Drives | **S26:** A Low-speed, High-torque Motor Drive using the Modular Multilevel Cascade Converter based on Triplet-star Bridge Cells (MMCC-TSBC) | **S27:** Flexible Grid Connection Technique of Voltage Source Inverter under Unbalanced Grid Conditions based on Direct Power Control | **S28:** Current Source Converter with Switched-inductor DC Link Circuit for Reduced Converter Losses | **S29:** Interleaved PWM Control for Neutral Point Balancing in Dual 3-level Traction Drives | **S30:** Analysis of FSCW SPM Servo Motor with Static, Dynamic and Mixed Eccentricity in Aspects of Radial Force and Vibration | **S31:** Design Methodology of a Series-series Inductive Power Transfer System for Electric Vehicle Battery Charger Regulation | **S32:** Winding Design for Minimum Power Loss and Low-Cost Manufacture in Application to Fixed-speed PM Generator | **S33:** Package and Assembly Requirements for SiC-based Power Modules in Industrial Applications |

#### 9:15 am – 9:40 am

| **S22:** A Flux Vector-based Discrete-time Direct Torque Control for Sallen-kelch Permanent-magnet Synchronous Generators | **S23:** Low Frequency Signal Injection for Grid Impedance Estimation in Three Phase Systems | **S24:** Frequency Stability of Hierarchically Controlled Hybrid Photovoltaic-Battery-Hydropower Microgrids | **S25:** Exploration of a Switching Loop Snubber for Parasitic Ringing Suppression | **S26:** Capacitor Voltage Balancing based on Fundamental Frequency Sorting Algorithm for Modular Multilevel Converter | **S27:** Resonant Controllers with Three-degree of Freedom for AC Power Electronic Converters | **S28:** Analysis and Design of a 1-kW 3X Interleaved Switched-capacitor DC-DC Converter | **S29:** Identification of the Magnetic Model of Permanent Magnet Synchronous Machines using DC-based Low Frequency AC Signal Injection | **S30:** The Structure Optimization of Novel Harmonic Current Excited Brushless Synchronous Machines based on Open Winding Pattern | **S31:** Analysis of Co-planar Intermediate Coil Structures in Inductive Power Transfer Systems | **S32:** Cylindrical Rotor Design for Acoustic Noise and Windage Loss Reduction in Switched Reluctance Motor for HEV Applications | **S33:** Reducing Cost in High-performance SC Power Modules |

#### 9:00 am – 6:00 pm Exhibit Hall Open
- Exhibit Hall C

#### 9:40 am – 10:00 am AM Break
- Exhibit Hall C

#### 10:00 am – 11:30 am Poster Session II
- Exhibit Hall C

#### Town Hall Meetings • 10:00 am – 12:00 pm

<table>
<thead>
<tr>
<th><strong>S29</strong></th>
<th><strong>S30</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide Band Gap Devices — Potentials versus Reality</td>
<td>Hybrid/Electric Vehicles — Today and Tomorrow</td>
</tr>
</tbody>
</table>

#### 12:00 pm – 2:00 pm

- Lunch
- Exhibit Hall C

#### 1:00 pm - 1:15 pm

- Presentation by SMMA — the Motor and Motion of Association
- Exhibit Hall C

#### 2:00 pm - 2:30 pm

- Powerex, Inc. Industrial Seminar
- Exhibit Hall C

#### 2:30 pm – 3:00 pm

- Keysight Technologies Industrial Seminar
- Exhibit Hall C

#### 3:00 pm – 3:30 pm

- Ford Motor Company Industrial Seminar
- Exhibit Hall C

#### 3:30 pm – 5:00 pm

- Poster Session III
- Exhibit Hall C

#### 4:15 pm – 4:30 pm

- PMI Break
- Exhibit Hall C

#### 5:00 pm – 5:30 pm

- Ingersoll Rand Industrial Seminar
- Exhibit Hall C

#### 5:30 pm – 6:00 pm

- Student Exhibit Hall Contest Prizes — Sponsored by Ingersoll Rand
- Exhibit Hall Stage
<table>
<thead>
<tr>
<th>7:00 am – 7:15 pm</th>
<th>Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am – 8:25 am</td>
<td>Oral Sessions • 8:00 am – 9:40 am</td>
</tr>
<tr>
<td>Room: 323</td>
<td>S33: Solar PV Technologies</td>
</tr>
<tr>
<td>Room: 324</td>
<td>S34: Energy Management in Residential Applications</td>
</tr>
<tr>
<td>Room: 326</td>
<td>S35: DC-DC Boost Converters</td>
</tr>
<tr>
<td>Room: 327</td>
<td>S36: Stability and Quality I</td>
</tr>
<tr>
<td>Room: 328</td>
<td>S37: Modular Multilevel Converters I</td>
</tr>
<tr>
<td>Room: 329</td>
<td>S38: Control of DC-DC Converters</td>
</tr>
<tr>
<td>Room: 330</td>
<td>S39: Active Power Filters and Power Quality</td>
</tr>
<tr>
<td>Room: 333</td>
<td>S40: Fault Diagnostics in Power Converters</td>
</tr>
<tr>
<td>Room: 334</td>
<td>S41: Control Issues in Electric Drives II</td>
</tr>
<tr>
<td>Room: 335</td>
<td>S42: IPM Machine Design</td>
</tr>
<tr>
<td>Room: 336</td>
<td>S43: Induction Motor Drives I</td>
</tr>
<tr>
<td>Room: 325</td>
<td>S34: Energy Features of a Vehicle-to-home System to Provide User-specific Technical Requirements</td>
</tr>
<tr>
<td>Room: 327</td>
<td>A High-efficiency High Step-up DC-DC Converter with Passive Clamped Coupled-inductor and Voltage Double Cells</td>
</tr>
<tr>
<td>Room: 328</td>
<td>Dynamic Phasor Models for AC Microgrids Stability Studies</td>
</tr>
<tr>
<td>Room: 329</td>
<td>Design Considerations on the DC Capacitor of Each Chopper Cell in a Modular Multilevel Cascade Inverters (MMCI-DSCC) for Medium-voltage Motor Drives</td>
</tr>
<tr>
<td>Room: 330</td>
<td>An Adaptive Ramp Compensation Scheme to Improve Stability for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 333</td>
<td>Selected Harmonic Resistance Control based Series Active Power Filter for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 334</td>
<td>A Novel Online ESR and C Identification Method for Output Capacitor of Buck Converter</td>
</tr>
<tr>
<td>Room: 335</td>
<td>Near Time-optimal Model Predictive Control using an L1-norm based Cost Functional</td>
</tr>
<tr>
<td>Room: 336</td>
<td>Design of High Torque Density Variable Flux Permanent Magnet Machine using Alnico Magnets</td>
</tr>
<tr>
<td>Room: 337</td>
<td>Input/output Feedback Linearization Control of Linear Induction Motors Including the Dynamic End-Effects</td>
</tr>
<tr>
<td>Room: 338</td>
<td>Harmonic Stability in Renewable Energy Systems an Overview</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8:00 am – 8:25 am</th>
<th>Oral Sessions • 8:00 am – 9:40 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room: 323</td>
<td>S33: Solar PV Technologies</td>
</tr>
<tr>
<td>Room: 324</td>
<td>S34: Energy Management in Residential Applications</td>
</tr>
<tr>
<td>Room: 326</td>
<td>S35: DC-DC Boost Converters</td>
</tr>
<tr>
<td>Room: 327</td>
<td>S36: Stability and Quality I</td>
</tr>
<tr>
<td>Room: 328</td>
<td>S37: Modular Multilevel Converters I</td>
</tr>
<tr>
<td>Room: 329</td>
<td>S38: Control of DC-DC Converters</td>
</tr>
<tr>
<td>Room: 330</td>
<td>S39: Active Power Filters and Power Quality</td>
</tr>
<tr>
<td>Room: 333</td>
<td>S40: Fault Diagnostics in Power Converters</td>
</tr>
<tr>
<td>Room: 334</td>
<td>S41: Control Issues in Electric Drives II</td>
</tr>
<tr>
<td>Room: 335</td>
<td>S42: IPM Machine Design</td>
</tr>
<tr>
<td>Room: 336</td>
<td>S43: Induction Motor Drives I</td>
</tr>
<tr>
<td>Room: 337</td>
<td>S34: Energy Features of a Vehicle-to-home System to Provide User-specific Technical Requirements</td>
</tr>
<tr>
<td>Room: 327</td>
<td>A High-efficiency High Step-up DC-DC Converter with Passive Clamped Coupled-inductor and Voltage Double Cells</td>
</tr>
<tr>
<td>Room: 328</td>
<td>Dynamic Phasor Models for AC Microgrids Stability Studies</td>
</tr>
<tr>
<td>Room: 329</td>
<td>Design Considerations on the DC Capacitor of Each Chopper Cell in a Modular Multilevel Cascade Inverters (MMCI-DSCC) for Medium-voltage Motor Drives</td>
</tr>
<tr>
<td>Room: 330</td>
<td>An Adaptive Ramp Compensation Scheme to Improve Stability for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 333</td>
<td>Selected Harmonic Resistance Control based Series Active Power Filter for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 334</td>
<td>A Novel Online ESR and C Identification Method for Output Capacitor of Buck Converter</td>
</tr>
<tr>
<td>Room: 335</td>
<td>Near Time-optimal Model Predictive Control using an L1-norm based Cost Functional</td>
</tr>
<tr>
<td>Room: 336</td>
<td>Design of High Torque Density Variable Flux Permanent Magnet Machine using Alnico Magnets</td>
</tr>
<tr>
<td>Room: 337</td>
<td>Input/output Feedback Linearization Control of Linear Induction Motors Including the Dynamic End-Effects</td>
</tr>
<tr>
<td>Room: 338</td>
<td>Harmonic Stability in Renewable Energy Systems an Overview</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8:25 am – 8:50 am</th>
<th>Oral Sessions • 8:00 am – 9:40 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room: 323</td>
<td>S33: Solar PV Technologies</td>
</tr>
<tr>
<td>Room: 324</td>
<td>S34: Energy Management in Residential Applications</td>
</tr>
<tr>
<td>Room: 326</td>
<td>S35: DC-DC Boost Converters</td>
</tr>
<tr>
<td>Room: 327</td>
<td>S36: Stability and Quality I</td>
</tr>
<tr>
<td>Room: 328</td>
<td>S37: Modular Multilevel Converters I</td>
</tr>
<tr>
<td>Room: 329</td>
<td>S38: Control of DC-DC Converters</td>
</tr>
<tr>
<td>Room: 330</td>
<td>S39: Active Power Filters and Power Quality</td>
</tr>
<tr>
<td>Room: 333</td>
<td>S40: Fault Diagnostics in Power Converters</td>
</tr>
<tr>
<td>Room: 334</td>
<td>S41: Control Issues in Electric Drives II</td>
</tr>
<tr>
<td>Room: 335</td>
<td>S42: IPM Machine Design</td>
</tr>
<tr>
<td>Room: 336</td>
<td>S43: Induction Motor Drives I</td>
</tr>
<tr>
<td>Room: 337</td>
<td>S34: Energy Features of a Vehicle-to-home System to Provide User-specific Technical Requirements</td>
</tr>
<tr>
<td>Room: 327</td>
<td>A High-efficiency High Step-up DC-DC Converter with Passive Clamped Coupled-inductor and Voltage Double Cells</td>
</tr>
<tr>
<td>Room: 328</td>
<td>Dynamic Phasor Models for AC Microgrids Stability Studies</td>
</tr>
<tr>
<td>Room: 329</td>
<td>Design Considerations on the DC Capacitor of Each Chopper Cell in a Modular Multilevel Cascade Inverters (MMCI-DSCC) for Medium-voltage Motor Drives</td>
</tr>
<tr>
<td>Room: 330</td>
<td>An Adaptive Ramp Compensation Scheme to Improve Stability for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 333</td>
<td>Selected Harmonic Resistance Control based Series Active Power Filter for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 334</td>
<td>A Novel Online ESR and C Identification Method for Output Capacitor of Buck Converter</td>
</tr>
<tr>
<td>Room: 335</td>
<td>Near Time-optimal Model Predictive Control using an L1-norm based Cost Functional</td>
</tr>
<tr>
<td>Room: 336</td>
<td>Design of High Torque Density Variable Flux Permanent Magnet Machine using Alnico Magnets</td>
</tr>
<tr>
<td>Room: 337</td>
<td>Input/output Feedback Linearization Control of Linear Induction Motors Including the Dynamic End-Effects</td>
</tr>
<tr>
<td>Room: 338</td>
<td>Harmonic Stability in Renewable Energy Systems an Overview</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8:50 am – 9:15 am</th>
<th>Oral Sessions • 8:00 am – 9:40 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room: 323</td>
<td>S33: Solar PV Technologies</td>
</tr>
<tr>
<td>Room: 324</td>
<td>S34: Energy Management in Residential Applications</td>
</tr>
<tr>
<td>Room: 326</td>
<td>S35: DC-DC Boost Converters</td>
</tr>
<tr>
<td>Room: 327</td>
<td>S36: Stability and Quality I</td>
</tr>
<tr>
<td>Room: 328</td>
<td>S37: Modular Multilevel Converters I</td>
</tr>
<tr>
<td>Room: 329</td>
<td>S38: Control of DC-DC Converters</td>
</tr>
<tr>
<td>Room: 330</td>
<td>S39: Active Power Filters and Power Quality</td>
</tr>
<tr>
<td>Room: 333</td>
<td>S40: Fault Diagnostics in Power Converters</td>
</tr>
<tr>
<td>Room: 334</td>
<td>S41: Control Issues in Electric Drives II</td>
</tr>
<tr>
<td>Room: 335</td>
<td>S42: IPM Machine Design</td>
</tr>
<tr>
<td>Room: 336</td>
<td>S43: Induction Motor Drives I</td>
</tr>
<tr>
<td>Room: 337</td>
<td>S34: Energy Features of a Vehicle-to-home System to Provide User-specific Technical Requirements</td>
</tr>
<tr>
<td>Room: 327</td>
<td>A High-efficiency High Step-up DC-DC Converter with Passive Clamped Coupled-inductor and Voltage Double Cells</td>
</tr>
<tr>
<td>Room: 328</td>
<td>Dynamic Phasor Models for AC Microgrids Stability Studies</td>
</tr>
<tr>
<td>Room: 329</td>
<td>Design Considerations on the DC Capacitor of Each Chopper Cell in a Modular Multilevel Cascade Inverters (MMCI-DSCC) for Medium-voltage Motor Drives</td>
</tr>
<tr>
<td>Room: 330</td>
<td>An Adaptive Ramp Compensation Scheme to Improve Stability for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 333</td>
<td>Selected Harmonic Resistance Control based Series Active Power Filter for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 334</td>
<td>A Novel Online ESR and C Identification Method for Output Capacitor of Buck Converter</td>
</tr>
<tr>
<td>Room: 335</td>
<td>Near Time-optimal Model Predictive Control using an L1-norm based Cost Functional</td>
</tr>
<tr>
<td>Room: 336</td>
<td>Design of High Torque Density Variable Flux Permanent Magnet Machine using Alnico Magnets</td>
</tr>
<tr>
<td>Room: 337</td>
<td>Input/output Feedback Linearization Control of Linear Induction Motors Including the Dynamic End-Effects</td>
</tr>
<tr>
<td>Room: 338</td>
<td>Harmonic Stability in Renewable Energy Systems an Overview</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9:15 am – 9:40 am</th>
<th>Oral Sessions • 8:00 am – 9:40 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room: 323</td>
<td>S33: Solar PV Technologies</td>
</tr>
<tr>
<td>Room: 324</td>
<td>S34: Energy Management in Residential Applications</td>
</tr>
<tr>
<td>Room: 326</td>
<td>S35: DC-DC Boost Converters</td>
</tr>
<tr>
<td>Room: 327</td>
<td>S36: Stability and Quality I</td>
</tr>
<tr>
<td>Room: 328</td>
<td>S37: Modular Multilevel Converters I</td>
</tr>
<tr>
<td>Room: 329</td>
<td>S38: Control of DC-DC Converters</td>
</tr>
<tr>
<td>Room: 330</td>
<td>S39: Active Power Filters and Power Quality</td>
</tr>
<tr>
<td>Room: 333</td>
<td>S40: Fault Diagnostics in Power Converters</td>
</tr>
<tr>
<td>Room: 334</td>
<td>S41: Control Issues in Electric Drives II</td>
</tr>
<tr>
<td>Room: 335</td>
<td>S42: IPM Machine Design</td>
</tr>
<tr>
<td>Room: 336</td>
<td>S43: Induction Motor Drives I</td>
</tr>
<tr>
<td>Room: 337</td>
<td>S34: Energy Features of a Vehicle-to-home System to Provide User-specific Technical Requirements</td>
</tr>
<tr>
<td>Room: 327</td>
<td>A High-efficiency High Step-up DC-DC Converter with Passive Clamped Coupled-inductor and Voltage Double Cells</td>
</tr>
<tr>
<td>Room: 328</td>
<td>Dynamic Phasor Models for AC Microgrids Stability Studies</td>
</tr>
<tr>
<td>Room: 329</td>
<td>Design Considerations on the DC Capacitor of Each Chopper Cell in a Modular Multilevel Cascade Inverters (MMCI-DSCC) for Medium-voltage Motor Drives</td>
</tr>
<tr>
<td>Room: 330</td>
<td>An Adaptive Ramp Compensation Scheme to Improve Stability for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 333</td>
<td>Selected Harmonic Resistance Control based Series Active Power Filter for DC-DC Converters with Ripple-based Constant On-time Control</td>
</tr>
<tr>
<td>Room: 334</td>
<td>A Novel Online ESR and C Identification Method for Output Capacitor of Buck Converter</td>
</tr>
<tr>
<td>Room: 335</td>
<td>Near Time-optimal Model Predictive Control using an L1-norm based Cost Functional</td>
</tr>
<tr>
<td>Room: 336</td>
<td>Design of High Torque Density Variable Flux Permanent Magnet Machine using Alnico Magnets</td>
</tr>
<tr>
<td>Room: 337</td>
<td>Input/output Feedback Linearization Control of Linear Induction Motors Including the Dynamic End-Effects</td>
</tr>
<tr>
<td>Room: 338</td>
<td>Harmonic Stability in Renewable Energy Systems an Overview</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9:40 am – 10:00 am</th>
<th>AM Break</th>
</tr>
</thead>
</table>
### Wednesday, September 17 (Continued)

#### Oral Sessions • 10:00 am – 11:40 am

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

**Lunch on Own**
|--------------|----------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
## Wednesday, September 17 (Continued)

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

---

7:00 pm – 9:00 pm | ECCE Banquet | | | | | | | | | | | |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am – 8:25 am</td>
<td>Energy Storage Systems</td>
</tr>
<tr>
<td>Flyback-type di/dt Snubber for 10kW IGCT in MV Wind Turbines</td>
<td></td>
</tr>
<tr>
<td>High Resolution Output Power Estimation of Large-scale Distributed PV Systems</td>
<td>Optimization of Fundamental Frequency Modulation for Cascaded Multilevel Inverter-based Transformer- less UPC</td>
</tr>
<tr>
<td>One Dimensional Cell Inversion; A Modulation Strategy for Hybrid Cascaded Converters</td>
<td></td>
</tr>
<tr>
<td>3-phase Three-level Series Resonant DC-DC Converter with Variable Frequency Control</td>
<td></td>
</tr>
<tr>
<td>LLC Resonant DC Transformer (DCX) with Parallel PWM Tight Regulation</td>
<td></td>
</tr>
<tr>
<td>DC-link Input EMI Filter Design in a Centralized Architecture PV Inverter; Impedance Approach</td>
<td></td>
</tr>
<tr>
<td>A Bidirectional Resonant DC-DC Converter with Frequency Tracking Control</td>
<td></td>
</tr>
<tr>
<td>Shielding-cancellation Technique for Suppressing Common Mode EMI in Isolated Power Converters</td>
<td></td>
</tr>
<tr>
<td>Transverse Flux Permanent Magnet Motor with Double-C Stator Hoops and Flux-concentrated Rotor for In-wheel Drive Electric Vehicle</td>
<td></td>
</tr>
<tr>
<td>The Measurement and Indexing of Unbalanced Magnetic Pull in Electrical Machines</td>
<td></td>
</tr>
<tr>
<td>Hardware Integration for an Integrated Modular Motor Drive Including Distributed Control</td>
<td></td>
</tr>
<tr>
<td>8:25 am – 8:50 am</td>
<td>Power Converters for Wind Energy Applications</td>
</tr>
<tr>
<td>Converter-fed Synchronous Machine for Pumped Hydro Storage Plants</td>
<td></td>
</tr>
<tr>
<td>Nine-switch Converter-based DFIG Wind Power System and its Dynamic DC Voltage Assignment Approach for Low Voltage Riding through (LVRT)</td>
<td></td>
</tr>
<tr>
<td>Modeling, Analysis and Evaluation of Smart Load Functionality in the CERTS Microgrid</td>
<td></td>
</tr>
<tr>
<td>One Dimensional Cell Inversion; A Modulation Strategy for Hybrid Cascaded Converters</td>
<td></td>
</tr>
<tr>
<td>A Compact Planar Rzogowski Coil Current Sensor for Active Current Balancing of Parallel-connected Silicon Carbide MOSFET’s</td>
<td></td>
</tr>
<tr>
<td>3-phase Three-level LC-type Series Resonant DC-DC Converter with Variable Frequency Control</td>
<td></td>
</tr>
<tr>
<td>LLC Resonant DC Transformer (DCX) with Parallel PWM Tight Regulation</td>
<td></td>
</tr>
<tr>
<td>DC-link Input EMI Filter Design in a Centralized Architecture PV Inverter; Impedance Approach</td>
<td></td>
</tr>
<tr>
<td>A Bidirectional Resonant DC-DC Converter with Frequency Tracking Control</td>
<td></td>
</tr>
<tr>
<td>Shielding-cancellation Technique for Suppressing Common Mode EMI in Isolated Power Converters</td>
<td></td>
</tr>
<tr>
<td>Transverse Flux Permanent Magnet Motor with Double-C Stator Hoops and Flux-concentrated Rotor for In-wheel Drive Electric Vehicle</td>
<td></td>
</tr>
<tr>
<td>The Measurement and Indexing of Unbalanced Magnetic Pull in Electrical Machines</td>
<td></td>
</tr>
<tr>
<td>Hardware Integration for an Integrated Modular Motor Drive Including Distributed Control</td>
<td></td>
</tr>
<tr>
<td>8:50 am – 9:15 am</td>
<td>Microgrid Modeling</td>
</tr>
<tr>
<td>Zero-sequence Voltage Injection for DC Capacitor Voltage Balancing Control of the Star-connected Cascaded H-bridge PWM Converter under Unbalanced Grid</td>
<td></td>
</tr>
<tr>
<td>Develop Parasitic Inductance Model for the Planar Busbar of an IGBT H Bridge in a Power Inverter</td>
<td></td>
</tr>
<tr>
<td>Characterization of the Voltage and Electric Field Stresses in Multi-cell Solid-state Converters</td>
<td></td>
</tr>
<tr>
<td>Analysis on the Influence of Secondary Parasitic Capacitance to ZVS Transistor in LLC Resonant Converter</td>
<td></td>
</tr>
<tr>
<td>Analysis and Filter Design of Differential Mode EMI Noise for GaN-based Interleaved MHz Critical Mode PFC Converter</td>
<td></td>
</tr>
<tr>
<td>Integrated Capacitor for Common-mode EMI Mitigation Applicable to High Frequency Planar Transformers used in Electric Vehicles DC-DC Converters</td>
<td></td>
</tr>
<tr>
<td>Flux Regulation Strategies for Hybrid Excitation Synchronous Machines</td>
<td></td>
</tr>
<tr>
<td>Modeling of Dual Mechanical Port Machine with Squirrel-cage Outer Rotor for Hybrid Electric Vehicles</td>
<td></td>
</tr>
<tr>
<td>9:15 am – 9:40 am</td>
<td>Multi-level Converters</td>
</tr>
<tr>
<td>Development of the Flywheel Energy Storage System with Multiple Parallel Drives</td>
<td></td>
</tr>
<tr>
<td>Diagnosis of Lithium-ion Batteries State-of-health based on Electrochemical Impedance Spectroscopy Technique</td>
<td></td>
</tr>
<tr>
<td>13.8 kV Five Level ANPC Inverter for Wind Power</td>
<td></td>
</tr>
<tr>
<td>Modeling, Analysis, and Measurement of Impedance for 3-phase AC Distributed Power System</td>
<td></td>
</tr>
<tr>
<td>Efficiency Improved and Current Balanced 3-phase Modular Cascaded H-bridge Multilevel PV Inverter for Grid-connected Applications</td>
<td></td>
</tr>
<tr>
<td>Realization and Characterization of an IGBT Module based on the Power Chip-on-chip 3D Concept1</td>
<td></td>
</tr>
<tr>
<td>Five-level Unidirectional T-rectifier for High Speed Gen-set Applications</td>
<td></td>
</tr>
<tr>
<td>A Bidirectional Resonant DC-DC Converter with Frequency Tracking Control</td>
<td></td>
</tr>
<tr>
<td>Shielding-cancellation Technique for Suppressing Common Mode EMI in Isolated Power Converters</td>
<td></td>
</tr>
<tr>
<td>Transverse Flux Permanent Magnet Motor with Double-C Stator Hoops and Flux-concentrated Rotor for In-wheel Drive Electric Vehicle</td>
<td></td>
</tr>
<tr>
<td>The Measurement and Indexing of Unbalanced Magnetic Pull in Electrical Machines</td>
<td></td>
</tr>
<tr>
<td>Hardware Integration for an Integrated Modular Motor Drive Including Distributed Control</td>
<td></td>
</tr>
</tbody>
</table>
| 9:40 am – 10:00 am AM Break... .........................................................................................................................
### Thursday, September 18 (Continued)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1000 am – 10:25 am</strong></td>
<td><strong>10:25 am – 10:50 am</strong></td>
<td><strong>10:50 am – 11:15 am</strong></td>
<td><strong>11:15 am – 11:40 am</strong></td>
<td><strong>11:50 am – 1:20 pm</strong></td>
<td><strong>Awards Lunch</strong>&lt;br&gt;Spirit of Pittsburgh Ballroom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Thursday, September 18 (Continued)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1:55 pm – 2:20 pm</td>
<td>An input-adaptive Self-oscillating Synchronous Boost Converter for LED Driving with Ultra-low Wide-range Voltage Input</td>
<td>Frequency-based Control of a Microgrid with Multiple Renewable Energy Sources</td>
<td>Medium Voltage AC Collection Grid for Large Scale Photovoltaic Plants based on Medium Frequency Transformers</td>
<td>A DC-DC Circuit Suitable for HVDC Applications with Large Step-ratios</td>
<td>Dual-input High Gain DC-DC Converter based on the Anti-fraction Multiplier</td>
<td>A Non-regenerative Five-level Rectifier</td>
<td>On-line DC-link Voltage Control of LLC Resonant Converter for Server Power Applications</td>
<td>Critical Modulation Method based on PWM in Back-to-back 3-phase System</td>
<td>Mission Profile Translation to Capacitor Stresses for High-power PWM Converters</td>
<td>Improved Selective Harmonics Elimination (SHE) Scheme with Online Harmonic Compensation for High-power PWM Converters</td>
<td>High Speed Operation of Electrical Machines, a Review on Technology, Benefits and Challenges</td>
<td>Roll Up Stator Development for 66 Frame PM Synchronous Motor</td>
</tr>
<tr>
<td>3:10 pm – 3:30 pm</td>
<td>PM Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
</tbody>
</table>
Registration

Contact the customer service staff, located in the Registration Desk. 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.

Full Conference and Tutorial Registration

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

Tutorials will take place on Sunday, September 14, 2014. 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>Membership</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>$350.00</td>
<td>$750.00</td>
</tr>
<tr>
<td>Student Non-Member</td>
<td>$450.00</td>
<td>$475.00</td>
<td>$800.00</td>
</tr>
<tr>
<td>Society Member</td>
<td>$850.00</td>
<td>$425.00</td>
<td>$1,250.00</td>
</tr>
<tr>
<td>Life Member</td>
<td>$400.00</td>
<td>$350.00</td>
<td>$750.00</td>
</tr>
<tr>
<td>Non-Member</td>
<td>$1050.00</td>
<td>$475.00</td>
<td>$1,450.00</td>
</tr>
</tbody>
</table>

One-Day Registration

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

One-Day Registration Rates

<table>
<thead>
<tr>
<th>Membership</th>
<th>$400.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Society Member</td>
<td>$400.00</td>
</tr>
<tr>
<td>IEEE Member</td>
<td>$450.00</td>
</tr>
<tr>
<td>Non-Member</td>
<td>$450.00</td>
</tr>
</tbody>
</table>

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

Certificate of Attendance

Certificates of Attendance will not be provided for ECCE 2014.

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 in the Registration Desk.

Expo Only

Expo Only Registration allows access to the exhibit hall on Tuesday, September 16. Registration is complimentary and tickets can be picked up at the Registration Desk located in the Noresco Foyer.

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 guests’ 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.

Full Guest Ticket ...................................................... $175.00
Opening Reception Only........................................... $60.00
ECCE Banquet Only................................................ $100.00
Awards Luncheon Only ............................................ $60.00

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 Digression

Sunday through Thursday

Rooms: 332 and 337

Creative Digressions is what we call a space reserved for those conference attendees who need to go someplace to think, to discuss, to organize their minds around the hubbub of active ties around them. ECCE 2014 is packed with activities that fully engage 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 rooms have 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 apace.
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.

Business Center
The Westin Convention Center Pittsburgh features a 24-hour Business Center on the 2nd floor, offering 3 computers, a printer and a copy machine. Copies and print outs are charged at 25 cents per page (black and white) and 30 cents per page (color). Wired High Speed Internet Access is available for a fee of $6.95 per 15 minutes used at the Westin.

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.

First Aid
If you are in need of emergency services or hospital care, the nearest hospitals are as follows:

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPMC Mercy</td>
<td>1400 Locust Street, Pittsburgh, PA 15219</td>
<td>412.232.8111</td>
</tr>
<tr>
<td>Allegheny General Hospital</td>
<td>320 E. North Avenue, Pittsburgh, PA 15212</td>
<td>412.359.3988</td>
</tr>
</tbody>
</table>

Hotels
The ECCE 2014 headquarters hotel is the Westin Convention Center Pittsburgh.

<table>
<thead>
<tr>
<th>Hotel</th>
<th>Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westin Convention Center Pittsburgh</td>
<td>1000 Penn Avenue, Pittsburgh, PA 15222</td>
<td>412.281.3700 or 888.627.7053</td>
</tr>
</tbody>
</table>

Internet Access
Guest Room Internet is complimentary in IEEE Guestrooms at the Westin Convention Center Pittsburgh. There is complimentary wifi in various areas throughout the David L. Lawrence Convention Center. Please note that wifi will be marked for 30 minutes at a time.

Local Transportation
Taxi stands are located at the East Lobby Cut Out of the David L. Lawrence Convention Center.

Lost & Found
Lost and found is located at the Registration Desk of the David L. Lawrence Convention Center.

Meals & Refreshments
Full conference registration includes all meals, refreshments and social functions (except the Industry Student Dinner) provided by ECCE 2014.

Morning Refreshments
Monday, Wednesday and Thursday — Noresco Foyer
Tuesday — Exhibit Hall C

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>10:00 am – 10:20 am</td>
<td>Noresco Foyer</td>
</tr>
<tr>
<td>Tuesday</td>
<td>9:40 am – 10:00 am</td>
<td>Exhibit Hall C</td>
</tr>
<tr>
<td>Wednesday</td>
<td>9:40 am – 10:00 am</td>
<td>Exhibit Hall C</td>
</tr>
<tr>
<td>Thursday</td>
<td>9:40 am – 10:00 am</td>
<td>Exhibit Hall C</td>
</tr>
</tbody>
</table>

Lunch
Tuesday — Exhibit Hall C

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday</td>
<td>12:00 pm – 2:00 pm</td>
</tr>
</tbody>
</table>

Awards Luncheon
Thursday — Spirit of Pittsburgh Ballroom

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>11:50 am – 1:20 pm</td>
</tr>
</tbody>
</table>

Afternoon Refreshments
Monday, Wednesday and Thursday — Noresco Foyer
Tuesday — Exhibit Hall C

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday</td>
<td>4:15 pm – 4:30 pm</td>
<td>Noresco Foyer</td>
</tr>
<tr>
<td>Wednesday</td>
<td>3:10 pm – 3:30 pm</td>
<td>Exhibit Hall C</td>
</tr>
<tr>
<td>Thursday</td>
<td>3:10 pm – 3:30 pm</td>
<td>Exhibit Hall C</td>
</tr>
</tbody>
</table>

Parking

<table>
<thead>
<tr>
<th>Type</th>
<th>Cost/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convention Center:</td>
<td></td>
</tr>
<tr>
<td>Self-Parking</td>
<td>$12 USD</td>
</tr>
<tr>
<td>Hotel Parking:</td>
<td></td>
</tr>
<tr>
<td>Self-Parking</td>
<td>$20 USD</td>
</tr>
<tr>
<td>Valet Parking:</td>
<td>$24 USD</td>
</tr>
</tbody>
</table>

Visitor Information Desk
Visit Pittsburgh has a desk at the David L. Lawrence Convention Center on the concourse outside of Exhibit Hall C. This desk is staffed between 7:00 am and 7:00 pm on Sunday and Monday, and 7:00 am and 6:00 pm on Tuesday. The staff specializes in Pittsburgh recommendations: restaurants, dining reservations, attractions, tours, things to do, and transportation options. The desk is also stocked with brochures.
Special Events

Newcomers Orientation
Sunday, 4:00 pm – 5:00 pm
Room: 335

The orientation will consist of a short session intended to act as a guide for those who are new to ECCE. The content of this session, however, contains information that should be of interest to anyone who wishes to organize their conference calendar in a meaningful way or to gain a behind the curtains feel for the content and organization of the conference. Many members of the organizing committee will describe the program elements that they were responsible for. Vice chairs of the Technical Programs Committee will briefly discuss the trends and topics that they felt dominated the submissions in various tracks, as well as the submissions to the Special Sessions. The Town Hall Meeting features student programs, exhibition programs, and Industrial Seminars. We hope to give everyone present a concise briefing on the upcoming conference.

Meet and Greet the Fellows Reception
Sunday, 5:00 pm – 7:00 pm
Fourth Floor North Terrace

Join us for a Meet and Greet the Fellows Reception within the Sunday evening Opening Reception of ECCE 2014. A chance to chat, take photos and congratulate the 2014 IEEE Power Electronics Society Class of Fellows that have chosen to receive their award at ECCE.

PELS Fellows

Cursino Jacobina
Federal University of Campina Grande/DEE
Honored for contributions to the development of power converters and machine drives.

Pedro Rodriguez
Abengoa Research
Honored for contributions to the control of distributed power generation.

Charles Sullivan
Dartmouth University
Honored for contributions to the design of power electronic circuits and magnetics.

IAS Fellows

Muhammed Fazlur Rahman
University of New South Wales
Honored for contributions to direct torque control of integrated permanent magnet machines.

Opening Reception
Sunday, 5:00 pm – 7:00 pm
Fourth Floor North Terrace

Catch up with your industry partners and friends! Grab a drink and relax before the week ahead.

Expo Reception
Monday, 4:00 pm – 6:30 pm
Exhibit Hall C
Supported by Ingersoll Rand

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.

Student Paper Awards

A special thank you to the following companies who have funded this year’s student paper awards:

United Technologies Research Center
Best Student Papers

Wiley
Best Student Papers

ECCE on Social Media

@ieee_ecce.com #ecce_2014
facebook.com/ieee.ecce
Join the IEEE Energy Conversion and Exposition Group.
We are happy to introduce the ECCE 2014 Student-Industry Visit with Exhibits Passport Game. This is a great way of highlighting the important relationship between students and industry companies that exhibit every year.

All students will receive an official Passport game-card at registration and have a chance to win great prizes at the official drawing on Tuesday afternoon in the exhibit hall. Directions on how to complete the game will be included on the game card available to students at the registration desk.

Industry Tours

Eaton Power Systems Experience Center
Cost: $40/person (transportation cost)
Limited to 50 people

At the Power Systems Experience Center (PSEC), Eaton’s full-scale laboratory and demonstration facility near Pittsburgh, visitors can see firsthand the latest advances in electrical power quality, energy management and safety. In this controlled environment, visitors observe product testing and performance, participate in live demonstrations and learn about power management technologies from Eaton experts.

Please inquire at the registration desk for more information.

ECCE Banquet

Wednesday, 7:00 pm – 9:00 pm
Spirit of Pittsburgh Ballroom

Join your colleagues for great food, drinks, entertainment and networking.

> Presenter Information

Oral Presenters

Speaker Ready Room
The Speaker Ready Room is located in Room 331 at the David L. Lawrence Convention Center.

The hours of operation of the Speaker Ready Room are as follows:
Saturday, September 13 ............................. 3:00 pm – 5:00 pm
Sunday, September 14 .............................. 8:30 am – 5:00 pm
Monday, September 15 .............................. 8:30 am – 5:00 pm
Tuesday, September 16 ............................ 8:30 am – 12:00 pm
Wednesday, September 17 ........................ 8:30 am – 5:00 pm
Thursday, September 18 ............................ 8:30 am – 12:00 pm

Presentations
The oral presentation time slots are 25 minutes each. Please prepare a presentation for 20 minutes and leave 5 minutes for setting up, and questions & answers. Please strictly observe this time limit in order to facilitate people moving between sessions. All oral presenters are required to prepare PowerPoint slides for their visual presentations. You do not need to submit a hard copy of your slides and you do not need to bring a computer onsite, as all presentations will be pre-loaded onto the Seminar computer that will be in your session room.

Presentation Upload
All presentations must be uploaded in the Speaker Ready Room at ECCE 2014! We will not have an advanced upload site this year as ALL speakers will be directed to the speaker ready room (room 331) to upload their presentation. If you are speaking before 12:00 pm, you will need to upload your presentation the day prior to your session. If you are speaking after 1:00 pm, you will need to upload your presentation by 10:00 am.

For your reference, see the following grid showing the due date/time for your presentation upload, based on the day/time you are speaking:

<table>
<thead>
<tr>
<th>Speaking Day/Time</th>
<th>Presentation Upload Cutoff Day/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday 8:00 am – 12:00 pm..........</td>
<td>No later than Saturday 5:00 pm</td>
</tr>
<tr>
<td>Sunday 1:00 pm – 5:00 pm</td>
<td>No later than Sunday 10:00 am</td>
</tr>
<tr>
<td>Monday 8:00 am – 12:00 pm..........</td>
<td>No later than Monday 10:00 am</td>
</tr>
<tr>
<td>Monday 1:00 pm – 5:00 pm</td>
<td>No later than Monday 10:00 am</td>
</tr>
<tr>
<td>Tuesday 8:00 am – 12:00 pm.........</td>
<td>No later than Tuesday 12:00 pm</td>
</tr>
<tr>
<td>Wednesday 8:00 am – 12:00 pm.......</td>
<td>No later than Wednesday 1:00 pm</td>
</tr>
<tr>
<td>Thursday 8:00 am – 12:00 pm........</td>
<td>No later than Thursday 12:00 pm</td>
</tr>
<tr>
<td>Thursday 1:00 pm – 5:10 pm.........</td>
<td>No later than Thursday 10:00 am</td>
</tr>
</tbody>
</table>

If you have edits to your presentation after the cutoff time listed above, you will need to bring your updated presentation with you on a flash drive directly to the session room.
**Oral Presenters (Continued)**

**Oral Presenters’ Orientation**
A Presenters’ orientation will be held for oral presenters and session chairs from 7:00 am – 8:00 am, Monday through Thursday at the David L. Lawrence Convention Center:
- Monday - Tuesday: Allegheny Overlook
- Wednesday - Thursday: Spirit of Pittsburgh Ballroom

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**
Tuesday  
*Exhibit Hall C*

Poster Session I ............ Monday, September 15, 5:00 pm – 6:30 pm  
Poster Session II ........... Tuesday, September 16, 10:00 am – 11:30 am  
Poster Session III .......... Tuesday, September 16, 3:30 pm – 5:00 pm

Posters will be on display on Monday and Tuesday in *Exhibit Hall C* at the David L. Lawrence Convention 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 starting on page 32.

Poster Presenters will have access to *Exhibit Hall C* at the David L. Lawrence Convention Center to set up and tear down their posters at the times listed below for each of the Poster Sessions.

**Poster Presenters’ Orientation**
A Presenters’ orientation will be held for poster presenters on Monday and Tuesday at the David L. Lawrence Convention Center. The orientation will be located at the stage in *Exhibit Hall C* as follows:
- Monday ......................... 1:30 pm – 2:00 pm
- Tuesday ......................... 7:30 am – 8:00 am

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.

**Poster Session I Setup**
Setup ........................................... Monday, September 15, 2:00 pm – 4:00 pm  
Poster Session ..................... Monday, September 15, 4:00 pm – 6:30 pm  
Breakdown ......................... Monday, September 15, 6:30 pm – 7:30 pm

Presenters for Poster Session I must have their posters set-up no later than 4:00 pm. Any posters that remain on the poster boards at 7:30 pm, and do not belong in Poster Session II will be removed and kept at the Registration Desk.

**Poster Session II Setup**
Setup ........................................... Tuesday, September 16, 8:00 am – 9:00 am  
Poster Session ................. Tuesday, September 16, 10:00 am – 11:30 am  
Breakdown ......................... Tuesday, September 16, 11:30 am – 12:30 pm

Presenters for Poster Session II must have their posters set-up no later than 9:00 am. Any posters that remain on the poster boards at 12:30 pm, and do not belong in Poster Session III will be removed and kept at the Registration Desk.

**Poster Session III Setup**
Setup ........................................... Tuesday, September 16, 2:00 – 3:00 pm  
Poster Session ..................... Tuesday, September 16, 3:30 – 5:00 pm  
Breakdown ......................... Tuesday, September 16, 6:00 – 7:00 pm

Presenters for Poster Session I must have their posters set-up no later than 3:00 pm. Any posters that remain on the poster boards at 7:00 pm, will be removed and kept at the Registration Desk.

Uncollected posters will be discarded.

**Poster Boards & Push-pins**
4’ x 8’ 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.
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 topics cover materials, components, subsystems and systems 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.

Tomy Sebastian
IEEE ECCE Plenary Session Chair

“Critical Materials for Energy Systems Manufacturing”
Dr. Alex King, Director of the Critical Materials Institute, The Ames Laboratory, Ames, Iowa, USA

Dr. Alex King is the Director of the US Department of Energy’s Critical Materials Institute; and the former Director of the Ames Laboratory, in Ames, Iowa. He has been a Visiting Fellow of the Japan Society for the Promotion of Science; and a US Department of State Jefferson Science Fellow. He is a Fellow of the Institute of Mining Minerals and Materials; ASM International; and the Materials Research Society. Dr. King has also been the President of the Materials Research Society; Chair of the University Materials Council; and Chair of the American Physical Society’s Group on Energy Research and Applications.

“High Power Electronics Innovation”
Dr. Peter K. Steimer, General Manager of the R&D Department for Drives & Power Electronics, ABB Switzerland

Dr. Peter K. Steimer received his MSc in 1981 and his PhD in 1991 from the Swiss Federal Institute of Technology in Zurich. From 1990 till 1996 he has been the general manager of the R&D department for drives & power electronics. From 1994 till 1997 he has been responsible for ABB’s high impact program focused on the development of the new IGCT power semiconductors technology. In 1998/99 he served as an adjunct professor at the University of Wisconsin in Madison. From 1999 onwards he has been responsible for the technology and innovation management of ABB’s business unit for medium voltage drives and power electronics systems. In 2002 he successfully graduated in the program “Mastering technology enterprise” of IMD, a management school for executive education. Since 2013 Dr. Peter K. Steimer is serving as Vice President of Innovation for ABB’s newly established global ABB Business Unit Power Conversion covering Renewables (wind, solar), Power protection, Power control, Energy storage, Transportation and Electric Vehicle charging markets. His research interests are with high power semiconductors, multi-level topologies and new applications. He is the inventor or co-inventor of more than 50 patents and has authored or co-authored more than 90 technical papers. He is an IEEE fellow and an ABB Corporate Executive Engineer.

Peter Savagian has worked on electric vehicles and systems since 1990. He now serves as General Director of GM’s Electrification Systems and Electric Drive Engineering organization. For the past 16 years he has managed product and technology development for GM’s hybrid and electric vehicles, including architecture development, electronics and motor design and development, systems engineering, systems analysis, and control algorithms development. Prior to his current assignment, Pete was Chief Engineer for GM’s EV1 Electric Vehicle Electric Drive at General Motors and at Delco Electronics. He has also worked at Hughes Aircraft Company and Sundstrand Aviation in various engineering roles. Pete holds a BS in Mechanical Engineering from the University of Wisconsin, a MS in Operations Research Engineering from the University of Southern California, and an MBA from Duke University.

S.S Mani received his Bachelors Degree in Electrical Engineering from Regional Engineering College (Presently, National Institute of Technology), Calicut in 1979, MS in Quality management from Birla Institute of Technology, Pilani, in 2012 & Post Graduate Certificate Program in Project Management from Indian Institute of Management, Indore during 2013-14. Currently, he is the General Manger of Renewable Energy Projects in NTPC Ltd, India. NTPC is India’s Largest Power Utility Company and, as on Nov 2013 NTPC is having an Installed Capacity of 42 GW with 10 MWp of Solar PV Power Capacity & another 20 GW including 100 MWp Solar PV Projects are under construction. He was responsible for the Construction & Commissioning of 5 MWp Solar PV Project in Port Blair/Andaman & Nicobar Island in India. This Project is NTPC’s ‘Numero-Unu’ Green Field Renewable Energy Project & was commissioned in a Benchmarking Schedule, thereby bagging the Company Award for Best Performance in Project Management (Renewable Projects) for 2012-13. He was also Head of Technical Services/Planning & Systems at NTPC’s 2600 MW Coal Based Project at Ramagundam & 350 MW Naphta Based Combined Cycle Power Project at Kayamkulam. Mani is a Qualified Assessor of CII-Exim Bank Award for Business Excellence (EFQM Model) & IPMA Award Assessor for Project Management.

Peter Savagian, General Director, Electrification Systems and Electric Drive Engineering, General Motors Corp, Pontiac, Michigan, USA

S.S. Mani, General Manager of Renewable Energy Projects, NTPC Ltd, Belgaum, Karnataka, India
Townhall Meetings

**Tuesday, September 16 10:00 am – 12:00 pm**

There will be two Townhall meeting sessions this year at ECCE for attendees to engage in debate concerning critical issues in state of the art and emerging technologies. This year’s format is less formal to allow attendees to feel at ease and engage in open discussion with expert panelists. Each panelist will make a brief presentation to initiate the discussion.

**Townhall: Hybrid/Electric Vehicles — Today and Tomorrow**

Room: 330

Hybrid/Electric vehicles are vital for energy efficiency and to reduce the dependency on oil. Many topologies have been proposed and developed to meet this desire. However there are challenges and uncertainties to overcome to penetrate the market profoundly. This meeting will focus on the latest technologies, policies and the future of hybrid/electric vehicles.

**Moderator**
Chris Mi, University of Michigan - Dearborn, USA

**Panelists**
- Mohamed Alamgir, LG Chem Power Inc.
- Bing Cheng, Chrysler Group LLC
- David Fulton, Remy Inc.
- Chun T. Rim, Department of NQE, KAIST
- V. Anand Sankaran, Ford Motor Company

**Townhall: Wide Band Gap Devices — Potentials versus Reality**

Room: 329

Power electronics are an enabling technology for almost every modern electrical system from the smart grid to consumer electronics. One reason for the success and implementation of power electronics is the ever increasing efficiency, performance and reliability, which is further enhanced by wide band gap devices such as GaN, SiC etc. This meeting will focus on the potentials, current trends and the state of the art of WBG device technologies.

**Moderator**
Burak Ozpineci, Oak Ridge National Laboratory, USA

**Panelists**
- Anant Argarwal, Wide Band Gap Initiative, EERE
- Sharon Beerman-Curtin, Sea Warfare and Weapons Department, Office of Naval Research
- Jeff Casady, CREE
- Alex Lidlow, Efficient Power Conversion
- Ranbir Singh, GeneSiC Semiconductor Inc.
- Ljubisa Stevanovic, GE Global Research

The meetings will be led by a moderator in order to keep the meandering digressions to a minimum, yet stimulate and promote innovative tangents. Participants are strongly encouraged to contribute to the debate, discussion, and discourse surrounding the selected topics. We are hoping for honest discussion about the topics in a passionate and intelligent way.

The two sessions this year will focus on hybrid/electric vehicles and wide band gap devices.
This tutorial focuses on industrial high-power medium-voltage converters that use high-power medium-voltage devices like IGCTs and IEGTs. Such converters reach high power ratings (e.g., 10 – 30 MVA) with minimum quantity of switching devices. However, medium-voltage devices have typically high switching losses, which limit the switching frequency of converters at only several hundred Hertz. As a result, the optimization of the converter performance like the power capability, power quality and the control dynamics becomes challenging. This tutorial discusses the design of such converters in three aspects: converter topology, modulation scheme and current controller. It should be noted that several special phenomena occur due to the low switching frequency, and they may lead to a significant performance degradation of the converter. In this tutorial, several modeling methodologies are introduced, which are explicitly developed to explore the mechanism of these special phenomena at low switching frequencies. Based on this, generalized design guidelines for the design and optimization are summarized, which have been developed, implemented and experimentally validated. Comparative analysis of converters with low switching frequencies versus high switching frequencies will be conducted throughout the tutorial, since the latter ones are more familiar to most audience (as reference). Moreover, some design examples will be given.

Up to now the control of electrical power using power converters has been based on the principle of mean value, using pulse width modulation with linear controllers in a cascaded structure. Recent research works have demonstrated that it is possible to use Predictive Control to control electrical energy with the use of power converters, without using modulators and linear controllers. This is a new approach that will have a strong impact on control in power electronics in coming decades. The main advantages of predictive control are: (1) Concepts are very intuitive and easy to understand; (2) It can be applied to a great variety of systems; (3) The multivariable case can be easily considered; (4) Dead times can be compensated; (5) Easy inclusion of non-linearities in the model; (6) Simple treatment of constraints; (7) The resulting controller is easy to implement; and (8) This methodology is open to include modifications and extensions depending on specific applications. The participants of this tutorial will learn: (1) The basic concepts and ideas; (2) Different types of predictive controllers; (3) Detailed examples of predictive controllers; and (4) Several applications in different converter topologies.

Proper selection and optimized utilization of permanent and soft magnetic materials requires an understanding of their magnetic and physical properties, how each material reacts to temperature, and the environment and what the application requires regarding a full set of magnetic and physical properties under either or both DC and AC applied field conditions. This tutorial is designed to introduce the fundamental principles of magnetism, explore a full range of magnetic materials and learn how to interpret manufacturer’s specifications. Also covered, the market for magnetic materials, sources, supply security, and forecast for material availability.

Continuous drive towards high-power density and high-efficiency machine designs has resulted in increased interest in more accurate design and optimization methodologies, where the multi-disciplinary and multi-physics phenomena are accounted for. In-depth understanding of the electromagnetic, thermal and mechanical interactions are essential when developing new machine designs or evaluating existing solutions. The electromechanical power loss is of particular interest as it determines the power output capability and power conversion efficiency of an electrical machine. The theoretical analysis of the power loss allows for identifying and quantifying the loss mechanisms that would be difficult to determine if a common testing procedure on complete machine hardware was used instead. It is important to note that the power loss and thermal effects are strongly interdependent and their accurate derivation requires a careful consideration. Importance of this research theme has been acknowledged by numerous authors and documented by the wide body of work from the instructors experience are given in detail including both theoretical and experimental techniques and methodologies. The loss mechanisms discussed in the tutorial include: mechanical loss, winding loss, core loss, permanent magnet loss and retaining sleeve loss. More specifically, the latest developments in timely topics such as proximity loss in windings, core loss in electric motors within variable speed systems, loss in high-energy permanent magnets (NdFeB and SmCo), loss in stator and rotor retaining sleeves (carbon fibre), mechanical and bearings loss are discussed. Some details regarding loss thermal dependence at high-frequency AC operation is also provided.
This tutorial will provide an overview of power semiconductor modules in automotive HEV/EV inverter applications. The tutorial will cover four major aspects of power module: design, applications, manufacturing and reliability. These four aspects are inter-related. A power module is designed to meet specific HEV/EV inverter applications. The broad module reliability specification is also driven by the applications requirements (vehicle drive cycles). However, the specific module reliability target will depend on module design (material, size etc.) and manufacturing process. The tutorial will cover the basics of power module design: structure, interconnections, thermal and electrical performance. Although the focus of this tutorial is power module design, the fundamentals of the semiconductor devices (IGBT/diodes) used in these modules will be summarized. The design of the power module strongly depends on the device characteristics. The characteristics of the devices can be tuned to optimize power module performance. Both the device and module performance strongly influences the inverter efficiency, which, in turn, impacts MPG rating of the vehicle. Heat losses from the devices and module thermal performance determine the silicon and module size and therefore the cost of the inverter. The mechanical stresses that vehicle operating conditions (duty cycle) imposes on an inverter also depends on device and module characteristics. The tutorial will connect various aspects of power device and module characteristics for Hybrid-Electric Vehicle inverter applications. Basic production processes will be discussed via a video of actual module production facility. A brief introduction to simulations for life time expectation of the modules will be presented and a couple of practical examples will be discussed. Special emphasis will be provided on the influence of power module design on lifetime and the impact of various external thermal and electrical parameters. The tutorial will prepare engineers and managers to answer in three questions: (1) how does the power device and module characteristics impact fuel economy? (2) how can I specify power module reliability requirements based on vehicle drive cycles? and (3) how is power module designed, manufactured and qualified?

**T1-5 Power semiconductor modules: Design, Applications, Manufacturing & Reliability**

*Room: 327*

*Instructor: Dr. Andre Christmann, Infineon Technologies North America Corp.*

Exploitation of Oil and Gas deposits from below sea surface is increasing and the production technology is moving from using fixed platforms/ floating vessels towards locating all production and processing equipment on the seabed. Processing equipment such as pumps and compressors need a large amount of electric power, which has to be provided from shore, platforms or floating vessels. The Tutorial will touch on the challenges for oil and gas production and transportation and provide background for the need of pumps and compressors and the required electric power to meet the flow and process needs. Different Electric Power Transmission and Distribution Systems will be presented and discussed related to the application and physical limitations. Critical components such as transformers, VSD’s, Switchgears, cables and Connections will be presented including challenges and limitations seen from a subsea perspective. Electrification of seabed electric consumers is challenging, not only because of all components being submerged in seawater at water depths down to 10000 feet/3000m, but also the required accessibility to repair/exchange the components by regular maintenance and /or in a “fault situation”. This shall be taken into account in the modularization and the subsea lay-out in order to achieve the required availability of typical 98%. Consequently all electric components has to undergo severe qualification testing prior to being installed subsea following agreed test schedules to meet required TRL (Technical Readiness Level). The TRL levels and requirements will be displayed and an example from electrical wet mate connector qualification will be briefly presented. As subsea electrification is a relatively new technology and application area, Subsea Standards are not very well developed. However, several Oil Companies are cooperating in developing common standards, with the intention to transfer these to IEEE/IEC standards. The first Standard following this path is on Connections, with more to come. The tutorial will inform briefly of the ongoing work. Finally the Tutorial will look at future challenges and potential solutions for transmission on long distances, (DC) and taking components down to very deep waters (Pressure Tolerant solutions).

**T1-6 Electrification of Subsea Process Plants, Why and How**

*Room: 328*

*Instructor: Sven Erik Rocke, GE Oil & Gas, Norway*

Exploitation of Oil and Gas deposits from below sea surface is increasing and the production technology is moving from using fixed platforms/ floating vessels towards locating all production and processing equipment on the seabed. Processing equipment such as pumps and compressors need a large amount of electric power, which has to be provided from shore, platforms or floating vessels. The Tutorial will touch on the challenges for oil and gas production and transportation and provide background for the need of pumps and compressors and the required electric power to meet the flow and process needs. Different Electric Power Transmission and Distribution Systems will be presented and discussed related to the application and physical limitations. Critical components such as transformers, VSD’s, Switchgears, cables and Connections will be presented including challenges and limitations seen from a subsea perspective. Electrification of seabed electric consumers is challenging, not only because of all components being submerged in seawater at water depths down to 10000 feet/3000m, but also the required accessibility to repair/exchange the components by regular maintenance and /or in a “fault situation”. This shall be taken into account in the modularization and the subsea lay-out in order to achieve the required availability of typical 98%. Consequently all electric components has to undergo severe qualification testing prior to being installed subsea following agreed test schedules to meet required TRL (Technical Readiness Level). The TRL levels and requirements will be displayed and an example from electrical wet mate connector qualification will be briefly presented. As subsea electrification is a relatively new technology and application area, Subsea Standards are not very well developed. However, several Oil Companies are cooperating in developing common standards, with the intention to transfer these to IEEE/IEC standards. The first Standard following this path is on Connections, with more to come. The tutorial will inform briefly of the ongoing work. Finally the Tutorial will look at future challenges and potential solutions for transmission on long distances, (DC) and taking components down to very deep waters (Pressure Tolerant solutions).

**Sunday, September 14 1:00 pm – 5:00 pm Afternoon Sessions**

**T2-1 Feedback-loop Design Issues of DC-DC Converters in High-power Energy Harvesting Applications**

*Room: 323*

*Instructor: Dr. Antonio Lazaro, Dr. Andrés Barrado, Carlos III University of Madrid*

Exploiting the energy of sea waves, or recuperating the kinetic or potential energy of mechanical systems (electric vehicles, cranes and elevators, etc.) can be considered highpower energy harvesting. It is a common characteristic of such systems that the input power shows relatively rapid fluctuations, necessitating the need for short-term energy storage and bidirectional energy processing. The power converters used to control the power flow between the various building blocks of the system (electric generators, storage devices, motors, utility interface) must maintain stability and be able to handle the fluctuations under widely varying operating conditions.

**T2-2 Design for Reliability of Power Electronic Systems**

*Room: 324*

*Instructors: Frede Blaabjerg, Center of Reliable Power Electronics (CORPE), Aalborg University, Denmark, Huai Wang, Center of Reliable Power Electronics (CORPE), Aalborg University, Denmark, Ke Ma, Center of Reliable Power Electronics (CORPE), Aalborg University, Denmark, Marco Liserre, Christian-Albrechts-University of Kiel, Germany*

In recent years, the automotive and aerospace industries have brought stringent reliability constraints on power electronic systems because of safety requirements. Today customers of many power electronic products expect up to 20 years of lifetime and they also want to have a “failure free period” and all with focus at the financials. The industrial and energy sectors are also following the same trend, and more and more efforts are being devoted to improving power electronic systems to account for reliability with cost-effective and sustainable solutions. The emphasis of this tutorial is to give a framework on the design for reliability of power electronic systems and the recent research activities and paradigm shifts in this research area. It will cover the reliability requirements in different industry sectors, reliability and lifetime of IGBT modules and capacitors used in power electronic converters, and the specific design for reliability procedure for power electronic systems. Study cases on mission profile based design of photovoltaic inverters and wind power converters, and active thermal control and condition monitoring of power converters are also discussed. The approaches presented in the tutorial are also the common interest for the companies involved in the
Impedance-based Modeling and Analysis of 3-phase Grid-connected Converters

Room: 325
Instructor: Dr. Jian Sun, Rensselaer Polytechnic Institute

Operation and control performance of grid connected converters are strongly influenced by the grid. A wind or solar inverter, for example, may become unstable when connected to a weak grid that has high impedance. A converter may also form resonance with the grid impedance, producing high harmonics that deteriorate grid power quality, trig converter and grid protection functions, and cause physical damages to the converter and other devices in the grid. Impedance-based methods have been used extensively to study stability and dynamic performance of dc power systems. However, the time-varying (sinusoidal) operation trajectory of a converter with ac power system makes it mathematically difficult to develop its impedance models by conventional small-signal analysis. Additionally, the method cannot be directly applied to three-phase converters due to the mutual coupling among three phases (when there is no neutral connection, as is usually the case). This tutorial introduces impedance-based modeling and analysis methods for converters connected to the ac power grid, with a focus on three-phase PWM inverters and rectifiers. A new method combining harmonic linearization with symmetrical component analysis is presented for three-phase converters. In this approach, a three-phase converter is modeled by positive-sequence and negative-sequence impedances, and converter-grid interactions are studied using a positive-sequence and a negative-sequence equivalent circuit that are uncoupled from each other, such that the conventional Nyquist criterion can be applied. Applications of the method in such practical problems as converter control instability under weak grid conditions and harmonic resonance between the converter and the grid will be presented. Practical methods to measure three-phase converter and grid impedances are also presented, and the possibility to develop adaptive control for solar and wind inverters based on real-time measurement of the grid impedance is discussed.

GaN Transistors for Efficient Power Conversion

Room: 326
Instructors: Dr. Alex Lidow, Dr. David Reusch, Efficient Power Conversion Corporation (EPC)

Gallium Nitride (GaN) is now accepted in many power conversion and RF applications. The technology is rapidly developing and product experience in the field is expanding. This tutorial will begin with a discussion of the state-of-the-art in GaN technology, an overview of GaN technology, GaN transistor structures and the latest electrical performance. The tutorial will continue with application examples including new developments in high efficiency DC-DC conversion and emerging applications enabled by GaN transistors, such as high frequency Envelope Tracking (ET), and Wireless Power Transfer (WiPo). Following these examples, drivers, layout, paralleling, dead-time management, and thermal considerations will be examined. The tutorial concludes with a look into future of this relatively young technology and its potential to improve performance in existing applications and enable new applications not possible with aging silicon MOSFETs. Beyond the discrete transistor, the extension of GaN technology to fully integrated circuits will be discussed, furthering the potential of GaN to raise the bar in power conversion performance.

The Rediscovery of Synchronous Reluctance and Ferrite PM Motors as Valid Competitors to Induction and Rare-earth PM Motors

Room: 327
Instructors: Dr. Gianmario Pellegrino, Politecnico di Torino, Turin, Italy, Dr. Thomas Jahns, University of Wisconsin-Madison, USA, Dr. Nicola Bianchi, University of Padova, Italy, Dr. Wen Soong, The University of Adelaide, Australia, Dr. Francesco Cupertino, Politecnico di Bari, Italy

The considerable recent variability in the price of rare-earth permanent magnets (PM) has caused a resurgence of interest in alternative machine topologies including synchronous reluctance and ferrite PM machines. This tutorial covers the analysis and design of synchronous motors for variable-speed applications, including permanent magnet and synchronous reluctance machines. It does not focus on a specific application, but aims to provide a broad perspective on electrical motors that are becoming a valid alternative to those currently used in variable-speed drives, such as induction motors and rare-earth PM synchronous machines. Among others, synchronous reluctance machines and PM machines without rare-earth materials will be considered and compared with state-of-the-art solutions.

Soft Crystalline Magnetic Materials

Room: 328
Instructor: Sigrid Jacobs, ArcelorMittal Belgium

Ferromagnetic materials play a key role in electrical machines; their presence in the cores of these machines can greatly influence the torque/power developed, as well as their efficiency. This works via the mechanism of flux concentration: if a current carrying conductor coil is placed around a ferromagnetic material, much more magnetic flux can be generated for a given current; and this flux is important for the torque developed by a motor or the energy transferred in a transformer. The tutorial starts with the principles of ferromagnetism and develops further into what happens during magnetisation processes, within the structure of typical ferromagnetic materials such as FeSi (electrical steels), FeCo and FeNi. Phenomena such as hysteresis, eddy currents, magnetic domains, Curie temperature, soft versus hard materials, are explained. The parameters that influence the level of flux concentration, as well as the level of energy losses within the ferromagnetic material are shown. The target of the tutorial is to clarify what are the differences between magnetic materials on the market, to show their key advantages and weaknesses. The different classes of magnetic materials will be explained: soft vs. hard, crystalline vs. amorphous, ferrites vs. composites vs. laminations, non-oriented vs. oriented, fully processed vs. semi-processed. The most suitable magnetic material for different types of electric applications will be explained, with examples on their influence of machine performance. The aim is to assist in a cost/performance choice when going into machine design and having a ferromagnetic material choice to make. This will be done in most detail for soft crystalline magnetic materials.
Monday, September 15 10:20 am – 12:00 pm

S1 MPPT for Solar PV Systems

Room: 323
Chair: Ahmed Elasser

10:20 am > Distributed Control of PV Strings with Module Integrated Converters in Presence of a Central MPPT
Dezso Sera, Laszlo Mathe, Frede Blaabjerg, Aalborg University, Denmark

10:45 am > Maximum Power Point Tracking for Multiple Photovoltaic Modules using Root-finding Methods
Joonhyun Kim, Alexis Kwasinski, University of Texas at Austin, United States

11:10 am > PV Generation Enhancement with a Virtual Inertia Emulator to Provide Inertial Response to the Grid
Xiaoyu Wang, Meng Yue, Eduard Muljadi, Brookhaven National Laboratory, United States; National Renewable Energy Laboratory, United States

11:35 am > Using MPPT in Multi-pulse Converters for Photovoltaic Cogeneration
Lucas Lapoll Brighenti, Rubens Tadeu Hock Jr., Luis Gustavo Kremer, Alessandro Luiz Batschauer, Marcello Mezaroba, Santa Catarina State University, Brazil

S2 Power Converters for Photovoltaic Applications

Room: 324
Chairs: M. Amirabadi, T. Shimizu

10:20 am > Low-voltage Ride through Capability of 3-phase Grid-connected Photovoltaic Inverters with Slim Film Capacitors
Baburaj Karanayil, Josep Pou, Mitra Mirhosseini, Vassilios G. Agelidis, University of New South Wales, Australia; Technical University of Catalonia, Spain

10:45 am > Modular Photovoltaic Inverter with High-frequency DC-DC Stage based on Low-voltage FETs
F. Giuliani, D. Barater, C. Concari, P. Cova, N. Delmonte, R. Menozzi, G. Buticchi, L. Tarisciotti, University of Parma, Italy; University of Kiel, Germany; University of Nottingham, United Kingdom

11:10 am > Control Approach to Achieve Burst Mode Operation with DC-link Voltage Protection in Single-phase Two-stage PV Inverters
Yang Du, Weidong Xiao, Yihua Hu, Dylan Dah-Chuan Lu, Masdar Institute of Science and Technology, United Arab Emirates; University of Strathclyde, United Kingdom; University of Sydney, Australia

11:35 am > Optimized Control of Isolated Residential Power Router for Photovoltaic Applications
Yuzhi Zhang, Yuming Wang, Yusi Liu, Chris Farnell, H. Alan Mantooth, Roger Dougal, University of Arkansas, United States; Texas A&M University, United States

S3 Microgrid Control I

Room: 325
Chairs: Sandeep Bala, Dragan Maksimovic

10:20 am > Dual Sequence Current Controller without Current Sequence Decomposition Implemented on DSRF for Unbalanced Grid Voltage Conditions
Sizhan Zhou, Jinjun Liu, Linyuan Zhou, Hongwei She, Xi’an Jiaotong University, China

10:45 am > Voltage-frequency Control of an Islanded Microgrid using the Intrinsic Droop Characteristics of Resonant Current Regulators
B. Sheiby, R. Davoodnejad, D.G. Holmes, B.P. McGrath, RMIT University, Australia

11:10 am > Plug and Play Nonlinear Droop Construction Scheme to Optimize Microgrid Operations
Fatih Cingoz, Ali Elrayyah, Yilmaz Sozer, University of Akron, United States

11:35 am > Transient Droop for Improved Transient Load Sharing in Microgrids
Andrew Paquette, Deepak Divan, Georgia Institute of Technology, United States

S4 Widebandgap Devices I

Room: 326
Chairs: Filippo Chimento, Jerry Hudgins

10:20 am > Modeling and Characterization of a 300 V GaN based Boost Converter with 96% Efficiency at 1 MHz
Raghav Khanna, Brian Hughes, William Stanchina, Rongming Chu, Karim Boutros, Gregory Reed, University of Pittsburgh, United States; HRL Laboratories LLC, United States

10:45 am > Analytical Loss Model of Low Voltage Enhancement Mode GaN HEMTs
Wang Kangping, Yang Xu, Zeng Xiangjun, Yu Xiaoling, Li Hongchang, Guo Yixuan, Gao Bing, Ma Huan, Xi’an Jiaotong University, China

11:10 am > Avoiding Si MOSFET Avalanche and Achieving True Zero-voltage-switching for Cascode Device
Xiu Cheng Huang, Wei Jing Du, Zheng Yang Liu, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

11:35 am > Characterization and Modeling of a Gallium Nitride Power HEMT
Kang Peng, Enrico Santi, University of South Carolina, United States

S5 Reliability and Diagnostics in Grid Converters

Room: 327
Chair: Antonio M. Cardoso

10:20 am > Detection of Capacitor Degradation in LC Filters for AC Drives
Rangarajan M. Tallam, Russel J. Kerkman, Richard A. Lukaszewski, Rockwell Automation, United States

10:45 am > Improved Reliability of Single-phase PV Inverters by Limiting the Maximum Feed-in Power
Yongheng Yang, Huai Wang, Frede Blaabjerg, Aalborg University, Denmark

11:10 am > Improved Dual Second-order Generalized Integrator PLL for Grid Synchronization under Non-ideal Grid Voltages including DC Offset
Jie Li, Jie Zhang, Jia Yu, Ping-ping Xu, Xi’an University of Technology, China

11:35 am > Single Phase Synchronous Reference Frame Power Control of Grid Connected Multi Level Inverter
Bhuru Naga V Angirekula, Olorunfemi Ojo, Tennessee Technological University, United States
S6  Telecom Power Supplies

Room: 328
Chair: Xiao-Bo Yang

10:20 am > Hyper-efficient (98%) and Super-compact (3.3kW/dm3) Isolated AC-DC Telecom Power Supply Module based on Multi-cell Converter Approach
Matthias Kasper, Dominik Bortis, Johann W. Kolar, Gerald Deboy, ETH Zurich, Switzerland; Infineon Technologies Austria, AG, Austria

10:45 am > Adaptive Implementation Strategy of Virtual Impedance for Paralleled Inverters UPS
Hongtai Shi, Fang Zhuo, Dong Zhang, Zhiquing Geng, Feng Wang, Xi’an Jiaotong University, China

11:10 am > Modeling the Output Impedance of 3-phase Uninterruptible Power Supply in D-Q Frame
Bo Wen, Dushan Boroyevich, Rolando Burgos, Paolo Mattavelli, Virginia Polytechnic Institute and State University, United States; University of Padova, Italy

11:35 am > A Series-stacked Architecture for Highly-efficiency Data Center Power Delivery
Josiah McClurg, Robert C.N. Pilawa-Podgurski, Pradeep S. Shenoy, University of Illinois at Urbana-Champaign, United States; Texas Instruments Inc., United States

S7  Modulation for Power Converters

Room: 329
Chair: Donald Holmes

10:20 am > Decoupled Modulation Techniques for a Four-level 5-phase Open-end Winding Drive
Martin Jones, Milan Darjicic, Emil Levi, Liverpool John Moores University, United Kingdom

10:45 am > Common-mode Voltage Reduction of Three Level Four Leg PWM Converter
Seung-Jun Chee, Hyeon-Sik Kim, Han-Beom Yeom, Hyun-Keun Ko, Sung-Sang Im, Pusan National University, Korea; Lehigh University, United States

11:10 am > A Dead-time Compensation Method for Parabolic Current Control with Improved Current Tracking Precision
Lanhua Zhang, Bin Gu, Jason Dominic, Jih-Sheng Lai, Virginia Polytechnic Institute and State University, United States

11:35 am > Investigation into the Control Methods to Reduce the DC-link Capacitor Ripple Current in a Back-to-back Converter
Zian Qin, Huai Wang, Frede Blaabjerg, Aalborg University, Denmark

S8  Control and Modulation of Multilevel Converters I

Room: 330
Chairs: Percice Zanchetta, Stefano Bifaretti

10:20 am > A Generalised Natural Balance Model and Balance Booster Filter Design for Three Level Neutral Point Clamped Converters
Z. Mohzani, B.P. McGrath, D.G. Holmes, Robert Bosch Pty. Ltd., Singapore; RMIT University, Australia

10:45 am > A Reduced Switching Loss PWM Strategy to Eliminate Common Mode Voltage In Multilevel Inverters
Nho-Van Nguyen, Tam Tu Nguyen Khanh, Hai Thanh Quach, Hong-Hee Lee, Hochiminh City University of Technology, Viet Nam; University of Ulsan, Korea

11:10 am > Capacitor Voltage Balancing of a Five-level Diode-clamped Converter using Minimum Loss SVPWM Algorithm for Wide Range Modulation Indices
Aparna Saha, Yilmaz Sozer, Ali Eryayyah, University of Akron, United States

11:35 am > A New Control Scheme of Five-level Active NPC Converters for Common Mode Voltage Mitigation in Medium Voltage Drives
Jun Li, Zach Pan, Rolando Burgos, ABB US Corporate Research Center, United States; Virginia Polytechnic Institute and State University, United States

S9  Assorted Issues in Electric Drives I

Room: 333
Chairs: Uday Deshpande, Akshay Rathore

10:20 am > Self-commissioning of Inverter Dead-time Compensation by Multiple Linear Regression based on a Physical Model
Nicola Bedetti, Sandro Calligaro, Roberto Petrella, Gefran s.p.a., Italy; DIEG-University of Udine, Italy

10:45 am > Current Reconstruction Method with Single DC-link Current Sensor based on the PWM Inverter and AC Motor
Kwang-Sik Kim, Han-Beom Yeom, Hyun-Keun Ko, Jang-Mok Kim, Won-Sang Im, Pusan National University, Korea; Lehigh University, United States

11:10 am > Dynamic Effects of Mismatched Time Constants in DC-DC Converters with Inductor DCR Current Sensing
Giorgio Spiazzi, Simone Buso, Luca Corradini, University of Padova, Italy

11:35 am > Insulated Signal Transmission System using Planar Resonant Coupling Technology for High Voltage IGBT Gate Driver
Hiroshi Shinoda, Takahide Terada, Hitachi, Ltd., Japan

S10  Induction Machines

Room: 334
Chairs: Aldo Boglietti, Andy Knight

10:20 am > Modeling and Performance of Novel Scheme Dual Winding Cage Rotor Variable Speed Induction Generator with DC Link Power Delivery
Lucian Nicolae Tutelaia, Ion Boldea, Nicolae Muntean, Sorin Ioan Deaconu, Politehnica University of Timisoara, Romania

10:45 am > A Differential Evolution Algorithm for Designing Inverter-driven Induction Motors
Alejandro J. Piña, Longya Xu, Ohio State University, United States

11:10 am > A 5-phase Induction Machine Model using Multiple DQ Planes Considering the Effect of Magnetic Saturation
Ayman S. Abdel-Khalik, Shehab Ahmed, Ahmed Massoud, Alexandria University, Egypt; Texas A&M University at Qatar, Qatar; Qatar University, Qatar

11:35 am > Analysis of Non-intrusive Efficiency Estimation of Induction Machines Compared to the IEEE 112B and IEC 34-2-1 Standards
C.S. Gajjar, M.A. Khan, P. Barendse, University of Cape Town, South Africa

S11  Flux-switching Machines

Room: 335
Chairs: Ed Lovelace, Peng Zhang

10:20 am > Analysis of Flux Switching Permanent Magnet Machine Design for High-speed Applications
Yingjie Li, Silon Li, Yida Yang, Bulent Sarlioglu, WEMPEC, University of Wisconsin-Madison, United States

10:45 am > Analysis of the Torque Production Mechanism for Flux-switching Permanent Magnet Machines
James D. McFarland, T.M. Jahns, Ayman M. El-Refaie, University of Wisconsin-Madison, United States; GE Global Research Center, United States
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:10 am</td>
<td>Reduced Rare-earth Flux Switching Machines for Traction Applications</td>
<td>Room: 323</td>
<td>Tsarafidy Raminosoa, Ayman El-Refaie, Di Pan, Kum-Kang Huh, James Alexander, Kevin Grace, Stefan Grubic, Steven Galliato, Patel Reddy, Xiaochun Shen, GE Global Research, United States; Enso PLC, United States</td>
</tr>
<tr>
<td>11:35 am</td>
<td>Investigation of On-loaded Performances of Hybrid-excitation Flux-switching Brushless Machines for HEV/EV Applications</td>
<td>Room: 323</td>
<td>Gan Zhang, Wei Hua, Ming Cheng, Jinguo Liao, Jianzhong Zhang, Wei Jiang, Southeast University, China</td>
</tr>
<tr>
<td>1:30 pm – 3:35 pm</td>
<td>S12 Power Converters for Transportation Applications I</td>
<td>Room: 323</td>
<td>Chair: S. Williamson, Giovanna Oriti</td>
</tr>
<tr>
<td>1:30 pm</td>
<td>Comparison of Multi-port Converter Topologies with Bidirectional Energy Flow for Automotive Energy Net Applications</td>
<td>Room: 323</td>
<td>Michael Mürken, Markus Simon, Christian Augustin, Johannes Pför, Technische Hochschule Ingolstadt, Germany</td>
</tr>
<tr>
<td>1:55 pm</td>
<td>An Asymmetrical FZ-source Hybrid Power Converter with Space Vector Pulse-width Modulation</td>
<td>Room: 323</td>
<td>Jun Cai, Qing-Chang Zhong, University of Sheffield, United Kingdom</td>
</tr>
<tr>
<td>2:20 pm</td>
<td>Design of a Solid-state DC Circuit Breaker for Light Rail Transit Power Supply Network</td>
<td>Room: 323</td>
<td>David Lawes, Li Ran, Zhenyu Xu, London Underground Ltd., United Kingdom; University of Warwick, United Kingdom; Beijing Sifang Automation Ltd., China</td>
</tr>
<tr>
<td>2:45 pm</td>
<td>Design of Coupled Inductor for Minimum Inductor Current Ripple in Rapid Traction Battery Charger Systems</td>
<td>Room: 323</td>
<td>Taewon Kang, Beomseok Chae, Taehyun Kang, Yongsuh Suh, Chonbuk National University, Korea</td>
</tr>
<tr>
<td>3:10 pm</td>
<td>Asymmetric Interleaving in Low-voltage CMOS Power Management with Multiple Supply Rails</td>
<td>Room: 323</td>
<td>Aaron D. Ho, Marcel Schuck, Robert C.N. Pilawa-Podgurski, University of Illinois at Urbana-Champaign, United States</td>
</tr>
<tr>
<td>1:30 pm – 3:35 pm</td>
<td>S13 Control of Power Converters in Renewable Energy</td>
<td>Room: 324</td>
<td>Chair: Jul-Ki Seok, Mahshid Amirabadi</td>
</tr>
<tr>
<td>1:30 pm</td>
<td>Analysis and Design of Grid-current-feedback Active Damping for LCL Resonance in Grid-connected Voltage Source Converters</td>
<td>Room: 324</td>
<td>Xiongfei Wang, Fred Wblaajber, Poh Chiang Loh, Aalborg University, Denmark</td>
</tr>
<tr>
<td>1:55 pm</td>
<td>Investigation on Series Active Filter Compensated High Power Grid-connected Voltage Source Converters with LCL Filter</td>
<td>Room: 324</td>
<td>S. Nadir Usulkan, Ahmed M. Hava, Aselsan Inc., Turkey; Middle East Technical University, Turkey</td>
</tr>
<tr>
<td>2:20 pm</td>
<td>Input Current Ripple Cancellation of Current-fed Switched Inverter</td>
<td>Room: 324</td>
<td>Soumya Shubhra Nag, Arun Sankar, Santanu Mishra, Avinash Joshi, Indian Institute of Technology Kanpur, India</td>
</tr>
<tr>
<td>2:45 pm</td>
<td>Advanced Techniques for Integration of Energy Storage and Photovoltaic Generator in Renewable Energy Systems</td>
<td>Room: 324</td>
<td>Suman Dwari, Luis Arnedo, Vladimir Blasko, United Technologies Research Center, United States</td>
</tr>
<tr>
<td>3:10 pm</td>
<td>Analysis and PWM Control of 3-phase Boost-derived Hybrid Converter</td>
<td>Room: 325</td>
<td>Olive Ray, Vimala Dharmarajan, Santanu Mishra, Ravindranath Adda, Prasad Enjeti, Indian Institute of Technology Kanpur, India; Indian Institute of Technology Guwahati, India; Texas A&amp;M University, United States</td>
</tr>
</tbody>
</table>

**Monday, September 15**
S16 Modular Multilevel Converters for HVDC
Room: 327
Chairs: Madhav Manjrekar, Qin Lei
1:30 pm > Control of Hybrid HVDC Transmission System with LCC and FB-MMC
Younggi Lee, Shenghui Cui, Sungmin Kim, Seung-Ki Sul, Seoul National University, Korea
1:55 pm > A Switching Frequency Reduction and a Mitigation of Voltage Fluctuation of Modular Multilevel Converter for HVDC
Hak-Jun Lee, Jae-Jung Jung, Seung-Ki Sul, LSIS Co., Ltd., Korea; Seoul National University, Korea
2:20 pm > Maximum Modulation Index for Modular Multilevel Converter with Circulating Current Control
Yalang Li, Xiaoyi Shi, Bo Liu, Fred Wang, Wannjun Lei, University of Tennessee, United States; Xi’an Jiaotong University, China
2:45 pm > Modulation and Control of MMC based Multiterminal HVDC
Xiu Yao, Luis Herrera, Jin Wang, Ohio State University, United States
3:10 pm > A Peak Current Limit Control Technique in Low-voltage Ride through Operation of the Star-connected Cascaded H-bridges Converter
Chia-Tse Lee, Hsin-Chih Chen, Ching-Wei Wang, Ping-Heng Wu, Ching-Hsiang Yang, Po-Tai Cheng, National Tsing Hua University, Taiwan

S17 Control of 3-phase Converters
Room: 328
Chairs: Luca Zarri, J. Pou
1:30 pm > Power Converter Control Framework for Agile Research and Development
Torben N. Matzen, Kim B. Larsen, Anders L. Jørgensen, Morten Weje, PowerCon A/S, Denmark; PowerCon Embedded A/S, Denmark
1:55 pm > Grid Frequency Tracking Control Strategy without PLL for 3-phase Inverter
Xinxin Zheng, Lan Xiao, Huizhen Wang, Shuo Liu, Nanjing University of Aeronautics and Astronautics, China
2:20 pm > An Improved Direct Power Control of PWM Rectifier with Active Power Ripple Minimization
Yongchang Zhang, Changqi Qu, Zhengxi Li, Wei Xu, North China University of Technology, China; Huazhong University of Science and Technology, China
2:45 pm > Capacitor Voltage Balancing Control of a Fully Integrated Three-level Isolated AC-DC PFC Converter for Reliable Operations
Xiong Li, Serkan Dusmez, Bilal Akin, Kaushik Rajashekara, University of Texas at Dallas, United States
3:10 pm > Discrete Time Modeling, Implementation and Design of Current Controllers
Christoph H. van der Broeck, Rik W. De Doncker, Sebastian A. Richter, Jochen von Bloh, RWTH Aachen University, Germany; AixControl GmbH, Germany

S18 AC-AC Converters
Room: 329
Chairs: Patrick Wheeler, Pericle Zanchetta
1:30 pm > Single-phase AC-AC Double-star Chopper-cells (DSCC) Converter without Common DC-link Capacitor
Italo Roger F.M.P. Da Silva, Alexandre C. Oliveira, Cursino B. Jacobina, Federal University of Campina Grande, Brazil
1:55 pm > A Novel Single-phase Cascaded Multilevel AC-AC Converter without Commutation Problem
Sanghoon Kim, Heung-Geun Kim, Honnyong Cha, Kyungpook National University, Korea
2:20 pm > Evaluation of a Maximum Power Density Design Method for Matrix Converter using SiC-MOSFET
Kazuhiro Koiwa, Jun-ichi Itoh, Nagaoka University of Technology, Japan
2:45 pm > Several-hundred-kHz Single-phase to Commercial Frequency 3-phase Matrix Converter using Delta-sigma Modulation with Space Vector
Yuki Nakata, Koji Orikawa, Jun-ichi Itoh, Nagaoka University of Technology, Japan
3:10 pm > The Impact of Switching Frequency on Input Filter Design for High Power Density Matrix Converter
Saeed Safari, Alberto Castellazzi, Pat Wheeler, University of Nottingham, United Kingdom

S19 Single-phase PFC Converters
Room: 330
Chairs: Paolo Mattavelli, Pericle Zanchetta
1:30 pm > A Single-stage Three-level Isolated PFC Converter
Serkan Dusmez, Xiong Li, Bilal Akin, University of Texas at Dallas, United States
1:55 pm > A Ripple-free Input Current PFC using Power Semiconductor Filter
Kuen-kaat Yuen, Wing-to Fan, Henry Shu-hung Chung, City University of Hong Kong, Hong Kong
2:20 pm > A Family of Single-phase Hybrid Step-down PFC Converters
Siyang Zhao, Junming Zhang, Hulong Zeng, Xinke Wu, Zhejiang University, China
2:45 pm > A Bridgeless Hybrid-resonant PWM Zero Voltage Switching Boost AC-DC Power Factor Corrected Converter
Muntasir Alam, Wilson Eberle, Chris Botting, Murray Edington, University of British Columbia, Canada; Delta-Q Technologies Corp., Canada
3:10 pm > Design and Evaluation of GaN-based Dual-phase Interleaved MHz Critical Mode PFC Converter
Zhengyang Liu, Xiucheng Huang, Mingkai Mu, Yuchen Yang, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

S20 Ernesto Weidenbrug Memorial Session: Diagnostics of Electric Machines
Room: 333
Chairs: Sang Bin Lee, Peter Wung
1:30 pm > Advanced Rotor Assessment of Motors Operating under Variable Load Conditions in Mining Facilities
José A. Antonino-Daviu, V. Climente-Alarcón, J. Pons-Llainares, E. Wiedenbrug, Universitat Politècnica de València, Spain; eta Scientific Inc, United States
1:55 pm > PM Synchronous Machine Drive Response to Asymmetrical Short-circuit Faults
Gilsu Choi, T.M. Jahns, University of Wisconsin-Madison, United States
2:20 pm > Online Broadband Insulation Spectroscopy of Induction Machines using Signal Injection
Prabhakar Neti, Stefan Grubic, General Electric Global Research, United States
2:45 pm > Evaluation of the Influence of Rotor Magnetic Anisotropy on Condition Monitoring of 2 Pole Induction Motors
Sungsik Shin, Jongwan Kim, Sang Bin Lee, Chaewoong Lim, Ernesto J. Wiedenbrug, Korea University, Korea; Hansung Electric Industrial Company, Korea
3:10 pm > Electrical Discharge and its Impact on Drivetrains of Wind Turbines
Pinjia Zhang, GE Global Research, United States
Tuesday, September 16 8:00 am – 9:40 am

**SS1** US Government Power Electronics and Electric Motors Research for Electric Motors

- **Room:** 334
- **Chair:** Burak Ozpineci

1:30 pm > **Advanced Power Electronics and Electric Motors Overview**
Burak Ozpineci, Oak Ridge National Laboratory, United States

1:55 pm > **WBG Power Electronics for Electric Vehicles**
Madhu Chinthavali, Oak Ridge National Laboratory, United States

2:20 pm > **Thermal Management for Electric Vehicles**
Sreekanth Narumanchi, National Renewable Energy Laboratory, United States

2:45 pm > **Electric Motors for Electric Vehicles**
Tim Burress, Oak Ridge National Laboratory, United States

3:10 pm > **CMI/Rare Earth Magnets**
Iver Anderson, the Ames Laboratory, United States

8:50 am > **Impacts of Providing Inertial Response on Dynamic Loads of Wind Turbine Drivetrains**
Irving P. Ginsang, Jaspreet S. Dhupia, Mohit Singh, Vahan Gevorgian, Eduard Muljadi, Jason Jonkman, Nanyang Technological University, Singapore; National Renewable Energy Laboratory, United States

9:15 am > **A Flux Vector-based Discrete-time Direct Torque Control for Salient-pole Permanent-magnet Synchronous Generators**
Zhe Zhang, Yue Zhao, Jianwu Zeng, Wei Qiao, University of Nebraska-Lincoln, United States

**S22** Wind Energy: Control and Operation I

- **Room:** 323
- **Chair:** Bulent Sarlioglu

8:00 am > **Reduced Cost of Reactive Power in Doubly Fed Induction Generator Wind Turbine System with Optimized Grid Filter**
Dao Zhou, Frede Blaabjerg, Toke Franke, Michael Tonnes, Mogens L. Aalborg University, Denmark; Danfoss Silicon Power GmbH, Germany; Siemens Wind Power A/S, Denmark

8:25 am > **Direct Power Control for DFIG under Unbalanced and Harmonically Distorted Grid Voltage in Stationary Frame**
Yipeng Song, Heng Nian, Zhejiang University, China

8:50 am > **Sub-synchronous Resonance Analysis in DFIG-based Wind Farms: Mitigation Methods — TCSC, GCSC, and DFIG Controllers — Part II**
Hossein Ali Mohammadmour, Enrico Santi, University of South Carolina, United States

9:15 am > **Impedance Matching based Stability Criteria for AC Microgrids**
Patricio A. Mendoza-Araya, Giri Venkataramanan, University of Chile, Chile; University of Wisconsin-Madison, United States

9:40 am > **A Review of Low Voltage Ride-through Techniques for Photovoltaic Generation Systems**
Hao Tian, Cong Ma, Guoqing He, Li Guanghui, Shandong University, China; China Electric Power Research Institute, China

9:15 am > **Frequency Stability of Hierarchically Controlled Hybrid Photovoltaic-battery-hydropower Microgrids**
Yajuan Guan, Juan C. Vasquez, Josep M. Guerrero, Dan Wu, Wei Feng, Yibo Wang, Aalborg University, Denmark; Chinese Academy of Sciences, China

**S23** Power Converters for Smart Grid and Utility Applications

- **Room:** 324
- **Chairs:** Madhav Manirekar, Milijana Odavic

8:00 am > **Development of the Active Capacitor Converter for PFC Converters**
Shen-Yang Lee, Yaow-Ming Chen, Kwang H. Liu, National Taiwan University, Taiwan; National Taiwan University of Science and Technology, Taiwan

8:25 am > **An Improved DPWM Method for Reduction of Resonant Problem in the Inverter**
Jin-Hyuk Park, Hae-Gwang Jeong, Kyo-Beum Lee, Ajou University, Korea; LG Electronics, Korea

8:50 am > **Extremely Sparse Parallel AC-link Universal Power Converters**
Majshid Amirabadi, University of Illinois at Chicago, United States

9:15 am > **Low Frequency Signal Injection for Grid Impedance Estimation in Three Phase Systems**
Pablo Garcia, Juan M. Guerrero, Jorge Garcia, Angel Navarro-Rodriguez, Mark Sumner, University of Oviedo, Spain; University of Nottingham, United Kingdom

**S24** Grid Stability

- **Room:** 325
- **Chairs:** Dragan Maksimović, Khurram Afridi

8:00 am > **Sub-synchronous Resonance Analysis in DFIG-based Wind Farms: Mitigation Methods — TCSC, GCSC, and DFIG Controllers — Part II**
Hossein Ali Mohammadmour, Enrico Santi, University of South Carolina, United States

8:25 am > **Impedance Matching based Stability Criteria for AC Microgrids**
Patricio A. Mendoza-Araya, Giri Venkataramanan, University of Chile, Chile; University of Wisconsin-Madison, United States

8:50 am > **A Review of Low Voltage Ride-through Techniques for Photovoltaic Generation Systems**
Hao Tian, Cong Ma, Guoqing He, Li Guanghui, Shandong University, China; China Electric Power Research Institute, China

**S25** Widebandgap Devices III

- **Room:** 326
- **Chairs:** John Siefken, Craig Winterhalter

8:00 am > **SiC MOSFETs based Split Output Half Bridge Inverter: Current Commutation Mechanism and Efficiency Analysis**
Helong Li, Stig Munk-Nielsen, Szymon Beczkowski, Xiongfei Wang, Aalborg University, Denmark
S26 Modular Multilevel Converters I

Room: 328  
Chair: Marcello Pucci, Pericle Zanchetta

8:00 am > Branch Energy Control for the Modular Multilevel Direct 
Converter Hexverter 
Dennis Karwatzki, Lennart Baruschka, Malte von Hofen, Axel Mertens, Leibniz 
Universität Hannover, Germany; Protolar GmbH, Germany

8:25 am > Realization of a Conceptual Approach for Power VLSI using 
Integrated Full-bridge Cells in Modular Multilevel Converters 
Hao Jiang, Zhengqiang Ma, Giri Venkataramanan, University of Wisconsin-
Madison, United States

8:50 am > A Low-speed, High-torque Motor Drive using the Modular 
Multilevel Cascade Converter based on Triple-star Bridge Cells (MMCC-
TSBC) 
Wataru Kawamura, Kuan-Liang Chen, Makoto Hagiwara, Hirofumi Akagi, Tokyo 
Institute of Technology, Japan

9:15 am > Capacitor Voltage Balancing based on Fundamental Frequency 
Sorting Algorithm for Modular Multilevel Converter 
Hao Peng, Ying Wang, Zibo Lv, Yan Deng, Xiangning He, Rongxiang Zhao, 
Zhejiang University, China

S27 Resonant Control in Power Converters

Room: 329  
Chair: Pericle Zanchetta

8:00 am > Selective Harmonic Control for Power Converters 
Keliang Zhou, Yongheng Yang, Frede Blaabjerg, Wenzhou Lu, Danwei Wang, 
University of Canterbury, New Zealand; Aalborg University, Denmark; Southeast 
University, China; Nanyang Technological University, Singapore

8:25 am > Reduced Order Generalized Integrators based Selective 
Harmonic Compensation Current Controller for Shunt Active Power Filters 
Zheng Zeng, Jiaqiang Yang, Shilan Chen, Jin Huang, Zhejiang University, China

8:50 am > Flexible Grid Connection Technique of Voltage Source Inverter 
under Unbalanced Grid Conditions based on Direct Power Control 
Yongbo Shen, Heng Nian, Zhejiang University, China

9:15 am > Resonant Controllers with Three-degree of Freedom for AC 
Power Electronic Converters 
A. Lidozzi, L. Solero, F. Crescimbini, M. Di Benedetto, S. Bifaretti, Roma Tre 
University, Italy; University of Roma Tor Vergata, Italy

S28 Switched-capacitor Converters 

Room: 330  
Chairs: Gui-Jia Su, Qiang Li

8:00 am > A High Step-up Converter based on Switched-capacitor Voltage 
Accumulator 
Shiying Hou, Jianfei Chen, Chongqing University, China

8:25 am > Analysis of Coupled Microinductors for Power-supply-on-chip 
Applications 
Ciaran Feeney, Mavee Duffy, Ningning Wang, Santosh Kulkarni, Cian O’Mathuna, 
National University of Ireland, Ireland; University College Cork, Ireland

8:50 am > Current Source Converter with Switched-inductor DC Link 
Circuit for Reduced Converter Losses 
Yichao Zhang, T.M. Jahns, University of Wisconsin-Madison, United States

9:15 am > Analysis and Design of a 1-kW 3X Interleaved Switched-
capacitor DC-DC Converter 
Shouxian Li, Bin Wu, Keyue Smedley, Sigmund Singer, University of California, 
Irvine, United States; Tel Aviv University, Israel

S29 Voltage Control Issues in Electric Drives

Room: 333  
Chairs: Vladimir Blasko, Sanjib Kumar Panda

8:00 am > An Optimal Solution for Operating a 3-phase Variable 
Frequency Drive from a Single-phase AC Source 
Mahesh M. Swamy, Joshua Collins, Anupama Balakrishnan, Yaskawa America, 
Inc., United States; Missouri University of Science and Technology, United States

8:25 am > Hexagon Voltage Manipulating Control (HVMC) for AC Motor 
Drives Operating at Voltage Limits 
Jul-Ki Seok, SeHwan Kim, Yeungnam University, Korea

8:50 am > Interleaved PWM Control for Neutral Point Balancing in Dual 
3-level Traction Drives 
Subhadeep Bhattacharya, Diego Mascarella, Benoit Boulet, Geza Joos, McGill 
University, Canada

9:15 am > Identification of the Magnetic Model of Permanent Magnet 
Synchronous Machines using DC-biased Low Frequency AC Signal 
Injection 
S.A. Odhano, R. Bojoi, S.G. Rosu, A. Tenconi, Politecnico di Torino, Italy; 
University “Politehnica” of Bucharest, Romania

S30 Prof. D. Howe Memorial Session: Synchronous Machines 

Room: 334  
Chairs: Z.Q. Zhu, Thomas Jahns

8:00 am > PMSM Magnetization State Estimation based on Stator-
reflected PM Resistance using High Frequency Signal Injection 
David Reigos, Daniel Fernandez, Zi-Qiang Zhu, Fernando Briz, University of 
Oviedo, Spain; University of Sheffield, United Kingdom

8:25 am > Comparison of Different Methods for Incipient Fault Diagnosis 
in PMSMs with Coaxial Insulated Windings 
Davide Barater, Jesus Arellano-Padilla, Chris Gerada, University of Parma, Italy; 
University of Nottingham, United Kingdom

8:50 am > Analysis of FSCW SPM Servo Motor with Static, Dynamic and 
Mixed Eccentricity in Aspects of Radial Force and Vibration 
Shaofeng Jia, Ronghai Qu, Jian Li, Zansong Fu, Hong Chen, Leilei Wu, Huazhong 
University of Science and Technology, China
9:15 am > The Structure Optimization of Novel Harmonic Current Excited Brushless Synchronous Machines based on Open Winding Pattern
Quntao An, Xiaolong Gao, Fei Yao, Lizhi Sun, Thomas Lipo, Harbin Institute of Technology, China; University of Wisconsin-Madison, United States

S31 Inductive Power Transfer II

Room: 335
Chairs: Burak Ozpineci, Fabio Giuli Capponi

8:00 am > Methods for Reducing Leakage Electric Field of a Wireless Power Transfer System for Electric Vehicles
Masaki Jo, Yukiya Sato, Yasuyoshi Kaneko, Shigeru Abe, Saitama University, Japan

8:25 am > Reducing Leakage Flux in IPT Systems by Modifying Pad Ferrite Structures
Fei Yang Lin, Adeel Zaheer, Mickel Budhia, Grant A. Covic, University of Auckland, New Zealand; Qualcomm NZ Ltd, New Zealand

8:50 am > Design Methodology of a Series-series Inductive Power Transfer System for Electric Vehicle Battery Charger Application
Zhicong Huang, Siu-Chung Wong, Chi K. Tse, Hong Kong Polytechnic University, Hong Kong

9:15 am > Analysis of Co-planar Intermediate Coil Structures in Inductive Power Transfer Systems
Abhilash Kamineni, Grant A. Covic, John T. Boys, University of Auckland, New Zealand

S32 Losses in Electrical Machines

Room: 336
Chairs: Rafal Wrobel, Emmanuel Agamloh

8:00 am > Combined Experimental and Numerical Method for Loss Separation in Permanent Magnet Brushless Machines
Greg Heins, Dan M. Ionel, Dean Patterson, Steve Stretz, Regal Beloit Corporation, United States

Hiroya Sugimoto, Seiyu Tanaka, Akira Chiba, Tokyo Institute of Technology, Japan

8:50 am > Winding Design for Minimum Power Loss and Low-cost Manufacture in Application to Fixed-speed PM Generator
Rafal Wrobel, Dave Staton, Richard Lock, Julian Booker, David Drury, University of Bristol, United Kingdom; Motor Design Ltd., United Kingdom

9:15 am > Cylindrical Rotor Design for Acoustic Noise and Windage Loss Reduction in Switched Reluctance Motor for HEV Applications
Kyohei Kiyota, Takeo Kakishima, Akira Chiba, Tokyo Institute of Technology, Japan

SS2 Wide Band Gap (WBG) Power Switch Modules — Requirements and Challenges

Room: 327
Chair: Krishna Shenai

8:00 am > Single-chip Data Sheets and Circuit Models — Do We Have Them Right for WBG Devices?
Krishna Shenai, Argonne National Laboratory, United States

8:25 am > WBG Usage in Automotive: Do Challenges Outweigh Advantages?
Andrew F Pinkos, Propulsion Systems, United States

8:50 am > Package and Assembly Requirements for SiC-based Power Modules in Industrial Applications
Thomas Grasshoff, Kevork Haddad, SEMIKRON International GmbH, United States

9:15 am > Reducing Cost in High-performance SiC Power Modules
Chad B. O’Neal, Arkansas Power Electronics International, Inc., United States

Wednesday, September 17
8:00 am – 9:40 am

S33 Solar PV Technologies

Room: 323
Chair: Dezso Sera

8:00 am > Power Electronic Components and System Installation for Plug-and-play Residential Solar PV
Md Tanvir Arafat Khan, Iqbal Hussain, David Lubkeman, North Carolina State University, United States

8:25 am > High-density Power Converters for Sub-module Photovoltaic Power Management
Rahul Sangwan, Kapil Kesarwani, Jason T. Stauth, Dartmouth College, United States

8:50 am > Cost-effective Photovoltaic Water Pumping System for Remote Regions Communities
Flavio Palmiro, João Onofre Pereira Pinto, Lucio Henrique Pereira, Ruben Barros Godoy, Federal University of Mato Grosso do Sul, Brazil

9:15 am > PV Arc-fault Detection using Spread Spectrum Time Domain Reflectometry (SSTDR)
Mohammed Khorsheed Alam, Faisal H. Khan, Jay Johnson, Jack Flicker, University of Utah, United States; Sandia National Laboratories, United States

S34 Energy Management in Residential Applications

Room: 324
Chairs: Mahesh Illindala, Feng Guo

8:00 am > Modeling the Energy Features of a Vehicle-to-home System to Provide User-specific Technical Requirements
Fabrizio Fattori, Norma Anglani, University of Pavia, Italy

8:25 am > Performance Characteristics of a Hybrid CERTS Microgrid Electric Vehicle Charging Station
Philip J. Hart, T.M. Jahns, R.H. Lasseter, University of Wisconsin-Madison, United States

8:50 am > Energy Management System Control and Experiment for Future Home
Wei Zhang, Fred C. Lee, Pin-Yu Huang, Virginia Polytechnic Institute and State University, United States; National Taiwan University of Science and Techno, Taiwan

9:15 am > A Review of Faults and Fault Diagnosis in Micro-grids Electrical Energy Infrastructure
James Hare, Xiaofang Shi, Shalabh Gupta, Ali Bazzi, University of Connecticut, United States

S35 DC-DC Boost Converters

Room: 326
Chairs: Hui Li, Paolo Mattavelli

8:00 am > A High-efficiency High Step-up DC-DC Converter with Passive Clamped Coupled-inductor and Voltage Double Cells
Jian Fu, Bo Zhang, Dongyuan Qiu, South China University of Technology, China
8:25 am  > High Power Step-up Modular Resonant DC-DC Converter for Offshore Wind Energy Systems
Amir Parastar, Jul-Ki Seok, Yeungnam University, Korea

8:50 am  > A New Hybrid Boosting Converter
Bin Wu, Shouxian Li, Smedley Keyue, University of California-Irvine, United States

9:15 am  > Identification and Robust Control of a Quadratic DC-DC Boost Converter by Hammerstein Model
F. Alonge, R. Rabbeni, M. Pucci, G. Vitale, Università degli Studi di Palermo, Italy; ISSIA-CNR, Italy

S36 Stability and Quality I
Room: 327
Chairs: Robert Pilawa, Hui Li

8:00 am  > Dynamic Phasor Models for AC Microgrids Stability Studies
Patricio A. Mendoza-Araya, Giri Venkataramanan, University of Chile, Chile; University of Wisconsin-Madison, United States

8:25 am  > Modeling and Resonant Characteristics Analysis of Multiple Paralleled Grid-connected Inverters with LCL Filter
Wei Hu, Jianjun Sun, Qian Ma, Fenxin Yin, Fei Liu, Xiaoming Zha, Wuhan University, China

8:50 am  > Strategies for the Connection of Distributed Power Generation Units to Distorted Networks
Cristian Blanco, David Díaz Reigosa, Fernando Briz, Juan M. Guerrero, University of Oviedo, Spain

9:15 am  > Analysis of Sinusoidal Current Reference Generation with Flat Instantaneous Active Power for Unbalanced Grids
Salvador Revelo, Marcelo A. Perez, Universidad Tecnica Federico Santa Maria, Chile

S37 Modular Multilevel Converters II
Room: 328
Chairs: Stefano Bifaretti, Alan Watson

8:00 am  > Design Considerations on the DC Capacitor of Each Chopper Cell in a Modular Multilevel Cascade Inverters (MMC-DSCC) for Medium-voltage Motor Drives
Yuhei Okazaki, Hitoshi Matsui, Makoto Hagiwara, Hirofumi Akagi, Tokyo Institute of Technology, Japan

8:25 am  > Study of Overcurrent Protection for Modular Multilevel Converter
R. Grinberg, E. Bjornstad, P. Steimer, A. Korn, M. Winkelinkemper, D. Gerardi, O. Senturk, O. Apeldoorn, J. Li, ABB Switzerland Ltd., Switzerland; ABB PAOG, Norway; ABB Corporate Research, United States

8:50 am  > Independent Control of Input Current, Load and Capacitor Voltage Balancing for a Modular Matrix Converter
Toshiki Nakamori, Mahmoud A. Sayed, Yuma Hayashi, Takaharu Takeshita, Shizunori Hamada, Kuniki Hiroa, Nagoya Institute of Technology, Japan; South Valley University, Egypt; Meidensha Corporation, Japan

9:15 am  > Analysis of the 5-cell Single Phase MMC Natural Balancing Mechanism
Wim van der Merwe, Peter Hokayem, Lidia Stepanova, ABB Corporate Research, Switzerland; École Polytechnique Fédérale de Lausanne, Switzerland

S38 Control of DC-DC Converters
Room: 329
Chairs: Giovanna Oriti, S. Williamson

8:00 am  > An Adaptive Ramp Compensation Scheme to Improve Stability for DC-DC Converters with Ripple-based Constant On-time Control
Ting Qian, Brad Lehman, Tongji University, China, Northeastern University, United States

8:25 am  > Resonant Augmentation Circuits for a Buck Converter Achieving Minimum-time Voltage Recovery from Load Transients
Zhenyu Shan, Siew-Chong Tan, Chi K. Tse, Juri Jatskevich, University of British Columbia, Canada; University of Hong Kong, Hong Kong; Hong Kong Polytechnic University, Hong Kong

8:50 am  > Digital Control of a High-voltage (2.5 kV) Bidirectional DC-DC Converter for Driving a Dielectric Electro Active Polymer (DEAP) based Capacitive Actuator
Prasanth Thummala, Zhe Zhang, Michael A.E. Andersen, Dragan Maksimovic, Technical University of Denmark, Denmark; University of Colorado-Boulder, United States

9:15 am  > Variable Frequency Multiplier Technique for High Efficiency Conversion over a Wide Operating Range
Wardah Inam, David J. Perreault, Khurram K. Afridi, Massachusetts Institute of Technology, United States

S39 Active Power Filters and Power Quality
Room: 330
Chairs: Milijana Odavic, David D Reigosa

8:00 am  > Selected Harmonic Resistance Control based Series Active Power Filter
Xiaoqing Song, Xijun Ni, Alex Q. Huang, North Carolina State University, United States

8:25 am  > Waveform Control Method for Mitigating Harmonics of Inverter Systems with Nonlinear Load
Hao-Ran Wang, Guo-Rong Zhu, Xiao-Bin Fu, Siew-Chong Tan, Wuhan University of Technology, China; University of Hong Kong, Hong Kong

8:50 am  > Shunt Active Power Filter based on the Interconnection of Single-phase and 3-phase Converters for 3-phase Four-wire Systems
A. de M. Maciel, C.B. Jacobina, E.C. dos Santos Jr., V.M.B. Melo, Federal University of Paraíba, Brazil; Federal University of Campina Grande, Brazil; Purdue School of Engineering and Technology, United States

9:15 am  > Adaptive Resonant Current-control for Active Power Filtering within a Microgrid
Diarmuid J. Hogan, Fran Gonzalez-Espin, John G. Hayes, Gordon Lightbody, Michael G. Egan, University College Cork, Ireland; United Technologies Research Center, Ireland

S40 Fault Diagnostics in Power Converters
Room: 333
Chair: Lixiang Wei

8:00 am  > A Novel Online ESR and C Identification Method for Output Capacitor of Buck Converter
Kai Yao, Wenbin Hu, Weijie Tang, Jianguo Lyu, Jingcheng Cao, Nanjing University of Science and Technology, China

8:25 am  > A New Fault-tolerant Realization of the Active Three-level NPC Converter
Anderson V. Rocha, Sidvelmo M. Silva, Igor A. Pires, Alysson A.P. Machado, Fernando V. Amaral, Victor N. Ferreira, Helder de Paula, Braz J. Cardoso Filho, Universidade Federal de Minas Gerais, Brazil; Centro Federal de Educação Tecnológica de Minas Gerais, Brazil
8:00 am > Design of High Torque Density Variable Flux Permanent Magnet Machine using Alnico Magnets
Maged Ibrahim, Pragasen Pillay, Concordia University, Canada

8:25 am > Saliency Ratio and Power Factor of IPM Motors Optimally Designed for High Efficiency and Low Cost Objectives
Peng Zhang, Dan M. Ionel, Nabeel A.O. Demerdash, General Motors, United States; Regal Beloit Corp., United States; University of Wisconsin-Milwaukee, United States; Marquette University, United States

8:50 am > On the Benefit of Long-horizon Direct Model Predictive Control for Drives with LC Filters
Tobias Geyer, Petros Karamanakos, Ralph Kennel, ABB Switzerland Ltd., Switzerland; Technical University of Munich, Germany

9:15 am > Discrete-time Control of High Speed Salient Machines
Antonio Altomare, Alessandra Guagnano, Francesco Cupertino, David Nasso, Politecnico di Bari, Italy

8:00 am > Harmonics Compensation and Power Factor Improvement using LED Driver
Saeed Anwar, Ali Elrayyah, Yilmaz Sozer, University of Akron, United States

10:25 am > Multi-channel LED Driver with CLL Resonant Converter
Xuebing Chen, Daocheng Huang, Qiang Li, Fred C. Lee, Virginia Polytechnic Institute and State University, United States

10:50 am > Design Consideration of a Current-source-output Inductive Power Transfer LED Lighting System
Xiaohui Qu, Siu-Chung Wong, Chi Kong Tse, Guobao Zhang, Southeast University, China; Hong Kong Polytechnic University, Hong Kong

11:15 am > Electrolytic-capacitor-less High-power LED Driver
Yajie Qiu, Hongliang Wang, Zhiyuan Hu, Laili Wang, Yan-Fei Liu, P.C. Sen, Queen’s University, Canada

8:50 am > Induction Motor Speed Estimation based on Rotor Slot Effects
Lihang Zhao, Jin Huang, Zhaowen Hou, He Liu, Zhejiang University, China

9:15 am > Induction Motor Control with Small DC-link Capacitor Inverters-fed by 3-phase Diode Front-end Rectifiers
SeHwan Kim, GwangRok Kim, Anno Yoo, Jul-Ki Seok, Yeungnam University, Korea; LSIS Co., Ltd, Korea

SS3A Harmonic Resonance in Renewable Energy Systems
Room: 325
Chairs: Frede Blaabjerg, Pedro Rodriguez

8:00 am > Harmonic Stability in Renewable Energy Systems: an Overview
Frede Blaabjerg, Xiongfei Wang, Aalborg University, Denmark

8:25 am > Modeling and Analysis of Supersynchronous Resonance by Sequence Impedances
Jian Sun, Rensselaer Polytechnic Institute, United States

8:50 am > Influence of Harmonic Grid Resonance on the Operation of Grid-connected Converters
Axel Mertens, Felix Fuchs, Leibniz University, Germany

9:15 am > Risk of DC-side Instabilities in VSC-based HVDC Systems
Gustavo Pinares, Massimo Bongiorno, Chalmers University of Technology, Sweden

Wednesday, September 17 10:00 am – 11:40 am
**S46 DC-DC Buck Converters**

Room: 326  
Chairs: Baoming Ge, Gui-Jia Su

10:00 am > A Series-capacitor Tapped Buck (Sc-TaB) Converter for Regulated High Voltage Conversion Ratio DC-DC Applications  
Minjie Chen, Pradeep S. Shenoy, Jeffrey Morroni, Massachusetts Institute of Technology, United States; Texas Instruments Inc., United States

10:25 am > A Cost-effective Circuit for Three-level Flying-capacitor Buck Converter Combining the Soft-start, Flying Capacitor Pre-charging and Snubber Functions  
Zhizhao Zhong, Yu Chen, Pengcheng Zhang, Yong Kang, Huazhong University of Science and Technology, China

10:50 am > 100 MHz, 20 V, 90% Efficient Synchronous Buck Converter with Integrated Gate Driver  
Yuanzhe Zhang, Miguel Rodriguez, Dragan Maksimović, University of Colorado-Boulder, United States

11:15 am > Modeling and Control of a Tapped-inductor Buck Converter with Pulse Frequency Modulation  
Luca Bessegato, Tomas Modeer, Staffan Norrega, KTH Royal Institute of Technology, Sweden

**S47 Stability and Quality II**

Room: 327  
Chairs: Robert Pilawa, Feng Guo

10:00 am > A Real-time Selective Harmonic Elimination based on a Transient-free, Inner Closed-loop Control for Cascaded Multilevel Inverters  
Hui Zhao, Tian Jin, Shuo Wang, Dejiang Wu, Liang Sun, University of Texas at San Antonio, United States

10:25 am > A Voltage Regulator using Multi-parallel-connected Series-voltage Compensator  
Victor Su-i-pung Cheung, Henry Shu-hung Chung, Alan Wai-Iun Lo, City University of Hong Kong, Hong Kong; Chu Hai College of Higher Education, Hong Kong

10:50 am > A Voltage Regulator based in a Voltage-controlled DSTATCOM with Minimum Power Point Tracker  
Rubens Tadeu Hock Jr., Yales Rômulo De Novaes, Alessandro Luiz Batschauer, Santa Catarina State University, Brazil

11:15 am > Stability Analysis of the High Voltage DC Link between the FEC and DC-DC Stage of a Transformer-less Intelligent Power Substation  
Sachin Madhusoodhanan, Awnesh Tripathi, Dhaval Patel, Krishna Mainali, Subhashish Bhattacharya, North Carolina State University, United States

**S48 Control and Modulation of Multilevel Converters II**

Room: 328  
Chairs: Stefano Bifaretti, Rolando Burgos

10:00 am > PWM for Active Thermal Protection in Three Level Neutral Point Clamped Inverters  
The-Minh Phan, Nikolaos Oikonomou, Gernot J. Riedel, Mario Pacas, University of Siegen, Germany; ABB Corporate Research, Switzerland

10:25 am > Control Strategy of a Multilevel Converter with Multi-winding MFT/HFT Isolation  
Chunyang Gu, Zedong Zheng, Yongdong Li, Tsinghua University, China

10:50 am > Carrier Interleaved PWM Techniques in Modular Multilevel Converters: A Comparison based on Same Voltage Level Waveforms  
Rosheila Darus, Georgios Konstantinou, Josep Pou, Salvador Caballos, Vassilios G. Agelidis, University of New South Wales, Australia; Université Teknologi Mara, Malaysia; TECNALIA, Spain

11:15 am > A State Machine Decoder for Phase Disposition Pulse Width Modulation of 3-phase Coupled-inductor Semi-bridge Converters  
C.A. Teixeira, B.P. McGrath, D.G. Holmes, RMIT University, Australia

**S49 Modeling and Control of DC-DC Converters**

Room: 329  
Chairs: Sudip Mazumder, Sung Yeul Park

10:00 am > A Detection Method of DC Magnetization Utilizing Local Inhomogeneity of Flux Distribution in Power Transformer Core  
Kazuhiro Umetani, Yuki Itoh, Masayoshi Yamamoto, Denso Corporation, Japan; Shimane University, Japan

10:25 am > Equivalent Circuit Model of Constant On-time Current Mode Control with External Ramp Compensation  
Shulin Tian, Fred C. Lee, Jian Li, Liang Li, Pei-hsin Liu, Virginia Polytechnic Institute and State University, United States; Linear Technology, United States

10:50 am > Dynamic Analysis of Hysteresis Control Strategy based on Ripple Characteristics  
Jianfeng Dai, Jinbin Zhao, Keqing Qu, Fen Li, Wei Cao, Shanghai University of Electric Power, China

11:15 am > A Generic and Accurate Frequency-domain Model for Buck, Boost and Buck-boost Converters  
Xin Li, Xinbo Ruan, Nanjing University of Aeronautics and Astronautics, China

**S50 Power Converters for Transportation Applications II**

Room: 330  
Chairs: Babak Fahimi, Fabio Giulii Capponi

10:00 am > Reduced Switching Loss based DC-bus Voltage Balancing Algorithm for Three-level Neutral Point Clamped (NPC) Inverter for Electric Vehicle Application  
Abhijit Choudhury, Pragasen Pillay, M. Amar, Sheldon S. Williamson, Concordia University, Canada; TM4 Inc., Canada

10:25 am > An Electrical-magnetic Hybrid Power Quality Compensation System and its Control Strategy for V/V Traction Power Supply System  
Baichao Chen, Chenmeng Zhang, Wenjun Zeng, Cuihua Tian, Jiaxin Yuan, Wuhan University, China

10:50 am > High Frequency Active-clamp Buck Converter for Low Power Automotive Applications  
Chenhao Nan, Raja Ayyanar, Youhao Xi, Arizona State University, United States; Woodward, Inc., United States

11:15 am > Analysis, Modeling and Control of Half-bridge Current-source Converter for Supercapacitor Applications  
Jorge Garcia, Pablo Garcia, Fabio Giulii Capponi, Gabriele Borocci, Giulio De Donato, University of Oviedo, Spain; University of Rome-Sapienza, Italy

**S51 Performance and Reliability Issues in Electric Drives**

Room: 334  
Chairs: Peter Liu, Radu Bojoi

10:00 am > Improving Position Sensor Accuracy through Spatial Harmonic Decoupling, and Sensor Scaling, Offset, and Orthogonality Correction using Self-commissioning MRAS-methods  
Caleb W. Secrest, Jon S. Pointer, Michael R. Buehner, Robert D. Lorenz, University of Wisconsin-Madison, United States; Woodward, Inc., United States
10:25 am > Current Sharing Strategies for Fault Tolerant AC Multi-drives
G. Scelba, G. Scarcella, M. Pulvirenti, M. Cacciato, A. Testa, S. De Caro, T. Scimone, University of Catania, Italy; University of Messina, Italy

10:50 am > Performance Evaluation of a Bearingless Flux-switching Slice Motor
Karol Radman, Neven Bulić, Wolfgang Gruber, University of Rijeka, Croatia; Johannes Kepler University, Austria

11:15 am > Novel Discontinuous PWM Control Method to Improve IGBT Reliability at Low Speed
Lixiang Wei, Jeffrey McGuire, Jiangang Hu, Rockwell Automation, United States

SS2 Switched-reluctance Machines

Room: 335
Chairs: Rajeev Vyas, Akira Chiba

10:00 am > A Continuous Toroidal Winding SRM with 6 or 12 Switch DC Converter
R. Marlow, N. Schofield, A. Emadi, McMaster University, Canada

10:25 am > Digital PWM Control-based Active Vibration Cancellation for Switched Reluctance Motors
H. Makino, T. Kosaka, N. Matsu, Nagoya Institute of Technology, Japan

10:50 am > Practical Considerations for the Design and Construction of a High Speed SRM with a Flux-bridge Rotor
Jie Dang, J. Rhet Mayor, S. Andrew Semidey, Ronald Harley, Thomas Habetler, Jose Restrepo, Georgia Institute of Technology, United States; Universidad Simon Bolivar, Venezuela

11:15 am > Design of a Switched Reluctance Machine for Off-road Vehicle Applications based on Torque Speed-curve Optimization
Md Wasi Uddin, Tausif Husain, Yilmaz Sozer, Iqbal Husain, University of Akron, United States; North Carolina State University, United States

SS3 Induction Motor Drives II

Room: 336
Chairs: A.J. Marques Cardoso, Tobias Geyer

10:00 am > Current Ripple Analysis of PWM Methods for Open-end Winding Induction Motor
Hajime Kubo, Yasuhiro Yamamoto, Takeshi Kondo, Kaushik Rajashekar, Bohang Zhu, Meidensha Corporation, Japan; University of Texas at Dallas, United States

Amarendra Edpuganti, Akshay K. Rathore, Joachim Holtz, National University of Singapore; Singapore; University of Wuppertal, Germany

10:50 am > Hybrid Open-end and NPC AC Six-phase Machine Drive Systems
Victor F.M.B. Melo, Cursino B. Jacobina, Nady Rocha, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil

11:15 am > A Time-varying Observer for the Flux Magnitude of the Induction Motor using the Synchronous Reference Frame Model
Trey Mock, Randi Bimeal, Stephen Ling, Mihai Comanescu, Penn State Altoona, United States

SS3B Harmonic Regulation and Mitigation

Room: 325
Chairs: Pedro Rodriguez, Fredre Blaagjerg

10:00 am > Harmonic Issues in Distribution Networks: Past and Future
Firuz Zare, Danfoss Power Electronics Company, Denmark

10:25 am > Active Filtering Techniques for Harmonic Damping
Po-Tai Cheng, National Tsing Hua University, Taiwan
1:55 pm > A Flexible DC Voltage Balancing Control based on the Power Flow Management for Star-connected Cascaded H-bridge Converter  
Chia-Tse Lee, Hsin-Chih Chen, Ching-Wei Wang, Ping-Heng Wu, Ching-Hsiang Yang, Po-Tai Cheng, National Tsing Hua University, Taiwan

2:20 pm > Multilevel, Multiport, Switched-capacitor based Inverter for Utility Applications  
Mark J. Scott, Rachid Darbali Zamora, Andong Long, Cong Li, Fanbo Zhang, Jing Wang, Ohio State University, United States

2:45 pm > A Transformerless Step-up Resonant Converter for Grid-connected Renewable Energy Sources  
Xiaogang Wu, Wu Chen, Renjie Hu, Yong Ke, Southeast University, China; WuHu Profession and Technology College, China

S56 Microgrid Control II

Room: 325  
Chairs: Alessandro Lidozzi, Yongseug Suh

1:30 pm > Application of Intelligent Agent Systems for Real-time Coordination of Power Converters (RCPC) in Microgrids  
Maryam Nasri, Herbert L. Ginn, Mehrdad Moallem, University of South Carolina, United States; Simon Fraser University, Canada

1:55 pm > Investigation of Extra Power Loss Sharing among Photovoltaic Inverters Caused by Reactive Power Management in Distribution Networks  
Erhan Demirok, Dezeo Sera, Remus Teodorescu, University of Manchester, United Kingdom; Aalborg University, Denmark

2:20 pm > DC-bus Voltage Regulation Strategy for 3-phase Back-to-back Active Power Conditioners  
Cheng-Yu Tang, Yen-Fu Chen, Yu-Cai Hsu, Yaow-Ming Chen, Yi-H Der Lee, National Taiwan University, Taiwan; Atomic Energy Council, Taiwan

2:45 pm > An Effective Smooth Transition Control Strategy using Droop Based Synchronization for Parallel Inverters  
Nayeem Arafat, Ali Elrayyah, Yilmaz Sozer, University of Akron, United States; Qatar Environment and Energy Research Institute, Qatar

S57 Battery Models

Room: 326  
Chairs: Henry Chung, John Miller

1:30 pm > A Transient Reduced Order Model for Battery Thermal Management based on Singular Value Decomposition  
Xiao Hu, Saeed Asgari, Ibrahim Yavuz, Scott Stanton, Chih-Cheng Hsu, Zhongying Shi, Bao Wang, Hao-Kun Chu, ANSYS Inc., United States; General Motor Company, United States

1:55 pm > Near-real-time Parameter Estimation of an Electrical Battery Model with Multiple Time Constants and SOC-dependent Capacitance  
Wenguan Wang, Liu Yang, Yiwei Ma, Jingxin Wang, Leon M. Tolbert, Fred Wang, Kevin Tomsovic, University of Tennessee, United States

2:20 pm > Development of Converter based Reconfigurable Power Grid Emulator  
Liu Yang, Yiwei Ma, Jingxin Wang, Jing Wang, Xiaohu Zhang, Leon M. Tolbert, Fred Wang, Kevin Tomsovic, University of Tennessee, United States

S58 Grid Emulation

Room: 327  
Chairs: Rolando Burgos, Omer Onar

1:30 pm > A Power-HIL Microgrid Testbed: Smart Energy Integration Lab (SEIL)  
F. Huerta, J.K. Gruber, M. Prodanovic, P. Matatagui, Institute IMDEA Energy, Spain

2:20 pm > Power Hardware-in-the-loop Simulation of Integrated Voltage Regulation and Islanding Detection for Distributed PV Systems on GRU Model  
Ran Mo, Ye Yang, Hui Li, Florida State University, United States

2:45 pm > Static and Dynamic Power System Load Emulation in Converter-based Reconfigurable Power Grid Emulator  
Jing Wang, Liu Yang, Yiwei Ma, Jingxin Wang, Leon M. Tolbert, Fred Wang, Kevin Tomsovic, University of Tennessee, United States

S59 Device Temperature Estimation

Room: 328  
Chairs: Adam Skorek, Bram Ferreira

1:30 pm > Online Junction Temperature Extraction with Turn-off Delay Time for High Power IGBTs  
Pengfei Sun, Haoze Luo, Yufei Dong, Wuhua Li, Xiangning He, Guodong Chen, Enxing Yang, Zuyi Dong, Zhejiang University, China; Shanghai Electric Power Transmission & Distribution Group, China

1:55 pm > P-i-N Diode Chip Temperature Extraction Method by Investigation into Maximum Recovery Current Rate di/dt  
Haoze Luo, Pengfei Sun, Yufei Dong, Wuhua Li, Xiangning He, Guodong Chen, Enxing Yang, Zuyi Dong, Zhejiang University, China; Shanghai Electric Power Transmission & Distribution Group, China

2:20 pm > Evaluation of Thermo-sensitive Electrical Parameters based on the Forward Voltage for On-line Chip Temperature Measurements of IGBT Devices  
Laurent Dupont, Yvan Avenas, IFSTTAR, France; Universite de Grenoble, France

2:45 pm > Frequency-domain Transient Temperature Estimation and Aging Analysis for Weak Points of IGBT Modules  
Ze Wang, Wei Qiao, Liyan Ou, University of Nebraska-Lincoln, United States

S60 Resonant DC-DC Converters I

Room: 329  
Chairs: Wei Qiao, Shuo Wang

1:30 pm > A ZCS-PWM Bidirectional DC-DC Converter with a Two-terminal Resonant Tank-based Auxiliary Switching Cell  
Tomokazu Mishima, Shinya Masuda, Mutsuo Nakaoka, Kobe University, Japan; University of Malaya, Malaysia; Kyungnam University, Korea

1:55 pm > Single-inductor Resonant Switched Capacitor Voltage Multiplier with Safe Commutation  
Julio C. Rosas-Caro, Jonathan C. Mayo-Maldonado, Fernando Mancilla-David, Antonio Valderrabano-Gonzalez, Francisco Beltran Carbajal, Victor M. Sanchez, Universidad Panamericana Campus Guadalajara, Mexico; University of Southampton, United Kingdom; University of Colorado-Denver, United States; Universidad Autonoma Metropolitana Azcapotzalco, Mexico; Universidad de Quintana Roo, Mexico

2:20 pm > Analysis, Design and Implementation of Quadrupler based High Voltage Full Bridge Series Resonant DC-DC Converter  
Amit K. Singh, Pritam Das, S.K. Panda, National University of Singapore, Singapore

2:45 pm > A Transformerless Step-up Resonant Converter for Grid-connected Renewable Energy Sources  
Xiaogang Wu, Wu Chen, Renjie Hu, Yong Ke, Southeast University, China; WuHu Profession and Technology College, China
**S61 AC-DC Multi-phase Converters**

*Room: 330*

**Chairs:** Maurizio Cirrincione, Norma Anglani

1:30 pm > DC Voltage Balancing of Flying Converter Cell Active Rectifier
M. Makoschitz, M. Hartmann, H. Ertl, R. Fehrer, Vienna University of Technology, Austria; Schneider Electric Power Drives, Austria

1:55 pm > Multilevel Multichannel Interleaved AC-DC Converter for High Current Applications
Eddy Aeloaiza, Yu Du, ABB Inc., United States

2:20 pm > Voltage Sequence Control based High-current Rectifier System
Jitendra Solanki, Norbert Fröhlke, Joachim Böcker, Gregor Duppe, Andreas Averberg, Peter Wallmeier, University of Paderborn, Germany; AEG Power Solutions GmbH, Germany

2:45 pm > Modulation Scheme for Delta-type Current Source Rectifier to Reduce Input Current Distortion
Ben Guo, Fred Wang, Eddy Aeloaiza, University of Tennessee, United States; ABB Corporate Research, United States

---

**S62 Control of Power Converters I**

*Room: 333*

**Chairs:** Vladimir Blasko, Sudip Mazumder

1:30 pm > A Dual Voltage Control Strategy for Single-phase PWM Converters with Power Decoupling Function
Yi Tang, Zian Qin, Frede Blaabjerg, Aalborg University, Denmark

1:55 pm > Hybrid Interleaving with Adaptive PLL Loop for Adaptive On-time Controlled Switching Converters
Pei-Hsin Liu, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

2:20 pm > Dynamic Physical Limits of Boost Converters: A Benchmarking Tool for Transient Performance
Ignacio Gallano Zurbriggen, Matias Anun, Martin Ordóñez, University of British Columbia, Canada

2:45 pm > On-chip Frequency Compensation Control Scheme with Independently Parameters Tuning and Green Native Adaptive Voltage Position (GNAVP) for Voltage Regulators
Ching-Jan Chen, Shao-Hung Lu, Sheng-Fu Hsiao, Yung-Jen Chen, Jian-Rong Huang, RichTek Technology Corporation, Taiwan; National Taiwan University, Taiwan

---

**S63 Sensorless Control: HF Injection**

*Room: 334*

**Chairs:** David Diaz-Reigosa, Jul-Ki Seok

1:30 pm > Analysis of Carrier Signal Injection based Sensorless Control of PMSM Drives under Limited Inverter Switching Frequency Condition
P.L. Xu, Z.Q. Zhu, University of Sheffield, United Kingdom

1:55 pm > Position Sensorless Control Method at Zero Speed Region for Permanent Magnet Synchronous Motors using the Neutral Point Voltage of Stator Windings
Yoshitaka Iwaji, Ryoichi Takahata, Takahiro Suzuki, Shigehisa Aoyagi, Hitachi Ltd., Japan

2:20 pm > High Frequency D-Q Modeling of Synchronous Machines for Sensorless Control
Luigi Alberti, Nicola Bianchi, Silverio Bolognani, Free University of Bozen, Italy; University of Padova, Italy

2:45 pm > Carrier Signal Injection Method in Three Shunt Sensing Inverter for Sensorless AC Machine Drive
Sungho Jung, Jung-Ik Ha, Seoul National University, Korea

---

**S64 Prof. B. Chalmers Memorial Session: IPM Analysis**

*Room: 335*

**Chairs:** Dan Ionel, Thomas Jahns

1:30 pm > Analysis of Torque versus Current Capability of Reluctance and Interior PM Machines under Limited Current and Flux-linkage Operation
Emanuele Formisario, Nicola Bianchi, Wen L. Soong, University of Padova, Italy; University of Adelaide, Australia

1:55 pm > Analysis of Iron Loss in Interior PM Machines with Distributed Windings under Deep Field-weakening
Chun Tang, Wen L. Soong, Nesim Ertugrul, Thomas M. Jahns, University of Adelaide, Australia; University of Wisconsin-Madison, United States

2:20 pm > Permanent Magnet Volume Minimization of Spoke Type Fractional Slot Synchronous Motors
Enrico Carraro, Nicola Bianchi, Sunny Zhang, Matthias Koch, University of Padova, Italy; Brose Fahrzeugteile GmbH and Co. KG, Germany

2:45 pm > Impact of the Field Weakening on the Iron Losses in the Stator of an Internal Permanent Magnet Synchronous Machine
S. Küttler, K. El Kadi Benkara, G. Friedrich, F. Vangraefschêpe, A. Abdelli, University of Technology of Compiègne, France; IFP New Energies, France

---

**S65 Magnetic Materials**

*Room: 336*

**Chairs:** Thomas Wu, Galina Mirzadeva

1:30 pm > Characterization of Electrical Steels for High Speed Induction Motor Applications: Going Beyond the Standards
André S.L. Costa, Rodrigo R. Bastos, Sebastião C. Paolinelii, Sebastião L. Nau, Ramón M. Valle, Braz J. Cardoso Filho, Universidade Federal de Minas Gerais, Brazil; Aperam South America, Brazil; WEG Motors, Brazil

1:55 pm > Design Considerations of 2-D Magnetizers for High Flux Density Measurements
J.G. Wanjiiku, P. Pillay, Concordia University, Canada

2:20 pm > A Simple Method to Minimize Effects of Temperature Variation on IPMSM Control in Real-time Manner
Sang Min Kim, Taesuk Kwon, Hyundai Mobis, Korea

2:45 pm > Effect of Magnet Properties on Power Density and Flux-weakening Performance of High-speed Interior Permanent Magnet Synchronous Machines
James D. McFarland, T.M. Jahns, Ayman M. El-Refaie, Patel B. Reddy, University of Wisconsin-Madison, United States; GE Global Research Center, United States

---

**Wednesday, September 17**

**3:30 pm – 5:10 pm**

---

**S66 Utility Interactive Solar PV System**

*Room: 323*

**Chair:** Pedro Rodriguez

3:30 pm > Comprehensive Modeling of Single-phase Quasi-Z-source Photovoltaic Inverter to Investigate Low-frequency Voltage and Current Ripples
Yushan Liu, Haitham Abu-Rub, Baoming Ge, Dongsen Sun, Hao Zhang, Daqiang Bi, Fang Z. Peng, Beijing Jiaotong University, China; Texas A&M University at Qatar, Qatar; Texas A&M University, United States; University of Texas at San Antonio, United States; Tsinghua University, China; Michigan State University, United States
Technical Program Schedule

S67 Power Converters for Renewable Energy Applications

Room: 324
Chair: V. Angelidis

- 3:30 pm > A Single-switch High-step-up DC-DC Converter with Coupled Inductor
  Liping Zhou, Dongyuan Qiu, Wenxun Xiao, Bo Zhang, South China University of Technology, China

- 3:55 pm > High Gain Single-stage Boosting Inverter
  Ben Zhao, Alexander Abramovitz, Keyue Smedley, Northwestern Polytechnical University, China; University of California, Irvine, United States

- 4:20 pm > PV Power Conditioning System with LLC Resonant Converter in DCM
  Giovanna Oriti, Alexander L. Julian, Troy D. Bailey, Naval Postgraduate School, United States

- 4:45 pm > High Efficiency Multilevel Flying-capacitor DC-DC Converter for Distributed Generation Applications
  MingGuo Jin, Amir Parastar, Ju-Ki Seok, Yeungnam University, Korea

S68 Microgrid Control

Room: 325
Chair: Hui Li, Mahesh Illindala

- 3:30 pm > Control Design of Coordinated Droop Control for Hybrid AC-DC Microgrid Considering Distributed Generation Characteristics
  Woonin Choi, Jong-Bok Baek, Bo-Hyung Cho, Seoul National University, Korea

- 3:55 pm > Power-based Control of Low-voltage Microgrids
  Tommaso Caldogneto, Paolo Tenti, Danilo Iglesias Brandao, University of Padova, Italy; State University of Campinas, Brazil

- 4:20 pm > Secondary Coordinated Control of Islanded Microgrids based on Consensus Algorithms
  Dan Wu, Tomislav Dragiccivic, Juan C. Vasquez, Josep M. Guerrero, Yajuan Guan, Aalborg University, Denmark

- 4:45 pm > A Controller for the Smooth Transition from Grid-connected to Autonomous Operation Mode
  Stefano Lissandron, Paolo Mattavelli, University of Padova, Italy

S69 Battery Energy Management

Room: 326
Chair: Chris Mi, Bulent Sarioglu

- 3:30 pm > Loss Minimization-based Charging Strategy for Lithium-ion Battery
  Zheng Chen, Bing Xia, Chunting Chris Mi, Rui Xiong, University of Michigan-Dearborn, United States

- 3:55 pm > Enhanced Coulomb Counting Method with Adaptive SOC Reset Time for Estimating OCV
  Yong-Min Jeong, Yong-Ki Cho, Jung-Hoon Ahn, Seung-Hee Ryu, Byoung-Kuk Lee, Sungkyunkwan University, Korea

- 4:20 pm > Equalization System for Serially-connected Battery Cells based on the Wave-trap Concept
  M. Arias, D. Bretón, M.M. Hernando, U. Viscarret, Ilígo Gil, University of Oviedo, Spain; Ikerlan-IK4, Spain; Oriona, Spain

- 4:45 pm > Modular Approach for Continuous Cell-level Balancing to Improve Performance of Large Battery Packs
  M. Muneeb Ur Rehman, Michael Evzelman, Kelly Hathaway, Regan Zane, Gregory L. Plett, Kandler Smith, Eric Wood, Dragan Maksimovic, Utah State University, United States; University of Colorado-Colorado Springs, United States; National Renewable Energy Lab, United States; University of Colorado-Boulder, United States

S70 Other Power Electronics Topics for Grid Applications

Room: 327
Chair: Peng Zhang, Dan Ionel

- 3:30 pm > New Power Electronic Interface Combining DC Transmission, a Medium-frequency Bus and an AC-AC Converter to Integrate Deep-sea Facilities with the AC Grid
  Andres Escobar-Mejia, Yusi Liu, Juan Carlos Balda, Kenny George, University of Arkansas, United States

- 3:55 pm > Operational Study of a Modular Direct Current Power System for Subsea Power Delivery
  Dong Dong, Di Zhang, Rixin Lai, Song Chi, Maja H. Todorovic, General Electrical Global Research Center, United States

- 4:20 pm > Investigation on Dynamic Voltage Restorer with Two DC-links and Series Converters for 3-phase Four-wire Systems
  Gregory A.A. Carlos, Cursino B. Jacobina, Euzeli C. dos Santos Jr., Federal Institute of Alagoas, Brazil; Federal University of Campina Grande, Brazil; Purdue School of Engineering Technology, United States

- 4:45 pm > Locking Frequency Band Exposure Method for Islanding Detection and Prevention in Distributed Generation
  Imran Mazhari, Lotfi Beighou, Johan Ensln, Babak Parkhideh, Shibasish Bhowmik, University of North Carolina, United States; SineWatts Inc., United States

S71 Power Electronic Modules I (high T and SiC)

Room: 328
Chair: Yvan Avenas, Puqi Ning

- 3:30 pm > Novel IGBT Module Design, Material and Reliability Technology for 175°C Continuous Operation
  Takashi Saito, Yoshitaka Nishimura, Fumihiko Momose, Akira Morozumi, Yuta Tamai, Eiji Mochizuki, Yoshikazu Takahashi, Fuji Electric Co., Ltd., Japan

- 3:55 pm > A High Temperature Silicon Carbide MOSFET Power Module with Integrated Silicon-on-insulator based Gate Drive
  Zhiqiang Wang, Xiaojie Shi, Leon M. Tolbert, Fred Wang, Zhenxian Liang, Daniel Costinett, Benjamin J. Blalock, University of Tennessee, United States; Oak Ridge National Laboratory, United States

- 4:20 pm > Evaluation of Commercially Available SiC Devices and Packaging Materials for Operation Up to 350°C
  Dean Hamilton, Michael Jennings, Yogesh Sharma, Craig Fisher, Olaiyiwola Alatise, Philip Mawby, University of Warwick, United Kingdom

- 4:45 pm > All-SiC Power Module for Delta-type Current Source Rectifier
  Ben Guo, Fred Wang, Eddy Aeloiza, Puqi Ning, Zhenxian Liang, University of Tennessee, United States; ABB Corporate Research, United States; Oak Ridge National Laboratory, United States
<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Room</th>
<th>Chairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>S72</td>
<td>Multilevel DC-DC Converters</td>
<td>Room: 329</td>
<td>Madhu Chinthavalli, Jin Wang</td>
</tr>
<tr>
<td>3:30 pm</td>
<td>A Bidirectional Multiple-input Multiple-output Modular Multilevel DC-DC Converter</td>
<td></td>
<td>Kia Filsoof, Peter W. Lehn, University of Toronto, Canada</td>
</tr>
<tr>
<td>3:55 pm</td>
<td>A Family of the New Interleaved Multi-channel Three-level DC-DC Converters</td>
<td></td>
<td>Yu Du, Eddy Aeloiza, ABB Corporate Research, United States</td>
</tr>
<tr>
<td>4:20 pm</td>
<td>A ZVS Bidirectional Three-level DC-DC Converter with Current Slew Rate Control of Leakage Inductance</td>
<td></td>
<td>Lingyu Xu, Deshang Sha, Hongyu Chen, Beijing Institute of Technology, China</td>
</tr>
<tr>
<td>4:45 pm</td>
<td>High Voltage Cell Power Supply for Modular Multilevel Converters</td>
<td></td>
<td>Osman S. Senturk, Tobias Maerki, Peter Steimer, Steven McLaughlin, ABB Ltd., Switzerland</td>
</tr>
<tr>
<td>S73</td>
<td>DC-AC Converters</td>
<td>Room: 330</td>
<td>Radu Bojoi, Luca Solero</td>
</tr>
<tr>
<td>3:30 pm</td>
<td>Generalized Active Power Decoupling Method for H-bridge with Minimum Voltage and Current Stress</td>
<td></td>
<td>Runruo Chen, Sisheng Liang, Fang Z. Peng, Michigan State University, United States</td>
</tr>
<tr>
<td>3:55 pm</td>
<td>Analysis and Design of Modified Half-bridge Series Resonant Inverter with DC-link Neutral Point Clamped Cell</td>
<td></td>
<td>Seung-Hee Ryu, Dong-Gyun Woo, Jung-Hoon Ahn, Byoung-Kuk Lee, Sungkyunkwan University, Korea</td>
</tr>
<tr>
<td>4:20 pm</td>
<td>Operation of Current Source Inverters in Discontinuous Conduction Mode</td>
<td></td>
<td>Daniel Drews, Robert Cuzner, Giri Venkataramanan, DRS Power and Control Technologies, United States; University of Wisconsin-Madison, United States</td>
</tr>
<tr>
<td>4:45 pm</td>
<td>A Hybrid Modulation Method for Single-phase Quasi-Z Source Inverter</td>
<td></td>
<td>Hao Zhang, Baoming Ge, Yushan Liu, Haidham Abu-Rub, Dongsen Sun, Fang Zheng Peng, Beijing Jiaotong University, China; Texas A&amp;M University, United States; Texas A&amp;M University at Qatar, Qatar; University of Texas at San Antonio, United States; Michigan State University, United States</td>
</tr>
<tr>
<td>S74</td>
<td>Control of Power Converters II</td>
<td>Room: 333</td>
<td>Madhu Chinthavalli, Jin Wang</td>
</tr>
<tr>
<td>3:30 pm</td>
<td>Utilization of Proportional Filter Capacitor Voltage Feedforward to Realize Active Damping for Digitally-controlled Grid-tied Inverter Operating under Wide Grid Impedance Variation</td>
<td></td>
<td>Yuanbin He, Ke-wei Wang, Shu-hung Chung, City University of Hong Kong, Hong Kong</td>
</tr>
<tr>
<td>4:20 pm</td>
<td>Gain-scheduled Control using Voltage Controlled Oscillator with Variable Gain for a LLC Resonant Converter</td>
<td></td>
<td>Sang Woo Kang, Hye Jin Kim, Bo Hyung Cho, Seoul National University, Korea</td>
</tr>
<tr>
<td>S75</td>
<td>Sensorless Control II</td>
<td>Room: 334</td>
<td>Giacomo Scelba, Fernando Briz</td>
</tr>
<tr>
<td>3:30 pm</td>
<td>An Integral Method Combining V/Hz and Vector Control of Permanent Magnet Motor</td>
<td></td>
<td>Vladimir Blasko, Luis Amredo, Dong Jiang, United Technologies Research Center, United States</td>
</tr>
<tr>
<td>3:55 pm</td>
<td>High-speed Sensorless Control of a PMSM Operating under Periodic Magnetic Saturation Conditions</td>
<td></td>
<td>Kwang-Woon Lee, Mokpo National Maritime University, Korea</td>
</tr>
<tr>
<td>4:20 pm</td>
<td>Sensorless Control of 3-phase BLDC Motors using DC Current Model</td>
<td></td>
<td>Won-Sang Im, Wenxin Liu, Jang-Mok Kim, Lehigh University, United States; Pusan National University, Korea</td>
</tr>
<tr>
<td>4:45 pm</td>
<td>Sensorless Control of Linear Permanent Magnet Synchronous Motor using a Combined Sliding Mode Adaptive Observer</td>
<td></td>
<td>M.A.M. Cheema, John Edward Fletcher, Dan Xiao, Faz Rahman, University of New South Wales, Australia</td>
</tr>
<tr>
<td>S76</td>
<td>IPM Machines for Automotive Applications</td>
<td>Room: 335</td>
<td>Bulent Sarlioglu, Rajeev Vyas</td>
</tr>
<tr>
<td>3:30 pm</td>
<td>Experimental Comparison of PM Assisted Synchronous Reluctance Motors</td>
<td></td>
<td>Nicola Bianchi, Emanuele Fornasier, Marco Ferrari, Mosè Castiello, University of Padova, Italy</td>
</tr>
<tr>
<td>3:55 pm</td>
<td>Influence of Magnet Arrangement on the Performance of IPMSMs for Automotive Applications</td>
<td></td>
<td>S. Yoshioka, S. Morimoto, M. Sanada, Y. Inoue, Osaka Prefecture University, Japan</td>
</tr>
<tr>
<td>4:20 pm</td>
<td>Effect of Magnet Types on Performance of High Speed Spoke Interior Permanent Magnet Machines Designed for Traction Applications</td>
<td></td>
<td>Steven J. Galioto, Patel B. Reddy, Ayman M. El-Refaie, GE Global Research Center, United States</td>
</tr>
<tr>
<td>4:45 pm</td>
<td>Variable Leakage Flux (VLF) IPMSMs for Reduced Losses over a Driving Cycle while Maintaining the Feasibility of High Frequency Injection-based Rotor Position Self-sensing</td>
<td></td>
<td>Apoorva Athavale, Takashi Fukushige, Takashi Kato, Chen-Yen Yu, Robert D. Lorenz, University of Wisconsin-Madison, United States; Nissan Motor Co. Ltd., Japan</td>
</tr>
<tr>
<td>S77</td>
<td>Solid-state Transformers</td>
<td>Room: 336</td>
<td>Yongsgue Suh, Zhiguo Pan</td>
</tr>
<tr>
<td>3:30 pm</td>
<td>Resonant Power Electronic Transformer for Power Grid</td>
<td></td>
<td>Zhaohui Wang, Jin Wang, Junming Zhang, Kuang Sheng, Wenxi Yao, Zhejiang University, China</td>
</tr>
<tr>
<td>3:55 pm</td>
<td>Multiple Objectives Tertiary Control Strategy for Solid State Transformer Interfaced DC Microgrid</td>
<td></td>
<td>Xunwei Yu, Xijun Ni, Alex Huang, North Carolina State University, United States</td>
</tr>
<tr>
<td>4:20 pm</td>
<td>Volume/Weight/Cost Comparison of a 1 MVA 10kV/400V Solid-state against a Conventional Low-frequency Distribution Transformer</td>
<td></td>
<td>Jonas E. Huber, Johann W. Kolar, ETH Zurich, Switzerland</td>
</tr>
<tr>
<td>4:45 pm</td>
<td>Design and Operation of a 3.6kV High Performance Solid State Transformer based on 13kV SiC MOSFET and JBS Diode</td>
<td></td>
<td>Fei Wang, Gangyao Wang, Alex Huang, Wensong Yu, Xijun Ni, North Carolina State University, United States; Cree Inc., United States</td>
</tr>
</tbody>
</table>
### S78  Energy Storage Systems

**Room:** 323  
**Chair:** Ion Exteberria

**8:00 am >** Converter-fed Synchronous Machine for Pumped Hydro Storage Plants  
Peter K. Steimer, Osman Senturk, Steve Aubert, Stefan Linder, ABB Ltd., Switzerland

**8:25 am >** Development of the Flywheel Energy Storage System with Multiple Parallel Drives  
Jun-ichi Itoh, Tsuyoshi Nagano, Kenta Tanaka, Koji Orikawa, Noboru Yamada, Nagaoka University of Technology, Japan

**8:50 am >** Diagnosis of Lithium–ion Batteries State-of-health based on Electrochemical Impedance Spectroscopy Technique  
Daniel I. Stroe, Maciej Swierczynski, Ana I. Stan, Vlaclav Knap, R. Teodorescu, Saren J. Andreassen, Aalborg University, Denmark

**9:15 am >** Derivation of an Equivalent Electrical Circuit Model for Degradation Mechanisms in High Temperature PEM Fuel Cells in Performance Estimation  
Chris de Beer, Paul Barendse, Pragasen Pillay, Raghu Nathan Rengaswamy, Brian Bullecks, University of Cape Town, South Africa; Texas Tech University, United States

### S79  Power Converters for Wind Energy Applications

**Room:** 324  
**Chairs:** D. D. Reigosa, Brian Welchko

**8:00 am >** Flyback-type di/dt Snubber for 10kV IGCT in MV Wind Turbines  
Kihyun Lee, Yongsusg Suh, Chonbuk National University, Korea

**8:25 am >** Nine-switch Converter-based DFIG Wind Power System and its Dynamic DC Voltage Assigned Approach for Low Voltage Riding through (LVRT)  
Wen Gang, Chen Yu, Zhong Zhihao, Kang Yong, Huazhong University of Science and Technology, China

**8:50 am >** 13.8 kV Five Level ANPC Inverter for Wind Power  
Mohammad Mohebbi, Michael L. McIntyre, John F. Naber, Robert Hickman, University of Louisville, United States; APIQ Semiconductor, United States

**9:15 am >** Single-stage 3-phase AC-DC Step-up Medium Voltage Resonant Converter for Offshore Wind Power Systems  
John Lam, Praveen K. Jain, York University, Canada; Queen’s University, Canada

### S80  Microgrid Modeling

**Room:** 325  
**Chairs:** Sandeep Bala, Rolando Burgos

**8:00 am >** High Resolution Output Power Estimation of Large-scale Distributed PV Systems  
Tong Yao, Yungying Tang, Raja Ayyanar, Arizona State University, United States

**8:25 am >** Modeling, Analysis and Evaluation of Smart Load Functionality in the CERTS Microgrid  
Abrez Mondal, David A. Klapp, Mahesh S. Illindala, Joseph H. Eto, Ohio State University, United States; American Electric Power, United States; Lawrence Berkeley National Lab, United States

**8:50 am >** Modeling, Analysis, and Measurement of Impedance for 3-phase AC Distributed Power System  
Hongtao Shi, Fang Zhuo, Dong Zhang, Zhiqing Geng, Feng Wang, Xi’an Jiaotong University, China

### S81  Cascaded Converters for Grid Applications

**Room:** 326  
**Chairs:** David Perreault, Navid Zargari

**8:00 am >** Optimization of Fundamental Frequency Modulation for Cascaded Multilevel Inverter based Transformer-less UPFC  
Shuitao Yang, Shao Zhang, Xiaorui Wang, Deepak Gunasekaran, Fang Z. Peng, Michigan State University, United States

**8:25 am >** One Dimensional Cell Inversion: A Modulation Strategy for Hybrid Cascaded Converters  
Christopher D. Townsend, Daniel Tormo, Hector Zelaya De La Parra, ABB Corporate Research, Sweden

**8:50 am >** Efficiency Improved and Current Balanced 3-phase Modular Cascaded H-bridge Multilevel PV Inverter for Grid-connected Applications  
Bailu Xiao, Leon M. Tolbert, University of Tennessee, United States

**9:15 am >** Zero-sequence Voltage Injection for DC Capacitor Voltage Balancing Control of the Star-connected Cascaded H-bridge PWM Converter under Unbalanced Grid  
Chia-Tse Lee, Hsin-Chih Chen, Ching-Wei Wang, Ping-Heng Wu, Ching-Hsiang Yang, Po-Tai Cheng, National Tsing Hua University, Taiwan

### S82  Power Electronic Modules II

**Room:** 327  
**Chairs:** Robert Pilawa, Jean Luc Schanen

**8:00 am >** Substrate Layout Evaluation for T-type Three-level IGBT Modules  
Nan Zhu, Min Chen, Xingyao Zhang, Jie Ma, Dehong Xu, Zhejiang University, China

**8:25 am >** A Compact Planar Rogowski Coil Current Sensor for Active Current Balancing of Parallel-connected Silicon Carbide MOSFETs  
Yang Xue, Junjie Lu, Zhiqiang Wang, Leon M. Tolbert, Benjamin J. Blalock, Fred Wang, University of Tennessee, United States

**8:50 am >** Realization and Characterization of an IGBT Module based on the Power Chip-on-chip 3D Concept  
Jean-Louis Marchesini, Pierre-Olivier Jeannin, Vyan Avenas, Leonardo Ruffeil de Oliveira, Cyril Buttay, Raphaël Riva, Université de Grenoble, France; Université de Lyon, France

**9:15 am >** Develop Parasitic Inductance Model for the Planar Busbar of an IGBT H Bridge in a Power Inverter  
Ning Zhang, Shuo Wang, Hui Zhao, University of Texas at San Antonio, United States

### S83  Multi-level Converters

**Room:** 328  
**Chairs:** Stefano Bifaretti, Alan Watson

**8:00 am >** Multi-phase Multilevel LLC Resonant Converter with Low Voltage Stress on the Primary-side Switches  
Feng Jin, Fuxin Liu, Xinxo Ruan, Xiaolin Meng, Nanjing University of Aeronautics and Astronautics, China

**8:25 am >** 3-phase Three-level LC-type Series Resonant DC-DC Converter with Variable Frequency Control  
Yue Chen, Fuxin Liu, Xinxo Ruan, Xiaolin Meng, Nanjing University of Aeronautics and Astronautics, China
8:50 am > **Five-level Unidirectional T-rectifier for High Speed Gen-set Applications**
Petar Grbovic, Alessandro Lidozzi, Luca Solero, Fabio Crescimbini, Huawei Technologies Dusseldorf GmbH, Germany; Roma Tre University, Italy

9:15 am > **Characterization of the Voltage and Electric Field Stresses in Multi-cell Solid-state Transformers**
Thomas Guillod, Jonas E. Huber, Gabriel Ortiz, Ankan De, Christian M. Franck, Johann W. Kolar, ETH Zurich, Switzerland; North Carolina State University, United States

---

### S84 Resonant DC-DC Converters II

**Room:** 329  
**Chairs:** Yogesh Patel, Hui Li

8:00 am > **Design and Implementation of a Half-bridge Dual LLC Converter with Symmetrical Autotransformer**  
Ke-Ming Chen, Tsorgn-Juu Liang, Shih-Ming Chen, Shih-Wen Tsai, National Cheng Kung University, Taiwan  

8:25 am > **LLC Resonant DC Transformer (DCX) with Parallel PWM Tight Regulation**  
Hui Chen, Xinke Wu, Zhejiang University, China  

9:15 am > **Analysis on the Influence of Secondary Parasitic Capacitance to ZVS Transient in LLC Resonant Converter**  
Hui Chen, Xinke Wu, Zhejiang University, China

---

### EMI and Power Converters

**Room:** 330  
**Chairs:** Sung Yeul Park, Jiangan Hu

8:00 am > **Development of a Frequency-analysis Equipment Capable of Judging Propagation Direction of Conductive EMI**  
Noriyuki Nosaka, Satoshi Ogasawara, Masatsugu Takemoto, Yoshitaka Ishii, Kazutoshi Ogawa, Hokkaido University, Japan; Hitachi, Ltd., Japan  

8:25 am > **DC-link Input EMI Filter Design in a Centralized Architecture PV Inverter: Impedance Approach**  
Djilali Hamza, Khalifa Hasan Al Hosani, Petroleum Institute, United Arab Emirates  

9:50 am > **Shielding-cancellation Technique for Suppressing Common Mode EMI in Isolated Power Converters**  
Lihong Xie, Xinbo Ruan, Qing Ji, Zhihong Ye, Nanjing University of Aeronautics and Astronautics, China; Lite-On Technology, China  

9:15 am > **Analysis and Filter Design of Differential Mode EMI Noise for GaN-based Interleaved MHz Critical Mode PFC Converter**  
Yuchen Yang, Zhengyang Liu, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

---

### S85 Non-conventional Electric Machines

**Room:** 333  
**Chairs:** Yang Wang, Rahman Khwaja

8:00 am > **A New Integrated Onboard Charger and Accessory Power Converter for Plug-in Electric Vehicles**  
Gui-Jia Su, Lixin Tang, Oak Ridge National Laboratory, United States  

8:25 am > **Optimal Sizing of Propulsion Systems Applied to Fuel Cell based Vehicles**  
C. Raga, A. Barrado, A. Lázaro, I. Quesada, H. Miniguano, P. Zumel, M. Sanz, Universidad Carlos III de Madrid, Spain

---

### S87 Asymmetry and Forces in Electric Machines

**Room:** 334  
**Chairs:** Antonio Cardoso, Dave Dorrell

8:00 am > **Effects of Unbalanced Magnetic Pull in Large Permanent Magnet Machines**  
M. Michon, K. Atallah, G. Johnstone, University of Sheffield, United Kingdom; Romax Technology Ltd., United Kingdom  

8:25 am > **Experimental Verification of 6th Radial Force Control for IPMSMs based on Flux Linkage**  
Masato Kanematsu, Hiroshi Fujimoto, Yoichi Hori, Toshihiko Nomoto, Masahiko Kondou, Hiroshi Komiyama, Kentaro Yoshimoto, Takayuki Miyakawa, University of Tokyo, Japan; Nissan Motor Co., Ltd., Japan  

9:50 am > **The Measurement and Indexing of Unbalanced Magnetic Pull in Electrical Machines**  
David G. Dorrell, Jonathan K.H. Shek, Min-Fu Hsieh, University of Technology Sydney, Australia; University of Edinburgh, United Kingdom; National Cheng Kung University, Taiwan

---

### S88 Permanent Magnet Machine Drives I

**Room:** 335  
**Chairs:** Gianmario Pellegrino, Long Wu

8:00 am > **Plug-in, Direct Flux Vector Control of PM Synchronous Machine Drives**  
Gianmario Pellegrino, Barbara Boazzo, Thomas M. Jahns, Politecnico di Torino, Italy; University of Wisconsin-Madison, United States  

8:25 am > **Analysis and Control of Mono Inverter Dual Parallel SPMSM Drive System**  
Yongiae Lee, Jung-Ik Ha, Seoul National University, Korea  

8:50 am > **Mechanical Parameter Estimation of Permanent Magnet Synchronous Machines with Aiding from Estimation of Rotor PM Flux Linkage**  
Kan Liu, Z.Q. Zhu, University of Sheffield, United Kingdom  

9:15 am > **Flux Regulation Strategies for Hybrid Excitation Synchronous Machines**  
F. Giulii Capponi, G. Borocci, G. De Donato, F. Caricchi, University of Roma “La Sapienza”, Italy

---

### S89 Non-conventional Electric Machines

**Room:** 336  
**Chairs:** Elena Lomonova, Abraham Gebregergis

8:00 am > **Transient Analysis of a Line Start Hysteresis Interior Permanent Magnet Motor**  
S.F. Rabbi, M.A. Rahman, Memorial University of Newfoundland, Canada  

8:25 am > **Bearingless Transverse Flux Permanent Magnet Machine for Large Direct-drive**  
Deok-Je Bang, Seon-Hwan Hwang, Ji-Won Kim, Wook Hwang, Pii-Wan Han, Dae-Hyun Koo, Korea Electrotechnology Research Institute, Korea, Kyungnam University, Korea
Technical Program Schedule Oral Sessions

Thursday, September 18 10:00 am – 11:40 am

S90  Wind Energy: Control and Operation II
Room: 323
Chair: Wei Qiao

10:00 am > Control of a Small Wind Turbine in the High Wind Speed Region
Carlos Lumbraeras, Juan M. Guerrero, Pablo García, Fernando Briz, David Díaz, University of Oviedo, Spain

10:25 am > Sideband Torque Ripple in Direct Drive Permanent Magnet Wind Power Generator System
W. Liang, W. Fei, P.C.K. Luk, Cranfield University, United Kingdom

10:50 am > Intelligent Maximum Power Extraction Control for Wind Energy Conversion Systems based on Online Q-learning with Function Approximation
Chun Wei, Wei Qiao, Liyan Qu, University of Nebraska-Lincoln, United States

11:15 am > Proportional Derivative based Stabilizing Control of Parallelled Grid Converters with Cables in Renewable Power Plants
Xiongfei Wang, Frede Blaabjerg, Poh Chiang Loh, Aalborg University, Denmark

S91  Voltage Control Issues in Renewable Energy Applications
Room: 324
Chairs: Jiangang Hu, Jaedo Park

10:00 am > Estimation of Synchronization Signal using Sinusoidal Amplitude Integrator in Synchronous Reference Frame
Xiong Du, Yandong Liu, Guoning Wang, Pengju Sun, Luowei Zhou, Heng-Ming Tai, Chongqing University, China; University of Tulsa, United States

10:25 am > High-dynamic Single-phase Hilbert-based PLL for Improved Phase-jump Ride-through in Grid-connected Inverters
Butiuchi Giampaolo, Davide Barater, Luca Tarisciotti, Pericle Zanchetta, University of Kiel, Germany; University of Parma, Italy; University of Nottingham, United Kingdom

10:50 am > Output Voltage Control of 3-p Switched Boost Inverter for Standalone Renewable Energy based Distribution Generation Systems
Ravindranath Adda, Avinash Joshi, Santanu Mishra, Indian Institute of Technology Guwahati, India; Indian Institute of Technology Kanpur, India

11:15 am > Decoupled Capacitor Voltage Control of Modular Multilevel Converters
Marcelo A. Perez, Jose Rodriguez, Steffen Bernet, Universidad Tecnica Federico Santa Maria, Chile; Technical University of Dresden, Germany

S92  Grid Devices
Room: 325
Chairs: Hui Li, Khurram Afridi

10:00 am > A Six-switch Solid State Variable Capacitor with Minimum DC Capacitance
Sisheng Liang, Fang Z. Peng, Dong Cao, Michigan State University, United States; North Dakota State University, United States

10:25 am > Verification by Current Control of Multi-phase Transformer-linked Type Boost Chopper Circuit using Current Sensorless Method
Taichi Kawakami, Hirotaka Tanada, Masayoshi Yamamoto, Shimane University, Japan

10:50 am > An Alternative Topology for Fault Current Limiting and Interrupting Devices
R. Alaei, S.A. Khajehoddin, W. Xu, S.H. Fathi, University of Alberta, Canada; Amirkabir University of Technology, Iran

11:15 am > A Silicon Carbide Fault Current Limiter for Distribution Systems
Yusi Liu, Chris Farnell, Hao Zhang, Andrés Escobar-Mejía, H. Alan Mantooth, Juan Carlos Balda, Simon S. Ang, University of Arkansas, United States

S93  Power Converters for Grid Applications
Room: 326
Chairs: Luca Solero, Di Pan

10:00 am > An Isolated Multiport Bidirectional DC-DC Converter for PV-battery-DC Microgrid Applications
Jianwu Zeng, Wei Qiao, Liyan Qu, University of Nebraska-Lincoln, United States

10:25 am > Bidirectional DC-AC Converter for Isolated Microgrids with Voltage Unbalance Reduction Capabilities
Felipe S.F. e Silva, Luiz A. de S. Ribeiro, José Gomes de Matos, Federal University of Maranhao, Brazil

10:50 am > A Multiport Power Sharing Converter Topology for Renewable-to-grid Interface
J.T. Hawke, H.S. Krishnamoorthy, P.N. Enjeti, Texas A&M University, United States

11:15 am > Y-connected Three-leg Converters Applied in Three or Four-wire Shunt Compensator
Edgardo L.L. Fabricio, Cursino B. Jacobina, Montê A. Vitorino, Mauricio B.R. Correa, Federal University of Campina Grande, Brazil; Federal University of Paraíba, Brazil

S94  Control of Power Converters based on Physical and Virtual Models
Room: 327
Chairs: Tobias Geyer, Tiefu Zhao

10:00 am > Estimation of the Plant Time Constant of Current-controlled Voltage Source Inverters
Ana Vidal, Alejandro G. Yepes, Jango Malvar, Óscar López, Jesús Doval-Gandoy, Francisco D. Freijedo, University of Vigo, Spain; Aalborg University, Denmark

10:25 am > Model Predictive Current Control for Modular Multilevel Converters
Georgios Darvianakis, Tobias Geyer, Wim van der Merwe, ABB Corporate Research Center, Switzerland

10:50 am > Virtual Impedance Current Sharing Control of Parallel Connected Converters for AC Motor Drives
Bassim Jassim, Bashar Zahawi, David J. Atkinson, Baghdad University, Iraq; Khalifa University, United Arab Emirates; Newcastle University, United Kingdom

11:15 am > Improving Power Quality with Multi-objective Modulated Model Predictive Control
Luca Tarisciotti, Pericle Zanchetta, Alan Watson, Jon Clare, Stefano Bifaretti, University of Nottingham, United Kingdom; University of Rome “Tor Vergata”, Italy
DC-AC Multi-phase Converters

Room: 328
Chairs: Radu Bojoi, Norma Anglani

10:00 am > A New Four-level π-type Converter with Neutral Point Voltage Balancing Capability
Xibo Yuan, University of Bristol, United Kingdom

10:25 am > SVPWM-based D-Σ Digital Control for 3ϕ Grid-connected Inverter with Wide Inductance Variation
T.-F. Wu, C.-H.-. Chang, L.-C. Lin, National Tsing Hua University, Taiwan; National Chung Cheng University, Taiwan

10:50 am > Switched Coupled-inductor Z-source Inverters with Large Conversion Ratio and Soft-switching Condition
Xingping Ding, Chenghui Zhang, Qingdao Technological University, China; Shandong University, China

11:15 am > A Novel P-Q Variations Method using a Decoupled Injection of Reference Currents for a Precise Estimation of Grid Impedance
Je-Hee Cho, Ki-Young Choi, Yong-Wook Kim, Rae-Young Kim, Hanyang University, Korea

Soft-switching Bridge DC-DC Converters

Room: 329
Chairs: Jin Wang, Madhu Chinthavali

10:00 am > A Low-RMS-current Passive Auxiliary Circuit for ZVS Operation of Full Bridge Converters
Alireza Safaei, Praveen Jain, Alireza Bakhshai, Bombardier Transportation Inc., Canada; Queen’s University, Canada

10:25 am > The Cost-efficient, Full ZVS Range Hybrid Full-bridge/Half-bridge Family with Shared Lagging Leg: Topology Derivation, Optimization Design and Experimental Results
Yu Chen, Gang Wen, Li Peng, Yong Kang, Huazhong University of Science and Technology, China

10:50 am > 3-phase Current-fed Zero Current Switching Phase-shift PWM DC-DC Converter
Ali Mohammadpour, Tao Li, Leila Parsa, Rensselaer Polytechnic Institute, United States

11:15 am > A Novel High Efficiency High Power Density Three-port Converter based on Interleaved Half-bridge Converter for Renewable Energy Applications
Lili Zhu, Hongfei Wu, Peng Xu, Haibing Hu, Hongjuan Ge, Nanjing University of Aeronautics and Astronautics, China

Flux and Direct Torque Control

Room: 330
Chairs: Mario Pacas, Robert Cuzner

10:00 am > A Novel Stator Flux Oriented V/f Control Method in Sensorless Induction Motor Drives for Accuracy Improvement and Oscillation Suppression
Bin Chen, Wenxi Yao, Zhengyu Lu, Kevin Lee, Zhejiang University, China; Eaton Corporation, United States

10:25 am > Loss Manipulation Capabilities of Deadbeat-direct Torque and Flux Control Induction Machine Drives
Yukai Wang, Takumi Ito, Robert D. Lorenz, University of Wisconsin-Madison, United States; Toshiba Mitsubishi-Electric Industrial Systems Corporation, Japan

10:50 am > A Novel Method of Maximum Torque per Ampere Control for a Direct Torque-controlled PMSM in a Stator Flux-linkage Synchronous Frame
Tatsuki Inoue, Yukinori Inoue, Shigeo Morimoto, Masayuki Sanada, Osaka Prefecture University, Japan

Synchronous Reluctance Machines

Room: 333
Chairs: Francesco Cupertino, Thomas Wu

10:00 am > FE-aided Analytical Method to Predict the Capabilities of Line-start Synchronous Motors
Damiano Mingardi, Nicola Bianchi, University of Padova, Italy

10:25 am > A Mechanically Robust Rotor with Transverse-laminations for a Synchronous Reluctance Machine for Traction Applications
Seyedmorteza Taghavi, Pragasen Pillay, Concordia University, Canada

10:50 am > Design of a 50,000 rpm Synchronous Reluctance Machine for an Aeronautical Diesel Engine Compressor
M. Palmieri, M. Perfa, F. Cupertino, Politecnico di Bari, Italy

11:15 am > On the Feasibility of Integer and Fractional Number of Slots per Pole Distributed Winding Designs for Synchronous Reluctance Motors
Mircea Popescu, James E. Goss, David A. Staton, Yi Wang, Dan M. Ionel, Motor Design Ltd., United Kingdom; University of Wisconsin-Milwaukee, United States

Modeling of Electric Machines

Room: 334
Chairs: Jagadeesh Tangudu, Ronghai Qu

10:00 am > Ultrafast Steady-state Multi-physics Model for PM and Synchronous Reluctance Machines
Yi Wang, Dan M. Ionel, David Staton, University of Wisconsin-Milwaukee, United States; Regal Beloit Corp., United States; Motor Design, Ltd., United Kingdom

10:25 am > Coupled Electromagnetic/Thermal Machine Design Optimization based on Finite Element Analysis with Application of Artificial Neural Network
Wenyong Jiang, T.M. Jahns, University of Wisconsin-Madison, United States

10:50 am > A Multi-physics Design Methodology Applied to a High-force-density Short-duty Linear Actuator
M. Simpson, R. Wrobel, P.H. Mellor, University of Bristol, United Kingdom

11:15 am > A Methodology for Predicting the Thermal Behaviour of Modular-wound Electrical Machines
J.L. Baker, R. Wrobel, D. Drury, P.H. Mellor, University of Bristol, United Kingdom

Permanent Magnet Machine Drives II

Room: 335
Chairs: Thomas Jahns, Gui-Jia Su

10:00 am > Low Switching Frequency Stator Flux Linkage Observer for Interior Permanent Magnet Synchronous Machines
Wei Xu, Robert D. Lorenz, University of Wisconsin-Madison, United States

10:25 am > Using D-Q Transformation to Variable Switching Frequency PWM Control for Interior Permanent Magnet Synchronous Motor Drives
Fei Yang, Allan Taylor, Hua Bai, Bing Cheng, Arshan Khan, Young Joo Lee, Zhong Nie, Kettering University, United States; Chrysler Group LLC, United States
10:00 am > A New Core Loss Model for Rectangular AC Voltages
Mingkai Mu, Fred C. Lee, Virginia Polytechnic Institute and State University, United States

10:25 am > Allowable Power Analysis for High Power Density DC-DC Converters using Integrated Magnetic Components
Shota Kimura, Shogo Aoto, Jun Imaoka, Masayoshi Yamamoto, Shimane University, Japan

10:50 am > Design and Evaluation of the Constant-flux Inductor with Enclosed-winding
Han Cui, Khai D.T. Ngo, Jim Moss, Michele Lim, Ernesto Rey, Virginia Polytechnic Institute and State University, United States; Texas Instruments Inc., United States

11:15 am > Gap Design for Nonlinear Ferrite Cores to Maximize Inductance
Ting Ge, Khai Ngo, Jim Moss, Michele Lim, Virginia Polytechnic Institute and State University, United States; Texas Instruments Inc., United States

Thursday, September 18 1:30 pm – 3:10 pm

S102  LED Drivers II
Room: 323
Chair: Yilmaz Sozer

1:30 pm > An Input-adaptive Self-oscillating Synchronous Boost Converter for LED Driving with Ultra-low Wide-range Voltage Input
Yi Chen, Yurong Nan, Siheng Zhong, Qinggang Kong, Zhejiang University of Technology, China; Dalian Shinergy Science & Technology Development Co., Ltd., China

1:55 pm > A Parallel LED String Driver using Capacitors for Source and String Ground Separation
Ruihong Zhang, Henry Shu-Hung Chung, City University of Hong Kong, Hong Kong

2:20 pm > Control Scheme for Decoupling Auxiliary Power Supply in Dimmable LED Drivers
Liang Jia, David Fang, Yan-Fei Liu, Philips Electronics North America, United States; Queen’s University, Canada

2:45 pm > Inductive Power Transfer System for Driving Multiple OLED Lighting Panels
Rui Zhou, Ruihong Zhang, Henry Shu-hung Chung, City University of Hong Kong, Hong Kong

S103  DC-DC Converters for Renewable Energy Applications
Room: 324
Chairs: Subhashish Bhattacharya, Tiefu Zhao

1:30 pm > Frequency-based Control of a Micro-grid with Multiple Renewable Energy Sources
Giampaolo Buiti, Marco Liserre, Davide Barater, Carlo Concari, Alessandro Soldati, Giovanni Franceschini, University of Kiel, Germany; University of Parma, Italy

2:20 pm > Multi-input Transformer Coupled DC-DC Converter for PV-wind based Stand-alone Single-phase Power Generating System
B. Mangu, B.G. Fernandes, Indian Institute of Technology Bombay, India

2:45 pm > Inductive-boost Switched-capacitor DC-DC Converter for Maximum Power Point Tracking Photovoltaic Systems
Ali Gandomkar, Jul-Ki Seok, Yeungnam University, Korea

S104  Smart Grid Technologies I
Room: 325
Chair: David Perreault, Zhiguo Pan

1:30 pm > Medium Voltage AC Collection Grid for Large Scale Photovoltaic Plants based on Medium Frequency Transformers
Bahaa Hafez, Harish S. Krishnamoorthy, Prasad Enjeti, Uffe Borup, Shehab Ahmed, Texas A&M University, United States; Danfoss Solar Inverters, United States; Texas A&M University at Qatar, Qatar

1:55 pm > Towards Fully Controllable Multi-terminal DC Grids using Flexible DC Transmission Systems
Kumars Rouzbeh, Arash Miranian, Alvaro Luna, Pedro Rodriguez, Technical University of Catalonia, Spain; Ferdowsi University of Mashhad, Iran; Abengoa Research, Spain

2:20 pm > Standalone ESS Modeling and Dual-loop Control using Zn-Br Redox Flow Battery
Jung-Muk Choe, Younghoon Cho, Gyu-Ha Choe, Konkuk University, Korea

2:45 pm > Storage System Requirements for Grid Supporting PV-power Plants
Catalin Gavrilita, Ignacio Candela, Joan Rocabet, Ion Eixeberria-Otadui, Pedro Rodriguez, Technical University of Catalonia, Spain; IKERLAN-IK4 Technological Research Centre, Spain; Abengoa Research, Spain

S105  HVDC Systems
Room: 326
Chairs: Subhashish Bhattacharya, Tiefu Zhao

1:30 pm > A DC-DC Circuit Suitable for HVDC Applications with Large Step-ratios
T. Lüth, M. Merlin, T. Green, Imperial College London, United Kingdom

1:55 pm > DC Impedance Modelling of a MMC-HVDC System for DC Voltage Ripple Prediction under a Single-line-to-ground Fault
Xiaojie Shi, Zhiqiang Wang, Bo Liu, Yalong Li, Leon M. Tolbert, Fred Wang, University of Tennessee, United States

2:20 pm > Optimization of Limiting Reactors Design for DC Fault Protection of Multi-terminal HVDC Networks
E. Kontos, S. Rodrigues, R. Teixeira Pinto, P. Bauer, Delft University of Technology, Netherlands
2:45 pm > Implementation and Testing of High-power IGCT-based Cascaded-converter Cells
Tomas Modeer, Staffan Norrga, Hans-Peter Nee, KTH Royal Institute of Technology, Sweden

S106 Dual Active Bridge DC-DC Converters
Room: 327
Chairs: Shuo Wang, Wei Qiao

1:30 pm > Dual-input High Gain DC-DC Converter based on the Cockcroft-Walton Multiplier
Lukas Müller, Jonathan W. Kimball, Missouri University of Science and Technology, United States

1:55 pm > Novel Multiobjective Optimization of MF Transformers for Soft-switching Converters using a Genetic Algorithm
Asier Garcia-Bediaga, Irma Villar, Luis Mir, Ion Etxeberria-Otadui, Alfred Rufer, IK4-IKERLAN Technological Research Centre, Spain; École Polytechnique Fédérale de Lausanne, Switzerland

2:20 pm > An Isolated Hybrid Switched C-L DC-DC Circuit with High Step-up Ratio and Reduced Switch Voltage Stress
Cong Li, Rachid Darbali Zamora, Chengcheng Yao, Lexing Fu, He Li, Xuan Zhang, Feng Guo, Jin Wang, Ohio State University, United States

2:45 pm > A Series Compensation Enabled ZVS Range Enhancement of a Dual Active Bridge Converter for Wide Range Load Conditions
Awnesh Tripathi, Krishna Mainali, Subhashish Bhattacharya, North Carolina State University, United States

S107 Multi-level Converter Topologies I

1:30 pm > A Non-regenerative Five-level Rectifier
Xibo Yuan, University of Bristol, United Kingdom

1:55 pm > Optimised Operation Mode for the Hexverter Topology based on Adjacent Compensating Power
Dennis Karwatzki, Lennart Baruschka, Malte von Hofen, Axel Mertens, Leibniz Universität Hannover, Germany; Protolar GmbH, Germany

2:20 pm > Low-speed Drive Operation of the Modular Multilevel Converter Hexverter Down to Zero Frequency
Lennart Baruschka, Dennis Karwatzki, Malte von Hofen, Axel Mertens, Leibniz Universität Hannover, Germany; Protolar GmbH, Germany

2:45 pm > A Cross Connected Submodule Topology for Hybrid Multilevel Converters
Ebin Cherian Mathew, Anshuman Shukla, Mahendra Ghat, Indian Institute of Technology Bombay, India

S108 Low-power Resonant Converters
Room: 329
Chair: Henry Chung

1:30 pm > On-line DC-link Voltage Control of LLC Resonant Converter for Server Power Applications
Zih-Jie Su, Yen-Shin Lai, National Taipei University of Technology, Taiwan

1:55 pm > Modeling and Experimentation of Misalignment-tolerable Loosely-coupled Coil Structure
Jeff Po Wa Chow, Nan Chen, Henry Shu Hung Chung, Leanne Lai Hang Chan, City University of Hong Kong, Hong Kong; ABB Corporate Research Center, Sweden

2:20 pm > Comparison of Two High Frequency Converters for Capacitive Power Transfer
Liang Huang, Aiguo Patrick Hu, Akshya Swain, Xin Dai, University of Auckland, New Zealand; Chongqing University, China

2:45 pm > Optimal Operation and Burst-mode Control for Improving the Efficiency of the Quasi-switched-capacitor Resonant Converter
Xuan Zhang, Chengcheng Yao, Feng Guo, Jin Wang, Ohio State University, United States

S109 Modulation for Power Converters II

1:30 pm > Critical Modulation Method based on PWAM in Back-to-back 3-phase System
Hojoon Shin, Jung-Ik Ha, Seoul National University, Korea

1:55 pm > A Comparative Investigation of Various Advanced Bus Clamped Space Vector Pulse Width Modulation (SVPWM) Techniques
Meenut D. Nair, Gopinath Vivek, Anjana Kolathiparambil, Mukti Barai, NIT Calicut, India

2:20 pm > A Control Mechanism to Compensate Nonlinearity of Discontinuous Modulation based Grid-connected Differential-mode Ćuk Inverter
Siamak Mehrnami, Sudip K. Mazumder, University of Illinois at Chicago, United States

2:45 pm > A New Space Vector Modulation Technique for Common-mode Voltage Reduction in both Magnitude and Third-order Component
Kai Tian, Jiacheng Wang, Bin Wu, Dewei Xu, Zhongyuan Cheng, Navid Reza Zargari, Ryerson University, Canada; Simon Fraser University, Canada; Rockwell Automation Canada, Canada

S110 Power Electronics Reliability Assessment
Room: 333
Chairs: Yehui Han, Shashank Krishnamurthy

1:30 pm > Mission Profile Translation to Capacitor Stresses in Grid-connected Photovoltaic Systems
Yongheng Yang, Ke Ma, Huai Wang, Frede Blaabjerg, Aalborg University, Denmark

1:55 pm > Reliability Assessment of Power MOSFETs Working in Avalanche Mode based on a Thermal Strain Direct Measurement Approach
S. Russo, A. Testa, S. De Caro, S. Panarello, S. Patanè, T. Scimone, G. Scelba, G. Scarcella, STMicroelectronics, Italy; University of Messina, Italy; University of Catania, Italy

2:20 pm > Transient Modelling of Loss and Thermal Dynamics in Power Semiconductor Devices
Ke Ma, Yongheng Yang, Frede Blaabjerg, Aalborg University, Denmark

2:45 pm > An Icepak-PSpice Co-simulation Method to Study the Impact of Bond Wires Fatigue on the Current and Temperature Distribution of IGBT Modules under Short-circuit
Rui Wu, Francesco Iannuzzo, Huai Wang, Frede Blaabjerg, Aalborg University, Denmark

S111 High Power Drives
Room: 334
Chairs: Lei Hao, Qin Lei

1:30 pm > Improved Selective Harmonics Elimination (SHE) Scheme with Online Harmonic Compensation for High-power PWM Converters
Ye Zhang, Yun Wei Li, Navid R. Zargari, Zhongyuan Cheng, University of Alberta, Canada; Rockwell Automation, Canada
S112 High Speed Electric Machines

Room: 335  
Chairs: Fabio Capponi, Radu Bojoi

1:30 pm > High Speed Operation of Electrical Machines, a Review on Technology, Benefits and Challenges  
Reza Rajabi Moghadam, ABB Corporate Research, Sweden

1:55 pm > High Frequency AC Machines Winding Model-parameters Estimation  
I. Rasoanirvo, A. Baddi, N. Haje Obeid, T. Boileau, B. Nahid-Mobarakeh, N. Takorabet, F. Melbody-Tabar, Université de Lorraine, France

2:20 pm > Minimization of Proximity Losses in Electrical Machines with Tooth-wound Coils  
Mario Vetuschi, Francesco Cupertino, Politecnico di Bari, Italy

2:45 pm > AC Losses in High Frequency Electrical Machine Windings formed from Large Section Conductors  
Phil Mellor, Rafal Wrobel, Nick Simpson, University of Bristol, United Kingdom

S113 Manufacturing Issues of Electric Machines

Room: 336  
Chairs: Marcello Pucci, Peter Wung

1:30 pm > Roll Up Stator Development for 56 Frame PM Synchronous Motor  
Jason J. Kreidler, Wes K. Anderson, Sree Venkateswararao, Bill J. Conway, Harold D. Willis, Peter Y.P. Wung, Regal Beloit America Inc., United States; Regal Beloit Inc., India

1:55 pm > Reduction of Cogging Torque due to Production Tolerances of Rotor by using Partially Placed Dummy Slots in Axial Direction  
Masatsugu Nakano, Yusuke Morita, Toshiohiro Matsunaga, Mitsubishi Electric Corporation, Japan

2:20 pm > Performance and Core Loss of Concentrated Winding IPMSM with Different Core Treatment  
Shah Asifur Rahman, Andrew M. Knight, University of Alberta, Canada; University of Calgary, Canada

2:45 pm > Manufacturing Influence on the Magnetic Properties and Iron Losses in Cobalt-iron Stator Cores for Electrical Machines  
Andreas Krings, Marco Cossale, Juliette Soulard, Aldo Boglietti, Andrea Cavagnino, KTH Royal Institute of Technology, Sweden; Politecnico di Torino, Italy
S117  DC Grids

Room: 326
Chairs: Dong Jiang, Amel Lachichi

3:30 pm > Stability Analysis of a DC Microgrid with Master-slave Control Structure
Li Guo, Yibin Feng, Xialin Li, Chengshan Wang, Yunwei Li, Tianjin University, China; University of Alberta, Canada

3:55 pm > Design Consideration for Contactless DC Connector in High Power Density Future 380 V DC Distribution System
Yusuke Hayashi, Hajime Toyoda, Toshifumi Ise, Akira Matsumoto, Osaka University, Japan; NTT Facilities, Japan

4:20 pm > DC Pole-to-pole Short-circuit Behavior Analysis of Modular Multilevel Converter
Guojie Zhang, Yao Chen, Chenyang Yue, Li Qi, Jiuping Pan, ABB Ltd., China; ABB Ltd., United States

4:45 pm > Control of Voltage Source Converter based Multi-terminal DC Grid under DC Fault Operating Condition
Nima Yousefpoor, Sungmin Kim, Subhashish Bhattacharya, Quanta Technology, United States; Seoul National University, Korea; North Carolina State University, United States

S118  Gate Drive Techniques

Room: 327
Chairs: David Cotini, Jelena Popovic

3:30 pm > Thermal Analysis and Improvement of Cascode GaN HEMT in Stack-die Structure
Shuojie She, Wenli Zhang, Xiucheng Huang, Weijing Du, Chengyang Liu, Fred C. Lee, Qiang Li, Beijing University of Technology, China; Virginia Polytechnic Institute and State University, United States

3:55 pm > Gate-driver for Safe Operation of Depletion-mode SiC JFETs
Simon Weber, Arvid Merkert, Axel Mertens, Leibniz Universität Hannover, Germany

4:20 pm > Transformer Isolated Gate Drive with Protection for SiC MOSFET in High Temperature Application
Feng Qi, Longya Xu, Guoliang Zhao, Jiangbo Wang, Ohio State University, United States

4:45 pm > Design and Experimental Validation of a High Frequency Gate Driver for Silicon Carbide Power Modules
Alejandro Rujas, Gabriel Garcia, Ion Etkeberria-Otadui, Uxue Larrañaga, Txomin Nieva, IK4-IERLAN Technological Research Centre, Spain; CAF Power and Automation, Spain

S119  Multi-level Converter Topologies II

Room: 328
Chairs: Rolando Burgos, Pierluigi Tenca

3:30 pm > Partial 5/3 Level Topology for Solar Grid-tie Inverters
Antonio Ginart, Richard Liou, Andres Salazar, Carlos Restrepo, Michael Ernst, SolarMax, United States; Georgia Institute of Technology, United States

3:55 pm > Design and Implementation of a Novel Multilevel DC-AC Inverter
Cheng-Han Hsieh, Tsong-Ju Liang, Shih-Wen Tsai, National Cheng Kung University, Taiwan

4:20 pm > A High Voltage Gain Multilevel Modular Switched-capacitor DC-DC Converter
Dong Cao, Wei Qian, Fang Z. Peng, North Dakota State University, United States; Michigan State University, United States

4:45 pm > Modification of Cascaded H-bridge Multilevel Inverter to Increase Output Voltage Level with a Single DC Voltage Source
Ju-sung Choi, Fei-soon Kang, Hanbat National University, Korea

S120  DC-DC Converter Applications

Room: 329
Chairs: Qiang Li, Baoming Ge

3:30 pm > Downsizing Effects of Integrated Magnetic Components in High Power Density DC-DC Converters for EV and HEV
Shota Kimura, Jun Imaoka, Masayoshi Yamamoto, Shimane University, Japan

3:55 pm > A Linear-assisted DC-DC Hybrid Power Converter for Envelope Tracking RF Power Amplifiers
Rajdeep Bondade, Yi Zhang, Dongsheng Ma, University of Texas at Dallas, United States; Texas Instruments Inc., United States

4:20 pm > A 98.7% Efficient Composite Converter Architecture with Application-tailored Efficiency Characteristic
Hua Chen, Kamal Sabi, Hyeokjin Kim, Tadakazu Harada, Robert Erickson, Dragan Maksimovic, University of Colorado-Boulder, United States

4:45 pm > Discontinuous Conduction Mode Operation of the 2-phase Integrated-magnetic Boost Converter
Brendan C. Barry, John G. Hayes, Marek S. Ryłko, Jerzy W. Masłoń, University College Cork, Ireland; dtw Sp. z o.o., Poland

S121  Control of Power Converters III

Room: 330
Chair: Jaedo Park

3:30 pm > Control and Experiment of High Frequency Isolated Modular Converter under Normal and AC Fault Operating Condition
Nima Yousefpoor, Babak Parkhideh, Ali Azidehak, Sungmin Kim, Subhashish Bhattacharya, Quanta Technology, United States; North Carolina State University, United States; Seoul National University, Korea

3:55 pm > Integrated Grid Inductance Estimation Technique for Finite Control Set Model Predictive Control in Grid Connected Converters
Bital Arif, Luca Tarisciotti, Pericle Zanchetta, Jon Clare, Marco Degano, University of Nottingham, United Kingdom

4:20 pm > Finite State Model Predictive Control for 3x3 Matrix Converter based on Switching State Elimination
Ozan Gulbudak, Enrico Santi, Janosch Marquart, University of South Carolina, United States; University of Applied Sciences, Switzerland

4:45 pm > Control Strategy for 3-phase Converter under Unbalanced Grid Voltage Conditions Considering Line Loss
Kyung-Hwan Lee, Jung-Ik Ha, Seoul National University, Korea
S122  Energy-efficient Motor Drives

3:30 pm > Minimum Copper Loss Control of a Single-phase Grid-connected Wound Rotor Machine over Full Speed Range
Kahyun Lee, Yongsu Han, Jung-Ik Ha, Seoul National University, Korea

3:55 pm > Power Loss, System Efficiency, and Leakage Current Comparison between Si IGBT VFD and SiC FET VFD with Various Filtering Options
Mahesh Swamy, Jun-Koo Kang, Kohei Shirabe, Yaskawa America, Inc., United States

4:20 pm > Pulsating Torque Control with Voltage Suppression Period for Position-dependent Load Torque Applications
Takahiro Suzuki, Yuichi Shimizu, Hitachi, Ltd., Japan; Hitachi Appliances, Inc., Japan

S123  Wound-field Machines

3:30 pm > Separately Excited Synchronous Motor with Rotary Transformer for Hybrid Vehicle Application
Constantin Stancu, Terence Ward, Khwaja Rahman, Robert Dawsey, Peter Savagian, General Motors, United States

3:55 pm > Investigation of an Improved Hybrid-excitation Flux Switching Brushless Machine for HEV/EV Applications
Gan Zhang, Wei Hua, Ming Cheng, Jianzhong Zhang, Wei Jiang, Southeast University, China

4:20 pm > Design of SPM and IPM Rotors in Novel One-axis Actively Positioned Single-drive Bearingless Motor
Hiroya Sugimoto, Itsuki Shimura, Akira Chiba, Tokyo Institute of Technology, Japan

4:45 pm > Design and Control Strategy of a 2-phase Brushless Exciter for Three-stage Starter/Generator
Ningfei Jiao, Weiguo Liu, Jichang Peng, Shuai Mao, Hua Zhang, Northwestern Polytechnical University, China

S124  Axial-flux Machines

3:30 pm > Increase in Operating Range and Efficiency for Variable Gap Axial Flux Motors
Greg Heins, Mark Thiele, Dean Patterson, Nicholas Lambert, Regal Beloit Corporation, Australia; Charles Darwin University, Australia

3:55 pm > Closed-form Solution for Winding Types of Axial Flux Permanent Magnet Machines
Ju Hyung Kim, Wooyung Choi, Bülent Sarlioğlu, WEMPEC, University of Wisconsin-Madison, United States

4:20 pm > Examination for the Higher Efficiency in a Ferrite Permanent Magnet 10 kW In-wheel Axial-gap Motor with Coreless Rotor Structure
Kodai Sone, Masatsugu Takamoto, Satoshi Ogasawara, Kenichi Takezaki, Wataru Hino, Hokkaido University, Japan; Dynax Corporation, Japan

4:45 pm > Analysis and Development of an Axial Flux Magnetic Gear
Matthew Johnson, Alireza Shapoury, Pedram Boghrat, Mike Post, Hamid A. Toliyat, Texas A&M University, United States; Physical Optics Corporation, United States

S125  Traction and Heavy-duty Vehicle Systems

3:30 pm > A Non-dissipative Controllable Charging Equalizer for Series Connected High-capacity Super-capacitors Urban Rail Transport System
Jianfeng Liu, Cheng Luo, Haikuan Jiang, Zhiwu Huang, Central South University, China; Hunan Engineering Laboratory for Advanced Control and Intelligent Automation, China

3:55 pm > Hybrid Railway Power Conditioner with Partial Compensation for Rating Optimization
Ningyi Dai, KengWeng Lao, ChiSeng Lam, University of Macau, Macau

4:20 pm > DC Side Ripple Cancellation in a Cascaded Multilevel Topology for Automotive Applications
Andrew Goodman, Alan Watson, Anubrata Dey, Jon Clare, Pat Wheeler, Yusuke Zushi, University of Nottingham, United Kingdom; Nissan Motor Co., Ltd., Japan

4:45 pm > Experimental Evaluation of E-motor Engine Start in a Heavy-duty Hybrid Vehicle under Cold Soak Conditions
J.G. Vining, Daimler Trucks North America, United States
Monday, September 15  
5:00 pm • 6:30 pm

**Poster Session: Control Aspects in Smart Grids**

**Room: Exhibit Hall C – East**  
**Chairs: Qin Lei, Omer Onar**

**P101 • Inverter Power Control to Support Distribution System Voltage Variability Mitigation**  
Xiao Liu, Aaron M. Cramer, University of Kentucky, United States

**P102 • A Unified Controller for a Microgrid based on Adaptive Virtual Impedance and Conducatance**  
Meiqin Mao, Zheng Dong, Yong Ding, Liuchen Chang, Hefei University of Technology, China; University of New Brunswick, Canada

**P103 • Small Signal Impedance Measurement in Droop Controlled AC Microgrids**  
Malte John, Patricio A. Mendoza-Araya, Giri Venkataramanan, Leibniz Universität Hannover, Germany; University of Chile, Chile; University of Wisconsin-Madison, United States

**P104 • Series-connected HV-IGBTs using Active Voltage Control with Status Feedback Circuit**  
Shiqi Ji, Ting Lu, Zhengming Zhao, Hualong Yu, Liqiang Yuan, Tsinghua University, China

**P105 • Independent Damping Control of Multimode Low-frequency Oscillations using Shunt-connected FACTS Devices in Power System**  
Mebtu Beza, Massimo Bongiorno, Chalmers University of Technology, Sweden

**P106 • The Improved Sen Transformer — A New Effective Approach to Power Transmission Control**  
Jiaxin Yuan, Li Chen, Baichao Chen, Wuhan University, China

**P107 • Independent Real and Reactive Power Control Flow without Sensing Receiving End Voltage in Transformer-less Unified Power Flow Controller**  
Deepak Gunasekaran, Shao Zhang, Shuitao Yang, Fang Zheng Peng, Michigan State University, United States

**P108 • A Line Impedance Conditioner to Improve Zigzag Transformer based Hybrid AC-DC Transmission under Unbalanced Line Impedance Conditions**  
Bo Liu, Xiaojie Shi, Fred Wang, Yangol Li, University of Tennessee, Knoxville, United States

**P109 • Multi-terminal DC Grid Control under Loss of Terminal Station**  
Nima Yousefpour, Sungmin Kim, Subhashish Bhattacharya, Quanta Technology, United States; Seoul National University, Korea; North Carolina State University, United States

**P110 • Control Concept Including Validation Strategy for an AC-DC Hybrid Link (Ultranel)**  
Volker Staudt, Andreas Steimel, Michael Kohlmann, Martin Kleine Jäger, Carsten Heising, Daniel Meyer, Klaus Vennemann, Eckhard Grebe, Klaus Kleinekorte, Ruhr-University Bochum, Germany; Avasition, Germany; Ampriion, Germany

**P111 • Suppression Strategy for Short-circuit Current in Loop-type DC Microgrid**  
Xiaoming Zha, Han Ning, Xiaoli Lai, Ying Huang, Fei Liu, Wuhan University, China

**P112 • Cost-based Droop Scheme for DC Microgrid**  
Inam Ullah Nutkani, Wang Peng, Poh Chiang Loh, Frede Blaabjerg, Nanyang Technological University, Singapore; Aalborg University, Denmark

**P113 • Droop Voltage Range Design in DC Micro-grids Considering Cable Resistance**  
Fang Chen, Wei Zhang, Rolando Burgos, Dushan Boroyevich, Virginia Polytechnic Institute and State University, United States

**P114 • Flexible Power Flow Control for Next-generation Multi-terminal DC Power Network**  
Kenji Natori, Hidemine Obara, Kouhei Yoshikawa, Bao Cong Hiu, Yukihiro Satoh, Chiba University, Japan

**P115 • Robust Control of a Single-phase VSI with LCL Filter for Grid-tie and Islanded Operation Modes Applied to PV Distributed Generation in Microgrids Environment**  
José C.U. Peña, Guillerme Melo, Carlos A. Canesin, Leonardo P. Sampaio, São Paulo State University, Brazil; Federal Technological University of Paraná, Brazil

**P116 • Average Modeling of a 3-phase Inverter for Integration in a Microgrid**  
Zeljko Jankovic, Bora Novakovic, Vijay Bhavaraju, Adel Nasiri, University of Wisconsin-Milwaukee, United States; Eaton Corporation, United States

**P117 • Optimization of the Maximum Power Point Tracking Method for Peak-current Controlled Flyback Micro-inverter**  
Zhe Zhang, Wang Chen, Min Chen, Zhejiang University, China

**P118 • Implementation of LVRT Techniques of Grid-connected PCS with the Adaptive Low Pass Notch PLL Method**  
Dong-sul Shin, Jong-Pil Lee, Kyong-Jun Lee, Tae-Jin Kim, Dong-Wook Yoo, Pusan National University, Korea; KERI, Korea

**P119 • Sub-synchronous Resonance Analysis in DFIG-based Wind Farms: Definitions and Problem Identification – Part I**  
Hossein Ali Mohammadpour, Enrico Santi, University of South Carolina, United States

**P120 • 8-shaped Trajectory Control for Rugged Rural PV Inverters**  
Juan M. Galvez, Martin Ordóñez, University of British Columbia, Canada

**P121 • Management of the Wind Turbine Energy Delivered to the Grid based on the Flatness Control Method**  
Merzak Aimene, Alireza Payman, Brayima Dakyo, University of Le Havre, France
**P306** • Evolutionary Multi-objective Optimization of H∞ Controller for Inductive Power Transfer System
Xin Dai, Yang Zou, Yue Sun, Zhihui Wang, Chunsen Tang, Aiguo Patrick Hu, Chongqing University, China; University of Auckland, New Zealand

**P307** • A Resonant Compensation Method for Improving the Performance of Capacitively Coupled Power Transfer System
Liang Huang, Aiguo Patrick Hu, Akshya Swain, University of Auckland, New Zealand

**P308** • Optimization of Foil Conductor Layout in Inductive Power Transfer System Resonators
Mohammad Etemadrezaei, Srdjan M. Lukic, North Carolina State University, United States

**P309** • Analysis, Design and Implementation of Phase-shifted Series Resonant High-voltage Capacitor Charging Power Supply and its Fuzzy Logic Controller
Lei Lin, Heqing Zhong, Yu Deng, Yongfu Liao, Ao Li, Yu Chen, Li Peng, Huazhong University of Science and Technology, China

**P310** • Hundreds kW Charging Stations for e-Buses Operating under Regular Ultra-fast Charging
Júlio C.G. Justino, Thiago M. Parreiras, Braz de J. Cardoso Filho, Federal University of Minas Gerais, Brazil

**P311** • Battery Management System with Cell Equalizer for Multi-cell Battery Packs
Giovanna Oriti, Alexander L. Julian, Peter Norgaard, Naval Postgraduate School, United States; United States Navy, United States

**P312** • Cell Selection through Two-level Basis Pattern Recognition with Low/High Frequency Components Decomposed by DWT-based MRA
Jonghoon Kim, Chosun University, Korea

**P313** • Tethered Aerial Robots using Contactless Power Systems for Extended Mission Time and Range
Su Y. Choi, Bo H. Choi, Seog Y. Jung, Beom W. Gu, Seung J. Yoo, Chun T. Rim, KAIST, Korea

**P314** • Variable Frequency Generation System for Aircraft
Denis Makarov, Sergey Kharitonov, Gennady Zinoviev, Dmitriy Korobkov, Andrey Sidirov, Novosibirsk State Technical University, Russian

**P315** • High Power Density SRC for Low Voltage Battery Charger in eEV with Third Harmonic Operation Technique
Jung-Hoon Ahn, Dong-Hee Kim, Won-Yong Sung, Seung-Hee Ryu, Byoung-Kuk Lee, Sungkyunkwan University, Korea

**P504** • Power Semiconductor Filter: Use of Series-pass Device in Switching Converters for Input Filtering
Wing-to Fan, Kuen-faat Yuen, Henry Shu-hung Chung, City University of Hong Kong, Hong Kong

**P505** • Master-slave Technique with Direct Variable Frequency Control for Interleaved Bidirectional Boost Converter
A. Vazquez, M. Arias, A. Rodriguez, D.G. Lamar, S. Luri, University of Oviedo, Spain; IK4-IKERLAN, Spain

**P506** • Design of a 2 MW DC Supply using a 4-stage Interleaved DC-DC Converter
Yusi Liu, Chris Farnell, Juan Carlos Baída, H. Alan Mantooth, University of Arkansas, United States

**P507** • 3D Printed Air Core Inductors for High Frequency Power Converters
Wei Liang, Luke Raymond, Juan Rivas, Stanford University, United States

**P508** • Inductor Loss Analysis of Various Materials in Interleaved Boost Converters
Yuki Itoh, Shota Kimura, Jun Imaoka, Masayoshi Yamamoto, Shimane University, Japan

**P509** • Voltage Balancing in an Interleaved High Gain Boost Converter
Jesús E. Valdez-Reséndiz, Abraham Claudio-Sánchez, Gerardo V. Guerrero-Ramírez, Alejandro Tapia-Hernández, Aldo N. Higuera Juárez, Adolfo R. López Núñez, Centro Nacional de Investigación y Desarrollo Tecnológico, Mexico

---

**Poster Session: Multi-phase Converters**

**P701** • Virtual-flux-based Power Predictive Control of 3-phase PWM Rectifiers using Space-vector Modulation
Yongsoo Cha, Kyo-Beum Lee, Ajou University, Korea

**P702** • Zero Sequence Blocking Transformers for Multi-pulse Rectifier in Aerospace Applications
Wenli Yao, Fred Blaabjerg, Xiaobin Zhang, Yongheng Yang, Zhaohui Gao, Northwest Polytechnical University, China; Aalborg University, Denmark

**P703** • A Novel 3-phase Current Source Rectifier with Delta-type Input Connection to Reduce Device Conduction Loss
Ben Guo, Fred Wang, Eddy Aeloiza, University of Tennessee, United States; ABB Corporate Research, United States

**P704** • Active Front End Rectifier Design Trade-off between PWM and Direct Power Control Method
Lixiang Wei, Yogesh Patel, Murthy Csn, Rockwell Automation, United States; L&T Technology, United States

**P705** • 3-phase Four-switch Partial Resonant Soft Switched Rectifier
Ankan De, Subhashish Bhattacharya, North Carolina State University, United States

**P706** • Control Strategy of PV Inverter under Unbalanced Grid Voltage Sag
Huang Hao, Xu Yonghai, North China Electric Power University, China

**P707** • Pulsed-width Modulation Technique for Family of (3N+3)-switch Converters
Kennedy A. Aganah, Olorunfemi Ojo, Tuskegee University, United States; Tennessee Technological University, United States

**P708** • Modeling of Voltage Source Inverter having Active Split DC-bus for Supply of Four-wire Electrical Utility Systems
Alessandro Lidozzi, Giovanni Lo Calzo, Sabino Pipolo, Luca Solero, Fabio Crescimbini, Roma Tre University, Italy

**P709** • High Reliability Capacitor Bank Design for Modular Multilevel Converter in MV Applications
Vahid Najimi, Jun Wang, Rolando Burgos, Dushan Boroyevich, Virginia Polytechnic Institute and State University, United States

**P710** • Model Predictive Control of a Direct Three-to-seven Phase Matrix Converter
Sk Moin Ahmed, Halitham Abu-Rub, Zainal Salam, Texas A&M University at Qatar, Qatar; University Technology Malaysia, Malaysia
P711 • A New Space Vector Modulation Strategy to Reduce Common-mode Voltage for Quasi-Z-source Indirect Matrix Converter
Xuyang You, Baoming Ge, Shuo Liu, Xinjian Jiang, Haitham Abu-Rub, Fang Z. Peng, Beijing Jiaotong University, China; Texas A&M University, United States; Tsinghua University, China; Texas A&M University at Qatar, Qatar; Michigan State University, United States

P712 • A Novel Medium-frequency-transformer Isolated Matrix Converter for Wind Power Conversion Applications
Chunyang Gu, Harish S. Krishnamoorthy, Prasad N. Enjeti, Yongdong Li, Tsinghua University, China; Texas A&M University, United States

P713 • Novel Matrix Converter Topologies with Reduced Transistor Count
S.M. Sajjad Hossain Rafin, Thomas A. Lipo, Byung-il Kwon, Hanyang University, Korea; University of Wisconsin-Madison, United States

P714 • Control of AC-capacitor Clamped Three and Five Level Matrix Converter using Voltage and Current Modulation
Lin Qiu, Lie Xu, Yongdong Li, Tsinghua University, China

Poster Session: DC-DC Converters
Room: Exhibit Hall C – South
Chairs: Lixiang Wei, Brian Welchko

P901 • A Digital Predictive Current Mode Controller using Average Inductor Current
Siyu He, John Y. Hung, Robert M. Nelms, Auburn University, United States

P902 • Phase-shift Control of Isolated Bidirectional DC-DC Converters for Unidirectional Power Flow
Junjie Ge, Zhengming Zhao, Junchao Ma, Fanbo He, Liqiang Yuan, Ting Lu, Tsinghua University, China

P903 • Auto-tuning and Self-calibration Techniques for V2 Control with Capacitor Current Ramp Compensation using Lossless Capacitor Current Sensing
Pei-hsin Liu, Yingyi Yan, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States; Linear Technology, United States

P904 • Band Separation in Linear-assisted Switching Power Amplifiers for Accurate Wide-bandwidth Envelope Tracking
Dongxue Li, Yuanzhe Zhang, Miguel Rodriguez, Dragan Maksimovic, University of Colorado-Boulder, United States

P905 • Modeling and State-space Feedback Control of a DC-DC Converter for Photovoltaic Systems
Darlan A. Fernandes, Márcea K. Vieira, Montê A. Vitorino, Fabiano Fragoso Costa, Poliya C. Ribeiro, Federal University of Paraiba, Brazil; Federal University of Campina Grande, Brazil; Federal University of Bahia, Brazil

P906 • Stability and Accuracy Considerations in the Design and Implementation of a Kilowatt-scale DC Power Hardware-in-the-loop Platform
Jonathan Siegers, Herbert L. Ginn, Enrico Santi, University of South Carolina, United States

P907 • A Method to Measure the DC bias in High Frequency Isolation Transformer of the Dual Active Bridge DC to DC Converter and its Removal using Current Injection and PWM Switching
Sumit Dutta, Subhashish Bhattacharya, North Carolina State University, United States

P908 • Fault Diagnosis in Unidirectional Non-isolated DC-DC Converters
E. Ribeiro, A.J. Marques Cardoso, C. Boccialetti, University of Beira Interior, Portugal; Sapienza University of Rome, Italy

Poster Session: DC-AC and DC-AC Converters
Room: Exhibit Hall C – South
Chairs: Lixiang Wei, Brian Welchko

P1101 • Parameter Design of the 3-phase Four-wire Testing Platform for New Energy Grid Connected Devices based on PRR Controller
Shuang Zhao, Fei Liu, Zha Xiaoming, Sun Jianjun, Hu Wei, Wuhan University, China

P1102 • Nonlinear Feedback Control of Compound Active-clamp Soft-switching 3-phase PFC Converter base on Load Observer
Xin Guo, Hai-Peng Ren, Xi’an University of Technology, China

P1103 • Second Harmonic Current Reduction and Dynamic Performance Improvement in the Two-stage Inverter: An Output Impedance Perspective
Li Zhang, Xinbo Ruan, Xiaoyang Ren, Nanjing University of Aeronautics and Astronautics, China

P1104 • Stationary Frame Control Strategy for Voltage Source Inverter under Unbalanced and Distorted Grid Voltage
Yipeng Song, Heng Nian, Zhejiang University, China

P1105 • Model Predictive Control of Nested Neutral Point Clamped (NNPC) Converter
Meihdi Narimani, Venkata Yaramasu, Bin Wu, George Cheng, Navid Zargari, Ryerson University, Canada; Rockwell Automation, Canada

P1106 • Power Loss Benchmark of Nine-switch Converters in 3-phase Online-UPS Application
Zian Qin, Poh Chiang Loh, Frede Blaabjerg, Aalborg University, Denmark

P1107 • A New Control Method for Minimizing the DC-link Capacitor Current of HEV Inverter Systems
Christian Sommer, Arvid Merkert, Axel Mertens, Leibniz Universitat Hannover, Germany

P1108 • Resonant-inductor-voltage-feedback Active Damping based Control for Grid-connected Inverters with LLC-filters
Min Huang, Xiongfei Wang, Poh Chiang Loh, Frede Blaabjerg, Aalborg University, Denmark

Poster Session: Control of Power Converters
Room: Exhibit Hall C – South
Chairs: Lixiang Wei, Brian Welchko

P1301 • Decentralized Voltage Sharing Control Strategy for Fully Modular Input-series Output-series High-voltage System
Guangjiang Wang, Wu Chen, Yong Ke, Wei Jiang, Southeast University, China; WuHu Profession and Technology College, China

P1302 • A Novel Input Voltage Sharing Control Strategy for Input-series Output-parallel System with High Reliability
Wu Chen, Xu Zhu, Guangiang Wang, Wei Jiang, Kai Yao, Southeast University, China; Nanjing University of Science and Technology, China

P1303 • Implementation of H∞ Controller for Active Voltage Quality Regulator under Distorted Grid
Yong Lu, Guochun Xiao, Xuanh Wu, Lifu Zheng, Jinjun Liu, Le Sun, Xi’an Jiaotong University, China

P1304 • Active Damping for Model Predictive Pulse Pattern Control
Peter Hokayem, Tobias Geyer, Nikolaos Oikonomou, ABB Corporate Research Center, Switzerland

P1305 • High Efficiency and Total Harmonic Distortion Improvement by Zero Current Prediction Technique for Transformer-free Buck Power Factor Corrector
Che-Hao Meng, Chih-Wei Chang, Chao-Chang Chiu, Ke-Horng Chen, Ying-Hsi Lin, Tsung-Yen Tsai, Chao-Cheng Lee, National Chiao Tung University, Taiwan; Realtek Semiconductor Corp., Taiwan
P1306 • Variable-speed IGBT Gate Driver with Loss/Overshoot Balancing for Switching Loss Reduction
Alexey Sokolov, Diego Mascarella, Geza Joose, McGill University, Canada

P1307 • New Current Control Scheme for the Vienna Rectifier in Discontinuous Conduction Mode
Michael Leibl, Johann W. Kolar, Josef Deuringer, ETH Zurich, Switzerland; Siemens AG Healthcare, Germany

P1308 • Synchronous Frame and Resonant Adaptive Observers as Disturbance Estimators and their Applications in Power Electronics
Vlatko Miskovic, Vladimir Blasko, Thomas M. Jahns, Robert D. Lorenz, Charles J. Romesnesko, Haojiong Zhang, Danfoss Power Electronics, United States; University of Wisconsin-Madison, United States; United Technologies Research Center, United States

P1309 • Sliding Mode Controlled Half Bridge Audio Amplifier using Single Power Supply
Sridhar Joshi, Parthasarathi Sensarma, Indian Institute of Technology Kanpur, India

Poster Session: General Topics

Room: Exhibit Hall C – South
Chair: Wen Ouyang

P1501 • Reconsideration of Loop Gain Measurement of DC/DC Converters
Chun Xiong, Xinbo Ruan, PeiLin Chen, Auehuwa Wang, Huazhong University of Science and Technology, China

P1502 • Simplified Electric Vehicle Models for use in Undergraduate Teaching and Research
John G. Hayes, University College Cork, Ireland

P1503 • AC-DC Converters with Open-end Grid for AC Machine Conversion Systems
João P.R.A. Mello, Cursino B. Jacobina, Gregory A.A. Carlos, Nady Rocha, Federal University of Campina Grande, Brazil; Federal Institute of Alagoas, Brazil; Federal University of Paraíba, Brazil

P1504 • Energy Saving HVAC System Modeling and Closed Loop Control in Industrial and Commercial Adjustable Speed Drives
Kevin Lee, Ravishankar Rugge, Kyle Zheng, Bing Yang, Eaton Corporation, United States

Poster Session: Induction Machines

Room: Exhibit Hall C – West
Chair: Galina Mirzaeva

P1701 • Maximum Efficiency per Torque Direct Flux Vector Control of Induction Motor Drives
S.A. Odhano, R. Bojoi, A. Boglietti, S.G. Rosu, G. Griva, Politecnico di Torino, Italy; University “Politehnica” of Bucharest, Romania

P1702 • Electric Circuit Coupling of a Slotted Semi-analytical Model for Induction Motors based on Harmonic Modeling

P1703 • Soft Start and Voltage Control of Grid Connected Induction Motors using Floating Capacitor H-bridge Converters
S. Leng, R. Ul Haque, N. Perera, A. Knight, J. Salmon, University of Alberta, Canada; University of Calgary, Canada

P1704 • Modeling and Parameter Estimation of Split-single Phase Induction Motors
Burak Tekgun, Yilmaz Sozer, Igor Tsukerman, University of Akron, United States

P1705 • Thermal Design of High Power-density Additively-manufactured Induction Motor
Ram Ranjan, Jagadeesh Tangudu, United Technologies Research Center, United States

P1706 • Dynamics and Vector Control of Wound-rotor Brushless Doubly Fed Induction Machines
Zhentao S. Du, Thomas A. Lipo, University of Wisconsin-Madison, United States

P1707 • The Doubly-fed Induction Machine as an Aero Generator
Tom Feehally, Judith Apsley, University of Manchester, United Kingdom

P1708 • Start-up Problem with an Induction Machine and a Permanent Magnet Gear
T.V. Frandsen, N.I. Berg, R.K. Holm, P.O. Rasmussen, Aalborg University, Denmark

Poster Session: Reluctance Machines

Room: Exhibit Hall C – West
Chair: Wen Ouyang

P1901 • Power Converter Rating for Switched Reluctance Motors
Howard C. Lovatt, CSIRO, Australia

P1902 • Control of Switched Reluctance Generators in Continuous Conduction Mode
W.U. Nuwantha Fernando, RMIT University, Australia

P1903 • Torque Ripple Minimization of Switched Reluctance Motors through Speed Signal Processing
Rakesh Mitra, Yilmaz Sozer, University of Akron, United States

P1904 • Synchronous Reluctance Motors with Toroidal Windings
Christopher Spargo, Barrie Mecrow, James Widmer, Newcastle University, United Kingdom

P1905 • Vector Control for Switched Reluctance Motor Drives using an Improved Current Controller
Noriya Nakao, Kan Akatsu, Shibaura Institute of Technology, Japan

P1906 • Magnetic Design of 2-phase Switched Reluctance Motor with Bi-directional Startup Capability
Lei Gu, Adam Clark, Wei Wang, Joseph Hearron, Babak Fahimi, University of Texas at Dallas, United States

P1907 • Design of a Synchronous Reluctance Motor with Non-overlapping Fractional-slot Concentrated Windings
Christopher Spargo, Barrie Mecrow, James Widmer, Newcastle University, United Kingdom

P1908 • Two Converter based Operation of a Brushless Doubly Fed Reluctance Machine
Ronald S. Rebeiro, Andrew M. Knight, University of Calgary, Canada

P1909 • Design Considerations for Reduction of Acoustic Noise in Switched Reluctance Drives
Chenjie Lin, Babak Fahimi, University of Texas at Dallas, United States

P1910 • Static Modeling of the Ultra High Speed Machine Rotor
B. Suttles, J. Mayor, A. Semidey, Georgia Institute of Technology, United States

Poster Session: Other Topics in Electrical Machines

Room: Exhibit Hall C – West
Chair: Dan Ionel

P2101 • A Magnetic Gearbox with an Active Region Torque Density of 239Nm/L
K.K. Uppalapati, J.Z. Bird, J. Wright, P. J. Ritchard, M. Calvin, W. Williams, University of North Carolina at Charlotte, United States
**Poster Session: Wave and Wind Generation Systems**

**Room: Exhibit Hall C – East**
Chair: Ahmed Elasser

**P2601** • Oscillating Water Column Power Conversion: A Technology Review
Nicola Delmonte, Davide Barater, Francesco Giuliani, Paolo Cova, Giampaolo Buticchi, University of Parma, Italy; University of Kiel, Germany

**P2503** • Wave Lab Testing of a Two-body Autonomous Wave Energy Converter
Timothy M. Lewis, Bret Bosma, Annette van Jouanne, Ted K.A. Brekken, Oregon State University, United States

**Poster Session: Converters for Solar PV Systems**

**Room: Exhibit Hall C – East**
Chair: Ahmed Elasser

**P2701** • Modeling and Digital Control of a High-power Full-bridge Isolated DC-DC Buck Converter Designed for a Two-stage Grid-tie PV Inverter
Paulo Sergio Nascimento Filho, Leonardo Ruffeif de Oliveira, Tárcio André dos Santos Barros, Marcelo Gradella Villalva, Ernesto Ruppert Filho, University of Campinas, Brazil

**P2702** • A High Set-up Quasi-Z-source Inverter based on Voltage-lifting Unit
Linlin Li, Yu Tang, Nanjing University of Aeronautics and Astronautics, China

**P2703** • A New DC-DC Buck-boost Modified Series Forward Converter for Photovoltaic Applications
D. López del Moral, A. Barrado, M. Sanz, A. Lázaro, P. Zumel, Carlos III of Madrid University, Spain

**P2704** • Development of a Four Phase Floating Interleaved Boost Converter for Photovoltaic Systems
Christopher D. Lute, Marcelo Simões, Danilo Iglesias Brandão, Ahmed Al Durra, S.M. Muyeen, Colorado School of Mines, United States; The Petroleum Institute, United Arab Emirates

---

**Poster Session: DFIG based Wind Systems**

**Room: Exhibit Hall C – East**
Chair: Bilal Akin

**P2301** • A No-load Grid-connected Strategy based on One-cycle Control for Doubly-fed Wind Power System
Yaxiao Shen, Zhicheng Ji, Tinglong Pan, Dinghui Wu, Jiangnan University, China

**P2302** • Capability of DFIG WTS to Ride through Recurring Asymmetrical Grid Faults
Wenjie Chen, Frede Blaabjerg, Min Chen, Dehong Xu, Zhejiang University, China; Aalborg University, Denmark

**P2303** • Model based methods for Rotor Position Detection of Doubly-fed Induction Generator
Rongwu Zhu, Zhe Chen, Yunqian Zhang, Xiaojie Wu, Aalborg University, Denmark; University of Mining and Technology, China

**P2304** • Sizing of the Series Dynamic Breaking Resistor in a Doubly Fed Induction Generator Wind Turbine
Hammam Soliman, Huai Wang, Dao Zhou, Frede Blaabjerg, Mostafa I. Marie, Aalborg University, Denmark; Ain Shams University, Egypt

---

**Technical Program Schedule Poster Sessions**

Wednesday, September 16 10:00 am – 11:30 am
**Poster Session: Power Supplies**

**P2904** • Alternate Arm Converter Operation of the Modular Multilevel Converter  
M.M.C. Merlin, P.D. Judge, T.C. Green, P.D. Mitchell, E. Moreno, K. Dyke, Imperial College London, United Kingdom; ABB Group, United Kingdom

**P2905** • Impact of Frequency Modulation Ratio on Capacitor Cells Balancing in Phase-shifted PWM based Chain-link Statcom  
Ehsan Behrouzian, Massimo Bongiorno, Remus Teodorescu, Chalmers University of Technology, Sweden; Chalmers University of Technology, Sweden; Aalborg University, Denmark

**P2906** • A Full-bridge AC Power Flow Controller with Reduced Capacitance Operated with both FFS (Fundamental Frequency Switching) and PWM  
Takanori Isobe, University of Tsukuba, Japan

**P2907** • Startup Strategy of VSC-HVDC System based on Modular Multilevel Converter  
Fanqiang Gao, Zixin Li, Fei Xu, Zunfang Chu, Ping Wang, Yaohua Li, Chinese Academy of Sciences, China

**P2908** • A Module based Self-balanced Series Connection for IGBTs  
Lei Yang, Peng Fu, Xi Yao, Jin Wang, Chinese Academy of Science, China; Ohio State University, United States

**P2909** • Turn-off Voltage Sharing of Field Stop IGBTs in Series Connection  
Xueqiang Zhang, Xin Yang, Jin Zhang, Weiwei He, Patrick R. Palmer, University of Cambridge, United Kingdom

**P2910** • Over-current Protection Scheme for SiC Power MOSFET DC Circuit Breaker  
Yuan Zhang, Yung C. Liang, National University of Singapore, Singapore

**P2911** • A High Density Converter for Mid Feeder Voltage Regulation of Low Voltage Distribution Networks  
Richard Silversides, Tim Green, Michael M.C. Merlin, Imperial College London, United Kingdom

**P2912** • Analysis on Practical Design of Virtual-air-gap Variable Reactors for Tieline Reclosing in Microgrid  
Yucheng Zhang, Praveen Devakota, Ruiyun Fu, South Dakota School of Mines and Technology, United States

**P2913** • Wind Powered Smart Charging Facility for PHEVs  
Preetham Goli, Wajiha Shireen, University of Houston, United States

**P2914** • Supercapacitor Assisted Surge Absorber (SCASA) Technique: Selection of Supercapacitor and Magnetic Components  
Jayathu Fernando, Nihal Liyanage, University of Waikato, New Zealand

**P2915** • One and Two DC-links Universal Active Power Filter without Series Isolation Transformer  

**Poster Session: Isolated DC-DC Converters**

**Room:** Exhibit Hall C – North  
**Chair:** Wei Qiao

**P3301** • A Line and Load Independent Constant-frequency Zero-voltage-switching Series Resonant Converter  
Alireza Safaei, Konrad Woronowicz, Praveen Jain, Alireza Bakhshai, Bombardier Transportation Inc., Canada; Queen’s University, Canada

**P3302** • An Improved Start-up Method for LLC Series Resonant Converter based on State-plane Analysis  
Dongdong Yang, Changsong Chen, Shanxu Duan, Jiuxing Cai, Huazhong University of Science and Technology, China

**P3303** • Analysis of a Novel Interleaved CLL Resonant Converter for EV Battery Charger Applications  
Erdem Asa, Kerim Colak, Dariusz Czarkowski, New York University, United States

**P3304** • High Power LLC Battery Charger: Wide Regulation using Phase-shift for Recovery Mode  
Navid Shafiei, Martin Ordonez, Marcin Cracium, Murray Eddington, Chris Botting, University of British Columbia, Canada; Delta-Q Technologies, Canada

**P3305** • Modular Snubberless Bidirectional Soft-switching Current-fed Dual 6-pack (CFD6P) DC/DC Converter  
Satarupa Bal, Akshay K. Rathore, Dipht Srinivasan, National University of Singapore, Singapore

**P3306** • A Novel Interleaved LLC Resonant Converter with Phase Shift Modulation  
Koji Murata, Fujio Kurokawa, Nagasaki University, Japan

**P3307** • High Voltage Dual Active Bridge with Series Connected High Voltage Silicon Carbide (SiC) Devices  
Kasunaidu Vechalapu, Arun Kumar Kadavelugu, Subhashish Bhattacharya, North Carolina State University, United States

**P3308** • Piecewise Linear Modeling of Snubberless Dual Active Bridge Commutation  
Babak Farhangi, Hamid A. Toliyat, Texas A&M University, United States

**P3309** • Analysis and Comparison of Voltage-source and Current-source Asymmetric Dual-active Half-bridge Converters  
Shiladri Chakraborty, Souvik Chattopadhyay, Indian Institute of Technology, India

**Poster Session: Multilevel Converters**

**Room:** Exhibit Hall C – North  
**Chair:** Pericle Zanchetta

**P3501** • Capacitor Selection for Modular Multilevel Converter  
Yuan Tang, Li Ran, Olayiwola Alatise, Philip Mawby, University of Warwick, United Kingdom

**P3502** • An FPGA-based Real-time Simulator for HIL Testing of Modular Multilevel Converter Controller  
Wei Li, Luc-André Grégoire, Sisounthone Souvanlasy, Jean Bélanger, OPAL-RT Technologies, Canada

**P3503** • A Carrier-based PWM Method for Neutral-point Ripple Reduction of a 3-level Inverter  
June-Seok Lee, Kye-Beum Lee, Ajou University, Korea

**P3504** • A Detection Method for an Open-switch Fault in Cascaded H-bridge Multilevel Inverters  
Hyun-Woo Sim, June-Seok Lee, Kye-Beum Lee, Ajou University, Korea
P3505 • AC-DC-AC 3-phase Converter based on Three Three-leg Converters Connected in Series
Nustenil S.M.L. Marinus, Cursino B. Jacobina, Nady Rocha, Euzeli C. dos Santos Jr., Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil; Federal Institute of the Ceará, Brazil; Indiana University-Purdue University Indianapolis, United States

P3506 • An Adaptive Backstepping Observer for Modular Multilevel Converter
Vahid Najmi, Hamed Nademi, Rolando Burgos, Virginia Polytechnic Institute and State University, United States; ABB Ltd., Norway

P3507 • Condition Monitoring for Submodule Capacitors in Modular Multilevel Converters
Yun-Jae Jo, Thanh Hai Nguyen, Dong-Choon Lee, Yeungnam University, Korea

P3508 • A New Five-level Hybrid-clamped Converter with Reduced Number of Clamping Devices
Kui Wang, Lie Xu, Zedong Zheng, Yongdong Li, Tsinghua University, China

P3509 • A Simple Capacitor Voltage Balancing Method for Nested Neutral Point Clamped Inverter
Kai Tian, Bin Wu, Mehdi Narimani, Dewei Xu, Zhongyang Cheng, Navid Reza Zargari, Ryerson University, Canada; Rockwell Automation Canada, Canada

P3510 • A High Cell Count Cascade Full Bridge Converter for Wide Bandwidth Ultrasonic Transducer Excitation
Geoffrey R. Walker, Negareh Ghasemi, Mark A.H. Broadmeadow, Gerard F. Ledwick, Queensland University of Technology, Australia

P3511 • Improved Thermal Management of Multilevel Converter Building Module to Realize Higher Power Density
Hidemine Obara, Yukihiko Sato, Chiba University, Japan

P3512 • THD Minimization of Modular Multilevel Converter with Unequal DC Values
Ghazal Falahi, Wensong Yu, Alex Q. Huang, North Carolina State University, United States

Poster Session: Passives and Converters
Room: Exhibit Hall C – North
 Chairs: Jean Luc Schanen, Shuo Wang

P3701 • Design and Analysis of 37.5% Energy-recycling Flyback-type Class-D Gate Driver IC with 5-to-15V Level-conversion
Taewook Kang, Jaeha Kim, Seoul National University, Korea

P3702 • Optimization and Analysis of PwrSoc Buck Converter with Integrated Passives for Automotive Application
V. Švikačová, J. Cortes, P. Alou, J. Oliver, J.A. Cobos, Universidad Politécnica de Madrid, Spain

P3703 • A 9-11 Bits Phase-interpolating Digital Pulse-width Modulator with 1000X Frequency Range
Yoontaek Lee, Taewook Kang, Jaeha Kim, Seoul National University, Korea

P3704 • A Transient Core Loss Analysis of Multiple-gap Inductor Designed for the 2010 Prius
Masaki Wasekura, Chi-Ming Wang, Robert D. Lorenz, Toyota Motor Corporation, Japan; Toyota Research Institute of North America, United States; University of Wisconsin-Madison, United States

P3705 • Low AC Resistance Foil Cut Inductor
Weyman Lundquist, Vivien Yang, Carl Castro, West Coast Magnetics, United States

P3706 • Loss Minimization for Coupled Inductors with Significant Ac Flux
Zhenlin Zhang, Milisav Danilovic, Khi D.T. Ngo, Jeff L. Nilles, Virginia Polytechnic Institute and State University, United States; Texas Instruments Inc., United States

P3707 • The Use of Dielectric Coatings in Capacitive Power Transfer Systems
Baoyun Ge, Daniel C. Ludois, Rodolfo Perez, University of Wisconsin-Madison, United States

P3708 • Litz Wire Pulsed Power Air Core Coupled Inductor
Victor Sung, W.G. Odendaal, Virginia Polytechnic Institute and State University, United States

P3709 • A 0.76W/mm2 On-chip Fully-integrated Buck Converter with Negatively-coupled, Stacked-LC Filter in 65nm CMOS
Minbok Lee, Yunju Choi, Jaeha Kim, Seoul National University, Korea

P3710 • Understanding dv/dt of 15 kV SiC N-IGBT and its Control using Active Gate Driver
Arun Kadavelugu, Subhashish Bhattacharya, Sei-Hyung Ryu, David Grider, Scott Leslie, Kamalesh Hatua, North Carolina State University, United States; Cree, Inc, United States; Powerex, Inc., United States; Indian Institute of Technology Madras, India

Poster Session: Grid-connected Power Converters and Control
Room: Exhibit Hall C – South
 Chairs: Jean Luc Schanen, Shuo Wang

P3901 • Grid-tie Switched Inductor with Voltage Multiplier Inverter
Omar Abdel-Rahim, Funato Hirohito, Junnosuke Haruna, Aswan University, Egypt; Utsunomiya University, Japan

P3902 • Voltage Droop Control of Dual Active Bridge for Integrating Battery Energy Storage to Utility Grid
Srinivas Bhaskar Karanaki, David Xu, Ryerson University, Canada

P3903 • Performance Evaluation of a 3-level ANPC Photovoltaic Grid-connected Inverter with 650V SiC Devices and Optimized PWM
Davide Barater, Carlo Concari, Giampaolo Buticchi, Emre Gurpinar, Dipankar De, Alberto Castellazzi, University of Parma, Italy; University of Kiel, Germany; University of Nottingham, United Kingdom

P3904 • Active Damping Control of LLC L filters based on Virtual Resistor for T-type Three-level PWM Converters
Payam Alemi, Dong-Choon Lee, Yeungnam University, Korea

P3905 • Coordinative Control of Active Power and DC-link Voltage for Cascaded Dual-active-bridge and Inverter in Bidirectional Application
Yanjun Tiaz, Zhe Chen, Fajin Deng, Xiaofeng Sun, Yanting Hu, Aalborg University, Denmark; Yanshan University, China; Glyndwr University, United Kingdom

P3906 • The Impact of Gate-driver Parameters Variation and Device Degradation in the PV-inverter Lifetime
C. Sintamarean, H. Wang, F. Blaabjerg, F. Iannuzzo, Aalborg University, Denmark; Yanshan University, China; Glyndwr University, United Kingdom

P3907 • Control of a 19 Level Cascaded H-bridge Multilevel Converter Photovoltaic System
N.D. Marks, T.J. Summers, R.E. Betz, University of Newcastle, Australia

P3908 • A New DPWM Modulation for Three-level Neutral Point Clamped Inverter with Assuming Balanced Neutral-point Voltage
Tzung-Lin Lee, Tsung-Yu Hsieh, National Sun Yat-Sen University, Taiwan

Poster Session: Off-grid Power Converters and Control
Room: Exhibit Hall C – South
 Chair: Luca Zarri

P4101 • Decentralized Architecture and Control of Photovoltaic Generation System based on Cascaded AC Module Integrated Converter
Huan Hu, Xu She, Alex Huang, Texas Instrument, United States; GE Global Research, United States; North Carolina State University, United States
Poster Session: PM Machines

**Room:** Exhibit Hall C – West

**Chairs:** Abraham Gebregergis, Akira Chiba

**P4301** • Design of Consequent-pole, Toroidal-winding, Outer Rotor Vernier Permanent Magnet Machines

Dawei Li, Ronghai Qu, Jian Li, Wei Xu, Huazhong University of Science and Technology, China

**P4302** • Design Process of Dual-stator, Spoke-array Vernier Permanent Magnet Machines

Dawei Li, Ronghai Qu, Wei Xu, Jian Li, T.A. Lipo, Huazhong University of Science and Technology, China; University of Wisconsin-Madison, United States

**P4303** • Analysis of a PM Vernier Motor with Spoke Structure

Byungtaek Kim, Thomas A. Lipo, Kunsan National University, Korea; University of Wisconsin-Madison, United States

**P4304** • A New Type of Harmonic Current Excited Brushless Synchronous Machine based on an Open Winding Pattern

Lizhi Sun, Xiaolong Gao, Fei Yao, Qunbao An, Thomas Lipo, Harbin Institute of Technology, China; University of Wisconsin-Madison, United States

**P4305** • Rotor Shape Optimization for Output Maximization of Permanent Magnet Assisted Synchronous Machines

Katsumi Yamazaki, Kazuya Utsuno, Kazuo Shimada, Tadashi Fukami, Masato Sato, Chiba Institute of Technology, Japan; Kanazawa Institute of Technology, Japan

**P4306** • Cancellation of Torque Ripple Accompanying Space Harmonics in Synchronous Reluctance Motors

Shingo Ebara, Shoji Shimomura, Shibaura Institute of Technology, Japan

**Poster Session: Control Issues in Electric Drives I**

**Room:** Exhibit Hall C – West

**Chair:** Mahesh Swamy

**P4501** • Sensorless Control Method using Differentiation Circuit for Switched Reluctance Motor

Satoshi Sumita, Kenta Deguchi, Yoshitaka Iwaji, Yuji Enomoto, Hitachi, Ltd., Japan

**P4502** • Sensorless Control of PMSM in a Ultra High Speed Region taking Iron Loss into Account

Junwoo Kim, Ilso Jeong, Kwanghee Nam, Jaesik Yang, Taewon Hwang, POSTECH, Korea; Hyundai Motor Company, Korea

**P4503** • Implementation and Evaluation of Online System Identification of Electromechanical Systems using Adaptive Filters

Parag Kshirsagar, Dong Jiang, Zhendong Zhang, United Technologies Research Center, United States

**P4307** • Study of Suitable Motor Structure for IPMSM with High Flux Density Material

Masashi Matsuura, Masayuki Sanada, Shigeo Morimoto, Yukinori Inoue, Osaka Prefecture University, Japan

**P4308** • Comparison of Optimized Permanent Magnet Assisted Synchronous Reluctance Motors with 3-phase and 5-phase Systems

Sai Sudheer Reddy Bonthu, Jeihoon Baek, Seungdeog Choi, University of Akron, United States; Korea Railroad Research Institute, Korea

**P4309** • A Comparison between Maximum Torque/Ampere and Maximum Efficiency Control Strategies in IPM Synchronous Machines

James Goss, Mircea Popescu, Dave Staton, Ralf Wrobel, Jason Yan, Phil Mellor, Motor Design Ltd, United Kingdom; University of Bristol, United Kingdom

**P4310** • Design of Several Un-skewed Radial Flux Permanent Magnet Synchronous Motors with Asymmetric and Symmetric AC Windings — A Comparative Study

Y. Demir, M. Aydin, MDS Motor Design Ltd., Turkey; Kocaeli University, Turkey

**P4311** • Optimal Design of 5-phase Permanent Magnet Assisted Synchronous Reluctance Motor for Low Output Torque Ripple

Jeihoon Baek, Sai Sudheer Reddy Bonthu, Sangshin Kwak, Seungdeog Choi, Korea Railroad Research Institute, Korea; University of Akron, United States; Chung-Ang University, Korea

**P4312** • Interior PM Generator for Portable AG Generator Sets

Wen L. Soong, Solmaz Kahourzade, Chong-Zhi Liaw, Paul Lillingston, University of Adelaide, Australia; Radial Flux Laboratories Pty. Ltd., Australia

**P4313** • Prediction of Magnetically Induced Vibration in a PMSM using Time Stretched Pulse Excitation

Dae-yoon Kim, Jeongyong Song, Gunhee Jang, Hanyang University, Korea

**P4314** • Optimal Rotor Shape Design to Reduce the Vibration of IPM Motor

Min-Chul Kang, Dong-yeong Kim, Gyu-Tak Kim, Changwon National University, Korea

**P4315** • Cogging Torque Reduction of Single-phase Brushless DC Motor with a Tapered Air-gap using Optimizing Notch Size and Position

Dae-kyong Kim, Young-un Park, Ju-Hee Cho, Sunchon National University, Korea; Korea Electronics Technology Institute, Korea

**P4316** • Verification of a Novel 5-axis Active Control Type Bearingless Canned Motor Pump Utilizing Passive Magnetic Bearing Function for High Power

Kazuya Miyamoto, Masatsugu Takemoto, Satoshi Ogawa, Masao Hiragushi, Hokkaido University, Japan; SEIKOW Chemical Engineering and Machinery, Ltd., Japan

**Technical Program Schedule Poster Sessions 2014 IEEE ENERGY CONVERSION CONGRESS & EXPOSITION®**

**Chair:** Mahesh Swamy

**P4307** • Study of Suitable Motor Structure for IPMSM with High Flux Density Material

Masashi Matsuura, Masayuki Sanada, Shigeo Morimoto, Yukinori Inoue, Osaka Prefecture University, Japan

**P4308** • Comparison of Optimized Permanent Magnet Assisted Synchronous Reluctance Motors with 3-phase and 5-phase Systems

Sai Sudheer Reddy Bonthu, Jeihoon Baek, Seungdeog Choi, University of Akron, United States; Korea Railroad Research Institute, Korea

**P4309** • A Comparison between Maximum Torque/Ampere and Maximum Efficiency Control Strategies in IPM Synchronous Machines

James Goss, Mircea Popescu, Dave Staton, Ralf Wrobel, Jason Yan, Phil Mellor, Motor Design Ltd, United Kingdom; University of Bristol, United Kingdom

**P4310** • Design of Several Un-skewed Radial Flux Permanent Magnet Synchronous Motors with Asymmetric and Symmetric AC Windings — A Comparative Study

Y. Demir, M. Aydin, MDS Motor Design Ltd., Turkey; Kocaeli University, Turkey

**P4311** • Optimal Design of 5-phase Permanent Magnet Assisted Synchronous Reluctance Motor for Low Output Torque Ripple

Jeihoon Baek, Sai Sudheer Reddy Bonthu, Sangshin Kwak, Seungdeog Choi, Korea Railroad Research Institute, Korea; University of Akron, United States; Chung-Ang University, Korea

**P4312** • Interior PM Generator for Portable AG Generator Sets

Wen L. Soong, Solmaz Kahourzade, Chong-Zhi Liaw, Paul Lillingston, University of Adelaide, Australia; Radial Flux Laboratories Pty. Ltd., Australia

**P4313** • Prediction of Magnetically Induced Vibration in a PMSM using Time Stretched Pulse Excitation

Dae-yoon Kim, Jeongyong Song, Gunhee Jang, Hanyang University, Korea

**P4314** • Optimal Rotor Shape Design to Reduce the Vibration of IPM Motor

Min-Chul Kang, Dong-yeong Kim, Gyu-Tak Kim, Changwon National University, Korea

**P4315** • Cogging Torque Reduction of Single-phase Brushless DC Motor with a Tapered Air-gap using Optimizing Notch Size and Position

Dae-kyong Kim, Young-un Park, Ju-Hee Cho, Sunchon National University, Korea; Korea Electronics Technology Institute, Korea

**P4316** • Verification of a Novel 5-axis Active Control Type Bearingless Canned Motor Pump Utilizing Passive Magnetic Bearing Function for High Power

Kazuya Miyamoto, Masatsugu Takemoto, Satoshi Ogawa, Masao Hiragushi, Hokkaido University, Japan; SEIKOW Chemical Engineering and Machinery, Ltd., Japan

**Poster Session: Control Issues in Electric Drives I**

**Room:** Exhibit Hall C – West

**Chair:** Mahesh Swamy

**P4501** • Sensorless Control Method using Differentiation Circuit for Switched Reluctance Motor

Satoshi Sumita, Kenta Deguchi, Yoshitaka Iwaji, Yuji Enomoto, Hitachi, Ltd., Japan

**P4502** • Sensorless Control of PMSM in a Ultra High Speed Region taking Iron Loss into Account

Junwoo Kim, Ilso Jeong, Kwanghee Nam, Jaesik Yang, Taewon Hwang, POSTECH, Korea; Hyundai Motor Company, Korea

**P4503** • Implementation and Evaluation of Online System Identification of Electromechanical Systems using Adaptive Filters

Parag Kshirsagar, Dong Jiang, Zhendong Zhang, United Technologies Research Center, United States
P4902 • Research of Multipurpose Optimization Control in Hybrid Energy Storage System
Wei Jiang, Xiaogang Wu, Renjie Hu, Wu Chen, Southeast University, China

P4901 • State-of-charge Balancing Control Strategy of Battery Energy Storage System based on Modular Multilevel Converter
Feng Gao, Lei Zhang, Qi Zhou, Mengxing Chen, Tao Xu, Shaogang Hu, Shandong University, China; State Grid Anshan Electric Power Supply Company, China

P4906 • The Impact of DC bias Current on the Modeling of Lithium Iron Phosphate and Lead-acid Batteries Observed using Electrochemical Impedance Spectroscopy
Larry W. Jiang, Phillip J. Kollmeyer, Ruxiu Zhao, T.M. Jahn, R.D. Lorenz, University of Wisconsin-Madison, United States

P4907 • Investigation of a Data-driven SOC Estimator based on the Merged SMO and Degradation Mitigation for Series/Parallel-cell Configured Battery Pack
Jonghoon Kim, Chosun University, Korea

Poster Session: Storage Systems

Room: Exhibit Hall C – East
Chairs: Adel Nasiri

P4504 • Control Strategy of a Permanent Magnet Synchronous Machine in the Flywheel Energy Storage System
Wei Guo, Yue Wang, Xi'an Jiaotong University, China

P4505 • Enhancement of Output Voltage using Current Shaping in Sensorless AC Machine Drive
Jin-Woong Kim, Jung-Ik Ha, Seoul National University, Korea

P4506 • Zero/Low Speed Magnetization State Estimation using High Frequency Injection for a Fractional Slot Variable Flux-intensifying Interior Permanent Magnet Synchronous Machine
Chen-Yen Yu, Takashi Fukushima, Apoorva Athavale, Brent Gagas, Kan Akatsu, David Reigosa, Robert D. Lorenz, University of Wisconsin-Madison, United States; Nissan Motor Co., Ltd., Japan; Shibaura Institute of Technology, Japan; University of Oviedo, Spain

P4507 • Operation of Doubly Fed Induction Generator in Ocean Wave Energy Conversion System by Stator Phase Sequence Switching
Samir Hazra, Subhashish Bhattacharya, North Carolina State University, United States

P4508 • Nonlinear Analysis for Interleaved Boost Converters based on Monodromy Matrix
Haimeng Wu, Volker Pickert, Damian Giaouris, Newcastle University, United Kingdom; Centre for Research and Technology Hellas, Greece

Tuesday, September 16 3:30 pm – 5:00 pm

Poster Session: Solar PV Systems

Room: Exhibit Hall C – East
Chair: Dezso Sera

P4701 • Comparison of the Perturb and Observe and Simulated Annealing Approaches for Maximum Power Point Tracking in a Photovoltaic System under Partial Shading Conditions
S. Lyden, M.E. Haque, University of Tasmania, Australia

P4702 • Statistical Analysis of Ramp Rates of Solar Photovoltaic System Connected to Grid
Md Kamal Hossein, Mohd Hasan Ali, University of Memphis, United States

P4703 • Single-phase ZVS Bidirectional AC-link Converter for EV Batteries-grid Integration
Gamal M. Dousoky, Mostafa Mosa, Hatam Abu-Rub, Minia University, Egypt; Aswan University, Egypt; Texas A&M University at Qatar, Qatar

P4704 • A High Performance Controller for a Single Phase Cascaded Multilevel Photovoltaic System
Huan Hu, Xu She, Alex Q. Huang, Texas Instrument Inc., United States; GE Global Research, United States; North Carolina State University, United States

Poster Session: Stability and Quality of Microgrids

Room: Exhibit Hall C – East
Chairs: Paolo Mattavelli, Ion Exteberria

P5101 • Modeling of Single-HB PWM Modulated Dual Active Bridge DC-DC Converter with Multifrequency Average Approach
Yuan Gao, Yue Wang, Jun Huang, Ming Li, Xu Yang, Xi'an Jiaotong University, China

P5102 • Modularized High Frequency High Power 3-level Neutral Point Clamped PEBB Cell for Renewable Energy System
Sizhao Lu, Zhengming Zhao, Lijiang Yuan, Ting Lu, Yang Jiao, Mingkai Mu, Fred C. Lee, Tsinghua University, China; Virginia Polytechnic Institute and State University, United States

P5103 • A Novel TRIAC Dimming LED Driver by Variable Switched Capacitance for Power Regulation
Eun S. Lee, Jun P. Cheon, Duy N. Tan, Chun T. Rim, KAIST, Korea

P5104 • Analysis and Design Considerations of Two-stage AC-DC LED Driver without Electrolytic Capacitor
Siyang Zhao, Xinnian Ge, Xinke Wu, Junming Zhang, Huajian Zhang, Zhejiang University, China; Inventronics (Hangzhou), Inc., China

Poster Session: Power Converters for Alternative Energy Systems

Room: Exhibit Hall C – East
Chairs: Norma Anglani, Feng Guo

P4504 • A Unified Control Scheme of Battery Energy Storage System based on Cascaded H-bridge Converter
Qiang Chen, Ning Gao, Rui Li, Xu Cai, Zhigang Lu, Shanghai Jiaotong University, China; Electric Power Research Institute, China

P4505 • State-of-charge Balancing Control Strategy of Battery Energy Storage System based on Modular Multilevel Converter
Feng Gao, Lei Zhang, Qi Zhou, Mengxing Chen, Tao Xu, Shaogang Hu, Shandong University, China; State Grid Anshan Electric Power Supply Company, China

P4506 • The Impact of DC bias Current on the Modeling of Lithium Iron Phosphate and Lead-acid Batteries Observed using Electrochemical Impedance Spectroscopy
Larry W. Jiang, Phillip J. Kollmeyer, Ruxiu Zhao, T.M. Jahn, R.D. Lorenz, University of Wisconsin-Madison, United States

P4507 • Investigation of a Data-driven SOC Estimator based on the Merged SMO and Degradation Mitigation for Series/Parallel-cell Configured Battery Pack
Jonghoon Kim, Chosun University, Korea

Poster Session: Power Converters for Alternative Energy Systems

Room: Exhibit Hall C – East
Chairs: Paolo Mattavelli, Ion Exteberria

P4904 • A Unified Control Scheme of Battery Energy Storage System based on Cascaded H-bridge Converter
Qiang Chen, Ning Gao, Rui Li, Xu Cai, Zhigang Lu, Shanghai Jiaotong University, China; Electric Power Research Institute, China

P4905 • State-of-charge Balancing Control Strategy of Battery Energy Storage System based on Modular Multilevel Converter
Feng Gao, Lei Zhang, Qi Zhou, Mengxing Chen, Tao Xu, Shaogang Hu, Shandong University, China; State Grid Anshan Electric Power Supply Company, China

P4906 • The Impact of DC bias Current on the Modeling of Lithium Iron Phosphate and Lead-acid Batteries Observed using Electrochemical Impedance Spectroscopy
Larry W. Jiang, Phillip J. Kollmeyer, Ruxiu Zhao, T.M. Jahn, R.D. Lorenz, University of Wisconsin-Madison, United States

P4907 • Investigation of a Data-driven SOC Estimator based on the Merged SMO and Degradation Mitigation for Series/Parallel-cell Configured Battery Pack
Jonghoon Kim, Chosun University, Korea

Poster Session: Power Converters for Alternative Energy Systems

Room: Exhibit Hall C – East
Chairs: Paolo Mattavelli, Ion Exteberria

P5101 • Modeling of Single-HB PWM Modulated Dual Active Bridge DC-DC Converter with Multifrequency Average Approach
Yuan Gao, Yue Wang, Jun Huang, Ming Li, Xu Yang, Xi’an Jiaotong University, China

P5102 • Modularized High Frequency High Power 3-level Neutral Point Clamped PEBB Cell for Renewable Energy System
Sizhao Lu, Zhengming Zhao, Lijiang Yuan, Ting Lu, Yang Jiao, Mingkai Mu, Fred C. Lee, Tsinghua University, China; Virginia Polytechnic Institute and State University, United States

P5103 • A Novel TRIAC Dimming LED Driver by Variable Switched Capacitance for Power Regulation
Eun S. Lee, Jun P. Cheon, Duy N. Tan, Chun T. Rim, KAIST, Korea

P5104 • Analysis and Design Considerations of Two-stage AC-DC LED Driver without Electrolytic Capacitor
Siyang Zhao, Xinnian Ge, Xinke Wu, Junming Zhang, Huajian Zhang, Zhejiang University, China; Inventronics (Hangzhou), Inc., China

Poster Session: Stability and Quality of Microgrids

Room: Exhibit Hall C – East
Chairs: Norma Anglani, Feng Guo

P5301 • Fault-decoupled Instantaneous Frequency and Phase Angle Estimation for 3-phase Grid-connected Inverters
G. De Donato, G. Scelba, F. Giuliani Capponi, G. Scarcella, University of Rome “La Sapienza”, Italy; University of Catania, Italy

P5302 • Fault Current and Overvoltage Calculations for Inverter-based Generation using Symmetrical Components
Laura Wieserman, T.E. McDermott, University of Pittsburgh, United States

P5303 • Power Quality Improvement of Single-phase Photovoltaic Systems through a Robust Synchronization Method
Lenos Hadjidemetriou, Elias Kyriakides, Yongheng Yang, Fred Blaabjerg, University of Aalborg, Denmark

P5304 • Analysis and Design Considerations of Two-stage AC-DC LED Driver without Electrolytic Capacitor
Siyang Zhao, Xinnian Ge, Xinke Wu, Junming Zhang, Huajian Zhang, Zhejiang University, China; Inventronics (Hangzhou), Inc., China

Poster Session: Stability and Quality of Microgrids

Room: Exhibit Hall C – East
Chairs: Norma Anglani, Feng Guo

P5301 • Fault-decoupled Instantaneous Frequency and Phase Angle Estimation for 3-phase Grid-connected Inverters
G. De Donato, G. Scelba, F. Giuliani Capponi, G. Scarcella, University of Rome “La Sapienza”, Italy; University of Catania, Italy

P5302 • Fault Current and Overvoltage Calculations for Inverter-based Generation using Symmetrical Components
Laura Wieserman, T.E. McDermott, University of Pittsburgh, United States

P5303 • Power Quality Improvement of Single-phase Photovoltaic Systems through a Robust Synchronization Method
Lenos Hadjidemetriou, Elias Kyriakides, Yongheng Yang, Fred Blaabjerg, University of Aalborg, Denmark

P5304 • Prediction and Avoidance of Grid-connected Converter’s Instability caused by Wind Park Typical, Load-varying Grid Resonance
F. Fuchs, A. Mertens, Leibniz Universität Hannover, Germany
**Poster Session: Single-phase AC-DC Converters**

<table>
<thead>
<tr>
<th>Paper Number</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5305</td>
<td>Grid Synchronization using Fixed Filtering with Magnitude and Phase Compensation</td>
<td>Bradford Trento, Leon M. Tolbert, Daniel Costinett, University of Tennessee, United States</td>
</tr>
<tr>
<td>P5306</td>
<td>Finite-time Frequency Synchronization in Microgrids</td>
<td>Ali Bidam, Ali Davoudi, Frank L. Lewis, University of Texas-Arlington, United States</td>
</tr>
<tr>
<td>P5307</td>
<td>Quadrature Signal Generator based on All-pass Filter for Single-phase Synchronization</td>
<td>Cristian Blanco, David Reigosa, Fernando Briz, Juan M. Guerrero, University of Oviedo, Spain</td>
</tr>
<tr>
<td>P5308</td>
<td>A DC Fault Clearance Method for Series Multiterminal HVDC System</td>
<td>Xiaobo Yang, Dawei Yao, Chunming Yuan, Chengyan Yue, Chao Yang, River Ting-Ho Li, ABB (China) Limited, China</td>
</tr>
<tr>
<td>P5309</td>
<td>Virtual Impedance Based Stability Improvement for DC Microgrids with Constant Power Loads</td>
<td>Xiaoran Lu, Kai Sun, Lipei Huang, Josep M. Guerrero, Juan C. Vasquez, Yan Xing, University of Tennessee, United States; Tsinghua University, China; Aalborg University, Denmark; Nanjing University of Aeronautics and Astronautics, China</td>
</tr>
<tr>
<td>P5310</td>
<td>Analysis and Assessment of Microgrid Stability using the Nu Gap Approach</td>
<td>Abdulfatah Alfares, Ahmed Sayed-Ahmed, Marquette University, United States; Rockwell Automation, United States</td>
</tr>
<tr>
<td>P5311</td>
<td>Comparison of Synchronous Condenser and STATCOM for Inertial Response Support</td>
<td>Yang Liu, Shuifao Yang, Shao Zhang, Fang Zheng Peng, Michigan State University, United States</td>
</tr>
</tbody>
</table>

**Poster Session: Single-phase DC-AC Converters**

<table>
<thead>
<tr>
<th>Paper Number</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Room: Exhibit Hall C – North Chair: Yogesh Patel</td>
<td></td>
</tr>
<tr>
<td>P5501</td>
<td>Direct AC-DC Rectifier with Mitigated Low-frequency Ripple through Waveform Control</td>
<td>Sinan Li, Guorong Zhu, Siew-Chong Tan, S.Y.R. Hui, University of Hong Kong, Hong Kong; Wuhan University of Technology, China</td>
</tr>
<tr>
<td>P5502</td>
<td>Design of Class E Resonant Rectifiers and Diode Evaluation for VHF Power Conversion</td>
<td>Juan A. Santiago-González, Khalil M. Elbaggari, Khurram K. Afridi, David J. Perreault, Massachusetts Institute of Technology, United States; University of Colorado–Boulder, United States</td>
</tr>
<tr>
<td>P5503</td>
<td>Novel Zero-voltage Transition Semi Bridgeless Boost PFC Converter with Soft Switching Auxiliary Switch</td>
<td>Wei Hu, Yong Kang, Xuehua Wang, Xiaoning Zhou, Huazhong University of Science and Technology, China; Wuhan Quanhuo Optoelectronics Co., Ltd, China</td>
</tr>
<tr>
<td>P5504</td>
<td>An Electrolytic-free Offline LED Driver with a Ceramic-capacitor-based Compact SSC Energy Buffer</td>
<td>Minjie Chen, Yu Ni, Curtis Serrano, Benjamin Montgomery, David Perreault, Khurram Afridi, Massachusetts Institute of Technology, United States; University of Colorado–Boulder, United States</td>
</tr>
<tr>
<td>P5505</td>
<td>A Comparison Study of Boost and Buck-boost Power Factor Corrector for Ultra-wide Input Voltage Range Applications</td>
<td>Sheng-Yang Yu, Hung-Chi Chen, Texas Instruments Inc., United States; National Chiao Tung University, Taiwan</td>
</tr>
<tr>
<td>P5506</td>
<td>Analysis on Ringing Effect of Auxiliary Winding in Primary Side Regulated Flyback Converter</td>
<td>Taizhi Zhang, Dinsong Qian, Manchao Xu, Weifeng Sun, Shengli Lu, Southeast University, China</td>
</tr>
<tr>
<td>P5507</td>
<td>A Single-phase Rectifier with a Neutral Leg to Reduce DC-bus Voltage Ripples</td>
<td>Wen-Long Ming, Qing-Chang Zhong, Wanxing Sheng, University of Sheffield, United Kingdom; China Electric Power Research Institute, China</td>
</tr>
<tr>
<td>P5508</td>
<td>Modelling and Simulation of Bridgeless PFC modified SEPIC Rectifier with Multiplier Cell</td>
<td>Ahmed M. Al Gabri, Abbas A. Fardoun, Esam H. Ismail, United Arab Emirates University, United Arab Emirates; College of Technological Studies, Kuwait</td>
</tr>
</tbody>
</table>

**Poster Session: Devices and Modules**

<table>
<thead>
<tr>
<th>Paper Number</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Room: Exhibit Hall C – North Chair: Marcello Pucci</td>
<td></td>
</tr>
<tr>
<td>P5701</td>
<td>A High Frequency Transformer Isolated Inverter Excepting No Duty Cycle Loss</td>
<td>Zibo Lv, Yan Deng, Hao Peng, Ying Wang, Xiangning He, Zhejiang University, China</td>
</tr>
<tr>
<td>P5702</td>
<td>Active Buck-boost Inverter with Coupled Inductors</td>
<td>Yu Tang, Yashua He, Xianmei Dong, Nanjing University of Aeronautics and Astronautics, China</td>
</tr>
<tr>
<td>P5703</td>
<td>A Systematic Method to Synthesize New Transformerless Full-bridge Grid-tied Inverter</td>
<td>Hongliang Wang, Sarah Burton, Yan-fei Liu, P.C. Sen, Josep M. Guerrero, Queen’s University, Canada; Aalborg University, Denmark</td>
</tr>
<tr>
<td>P5704</td>
<td>Phase-shift Soft-switching Power Amplifier with Lower EMI Noise</td>
<td>Ruxi Wang, Juan Sabate, Ying Mei, Jianguo Xiao, Song Chi, General Electric Global Research, United States</td>
</tr>
<tr>
<td>P5705</td>
<td>SiC Full-bridge Grid-tied Inverter with ZVS-switching</td>
<td>Guangcheng Hu, Yawen Li, Yenan Chen, Min Chen, Dehong Xu, Yasuhiko Arita, Seiki Igarashi, Tatsukihon Fujihira, Zhejiang University, China; Fuji Electric Co., Ltd, Japan</td>
</tr>
<tr>
<td>P5706</td>
<td>A Unified Switched Capacitor Converter</td>
<td>Bin Wu, Smedley Keyue, Singer Sigmond, University of California-Irvine, United States; Tel-Aviv University, Israel</td>
</tr>
<tr>
<td>P5707</td>
<td>Improved Trans-current-fed Switched Inverter</td>
<td>Soumya Shubhra Nag, Santanu Mishra, Indian Institute of Technology Kanpur, India</td>
</tr>
<tr>
<td>P5708</td>
<td>Compression of the Load Resistance Range in Constant Frequency Resonant Inverters</td>
<td>Milisav Danilovic, Khal D.T. Ngo, Zheemin Zhang, Virginia Polytechnic Institute and State University, United States</td>
</tr>
<tr>
<td>P5709</td>
<td>Double Four-quadrants Single-phase Current Source Converter Sharing the Same DC-bus</td>
<td>Montiê A. Vitorino, Mauricio B.R. Corrêa, Louelson C. Costa, Lucas V. Hartmann, Darlan A. Fernandes, Federal University of Campina Grande, Brazil; Federal University of Paraiba, Brazil</td>
</tr>
<tr>
<td>P5710</td>
<td>A Hybrid Inverter System for Medium Voltage Applications using a Low Voltage Auxiliary CSI</td>
<td>Savvas Papadopoulos, Mohamed Rashed, Christian Klumpner, Pat Wheeler, University of Nottingham, United Kingdom</td>
</tr>
</tbody>
</table>
**Poster Session: Control and Applications in Renewable Energy, EMI and EVs**

**Room:** Exhibit Hall C – South  
**Chairs:** Tanya Gachovska, Angus Bryant

**P6101** • An Electronically Isolated 12 Pulse Autotransformer Rectification Scheme to Improve Input Power Factor and Lower Harmonic Distortion in Variable Frequency Drives  
Mahesh M. Swamy, Yaskawa America Inc., United States

**P6102** • Three Level NPC Inverter dc Capacitor Sizing for a Synchronous Reluctance Machine Drive  
Lesedi Masisi, Pragasen Pillay, Sheldon S. Williamson, Concordia University, Canada

**P6103** • DG Control Strategies for Grid Voltage Unbalance Compensation  
Jinghang Lu, Farzam Nejabatkah, Yunwei Li, Bin Wu, University of Alberta, Canada; Ryerson University, Canada

**P6104** • Design of LCL Filter for Improving Robustness of Grid-connected Voltage Source Inverter  
DongSul Shin, Hee-Je Kim, Jong-Pil Lee, Tae-Jin Kim, Dong-Wook Yoo, Pusan National University, Korea; Korea Electrotechnology Research Institute, Korea

**P6105** • Neutral Current Mitigation using Controlled Electric Springs Connected to Microgrids within Built Environment  
Krishnanand K.R., Syed Muhammad Farzan Hasani, Jayantika Soni, Sanjib Kumar Panda, National University of Singapore, Singapore

**P6106** • Resonant-repetitive Combined Control for Stand-alone Power Supply Units  
Alessandro Lidozzi, Chao Ji, Luca Solero, Pericle Zanchetta, Fabio Crescimbeni, Roma Tre University, Italy; University of Nottingham, United Kingdom

**P6107** • Convertible Static Transmission Controller (CSTC) System Model Validation by Controller Hardware-in-the-loop-simulation  
Nima Yousefoor, Babak Parkhdehi, Ali Azidehak, Subhashish Bhattacharya, Quanta Technology, United States; North Carolina State University-Raleigh, United States; North Carolina State University-Charlotte, United States

**P6108** • Isolated Flyback Half-bridge OCC Micro-inverter  
Alexander Abravmiştir, Mojtaba Heydari, Ben Zhao, Keyue Smedley, University of California-Irvine, United States

---

**Poster Session: Selected Topics in Control of Power Converters**

**Room:** Exhibit Hall C – South  
**Chairs:** Luca Zarri, Brian Welchko

**P6301** • Optimal Algorithm of a Novel Infinite Impulse Response Digital Filter  
Liqing Tong, Fangzheng Peng, Fudan University, China; Michigan State University, United States

**P6302** • Output Impedance Analysis of Digitally Controlled DC-DC Converter  
Hua Wang, Hua Lin, Xing Li, Xingwei Wang, Huazhong University of Science and Technology, China

**P6303** • An Iteration Method for Determining Critical Stable Regions of Shunt Regulator with Multistage Hysteresis Control and its Complex Behaviors  
Hong Li, Jiangang Shang, Xiaojie You, Shiheng Wang, Beijing Jiaotong University, China; State Grid Beijing Changping Electric Power Supply, China

**P6304** • An Analysis of False Turn-on Mechanism on Power Devices  
Akihiro Nishigaki, Hirokatsu Ohashi, Fumiya Hattori, Kenji Hatori, Mitsubishi Electric Corporation, Japan; Mitsubishi Electric Europe B.V., Germany; Mitsubishi Electric Corp., Japan

---

**P5902** • Static and Dynamic Characterization of High Power Silicon Carbide BJT Modules  
Muhammad Nawaz, Nan Chen, Filippo Chimento, Livie Wang, ABB Corporate Research, Sweden

**P5903** • Analysis on Reverse Recovery Characteristics of SiC MOSFET Intrinsic Diode  
Zhaohui Wang, Jiajia Ouyang, Junming Zhang, Xinke Wu, Kuang Sheng, Zhejiang University, China

**P5904** • Analysis of Stray Inductance’s Influence on SiC MOSFET Switching Performance  
Zhaohui Wang, Junming Zhang, Xinke Wu, Kuang Sheng, Zhejiang University, China

**P5905** • Design of Overcurrent Protection Circuit for GaN HEMT  
Bo Huang, Yan Li, Trillion Q. Zheng, Yajing Zhang, Beijing Jiaotong University, China

**P5906** • Insulated Gate Driver for eGaN FET  
Johan Delaine, Pierre-Olivier Jeannin, David Frey, Kevin Guepratte, University Grenoble Alpes, France; Thales Systemes Aeropotes, France

**P5907** • Physical Modeling and Optimization of a GaN HEMT Design with a Field Plate Structure for High Frequency Applications  
D. Cucak, M. Vasic, O. Garcia, Y. Bouvier, J. Oliver, P. Alou, J.A. Cobos, A. Wang, S. Martin-Horcajo, F. Romero, F. Calle, Universidad Politècnica de Madrid, Spain

**P5908** • Investigation of Soft-switching Behavior of 600 V Cascode GaN HEMT  
Weimin Zhang, Fred Wang, Leon M. Tolbert, Benjamin J. Blalock, Daniel Costinett, University of Tennessee-Knoxville, United States

**P5909** • A Temperature Dependent Simple Spice based Modeling Platform for Power IGBT Modules  
Georgios Sfakianakis, Muhammad Nawaz, Filippo Chimento, Eindhoven University of Technology, Netherlands; ABB Corporate Research, Sweden

**P5910** • An Ultra-fast SiC Phase-leg Module in Modified Hybrid Packaging Structure  
Zheng Chen, Yiling Yao, Dushan Boroyevich, Khai Ngo, Wenli Zhang, Virginia Polytechnic Institute and State University, United States

**P5911** • Effect of Pulse Width on Dynamic Characteristics of High Voltage IGBTs  
John F. Donlon, Eric R. Motto, Eugen Wiesner, Eugen Stumpf, Shinichi Iura, Hitoshi Uemura, Powerex, Inc., United States; Mitsubishi Electric Europe B.V., Germany; Mitsubishi Electric Corp., Japan

**P5912** • Next Generation Industrial IGBT Module  
Eric R. Motto, John F. Donlon, Masaomi Miyazawa, Mitsuharu Tabata, Hiroki Muraoka, Tomohiro Hida, Thomas Radke, Powerex Inc., United States; Mitsubishi Electric Corporation, Japan; Mitsubishi Electric Europe B.V., Germany

**P5913** • The Next Generation 6.5kV IGBT Module  
John F. Donlon, Eric R. Motto, Eugen Wiesner, Eckhard Thal, Kenji Hatori, Yasuhiro Sakai, Shuichi Kitamura, Tetsuo Motomiya, Kenji Ota, Yumie Hattori, Mitsubishi Electric Europe B.V., Germany; Mitsubishi Electric Corp., Japan

**P5914** • A Temperature-dependent Thermal Model of IGBT Modules Suitable for Circuit-level Simulations  
Rui Wu, Huai Wang, Ke Ma, Pramod Ghimire, Francesco Iannuzzo, Fredel Blaabjerg, Aalborg University, Denmark

**P5915** • Sensing Power MOSFET Junction Temperature using Gate Drive Turn-on Current Transient Properties  
He Niu, Robert D. Lorenz, University of Wisconsin Madison, United States
P6305 • PQ, DQ, and CPT Control Methods for Shunt Active Compensators — A Comparative Study
Ali Mortezaei, Christopher Lute, M. Godoy Simões, Fernando P. Marafão, Alessandro Bogila, Colorado School of Mines, United States; UNESP, Brazil

P6306 • Comparison of the Gate Drive Parameter Space for Driving Power MOSFETs using Conventional and Cascade Configurations
Mark A.H. Broadmeadow, Geoffrey R. Walker, Gerard F. Ledwich, Queensland University of Technology, Australia

P6307 • Reduced-order Multifrequency Averaging in Naturally Sampled PWM Converters
Fei Pan, Aaron M. Cramer, University of Kentucky, United States

P6308 • Stability Analysis and Voltage Control Method based on Virtual Resistor and Proportional Voltage Feedback Loop for Cascaded DC-DC Converters
Wen Cai, Babak Fahimi, Eva Cosoroba, Fan Yi, University of Texas at Dallas, United States

P6309 • Control and Modulation of the Stacked Polyphase Bridges Inverter
Lebing Jin, Staffan Norrga, Oskar Wallmark, Mojgan Nikouei Harnefors, KTH Royal Institute of Technology, Sweden

P6310 • Digitally Controlled Switch-mode Power Driver for Active Magnetic Bearings
Tomer Ben Moha, Sergei Basovich, Mor Mordechai Peretz, Shai Arogeti, Ziv Brand, Ben-Gurion University of the Negev, Israel

P6311 • Modular Interleaved Single-phase Series Voltage Injection Converter used in Small-signal D-Q Impedance Identification
Jaksic Marko, Boroyevich Dushan, Burgos Rolando, Mattavelli Paolo, Shen Zhiyu, Cvetkovic Igor, Virginia Tech, United States; University of Padova, Italy

Poster Session: Reliability and Fault Diagnostics in Power Converters
Room: Exhibit Hall C – South
Chairs: Luca Zarrì, Brian Welchko

P6501 • Duty Cycle-based Start-up Control for a ZVS Bidirectional DC-DC Converter
Chi Xu, Hongbin Yu, Yunjie Gu, Pengfei Sun, Wuhua Li, Xiangning He, Fengwen Cao, Zhejiang University, China; Suzhou Vocational University, China

P6502 • Reliability Evaluation Model of Wind Power Converter System Considering Variable Wind Profiles
Hui Li, Haiting Ji, Yang Li, Shengquan Liu, Dong Yang, Xing Qin, Li Ran, Chongqing University, China; Chongqing Three Gorges University, China

P6503 • Condition Monitoring and Failure Prognosis of IGBT Inverters based on On-line Characterization
Andrew Babel, Annnette Muetze, Roland Seebacher, Klaus Krischan, Elias G. Strangas, Michigan State University, United States; Graz University of Technology, Austria

P6504 • Reliability and Energy Loss in Full-scale Wind Power Converter Considering Grid Codes and Wind Classes
Dong Zhou, Frede Blaabjerg, Toke Franke, Michael Tonnes, Mogens Lau, Aalborg University, Denmark; Danfoss Silicon Power GmbH, Germany; Siemens Wind Power A/S, Denmark

P6505 • Suppression of Real Power Back Flow of Non-regenerative Cascaded H-bridge Inverters Operating under Faulty Conditions
Le Sun, Zhenxing Wu, Fei Xiao, Xinjian Cai, Xi’an Jiaotong University, China; Naval University of Engineering, China

P6506 • Wide Bandwidth and Low Propagation Time Delay Current Sensor applied to a Laminated Bus Bar
Keiji Wada, Atsushi Yamashita, Tokyo Metropolitan University, Japan

P6507 • Comparison and Design of InterCell Transformer Structures in Fault-operation for Parallel Multicell Converters
Sébastien Sanchez, Damien Risaletto, Frédéric Richardneau, Guillaume Gateau, University of Toulouse, France

P6508 • Dynamic Thermal Analysis of DFIG Rotor-side Converter during Balanced Grid Fault
Dao Zhou, Frede Blaabjerg, Aalborg University, Denmark

Poster Session: Machine Diagnostics
Room: Exhibit Hall C – West
Chair: Pinjia Zhang

P6701 • Automatizing the Broken Bar Detection Process via Short Time Fourier Transform and Two-dimensional Piecewise Aggregate Approximation Representation
George Georgoulas, Petros Karvelis, Chrysostomos D. Stylios, Ioannis P. Tsoumas, Jose Alfonso Antonino-Daviu, Vicente Climente-Alarcon, Technological Institute of Epirus, Greece; Siemens Industry Sector-Drive Technologies, Germany; Universitat Politècnica de València, Spain

P6702 • Detection of AC Machines Insulation Health State based on Evaluation of Switching Transients using Two Current Sensors and Eigenanalysis-based Parameter Estimation
C. Zeoller, Th. Winter, Th. Wolbank, M. Vogelsberger, Vienna University of Technology, Austria; Bombardier Transportation Austria GmbH, Austria

P6703 • Fault Diagnosis of Wind Turbine using Control Loop Current Signals
Jun Hang, Jianzhong Zhang, Ming Cheng, Southeast University, China

P6704 • Diagnosis of Stator Winding Short-circuit Faults in an Interior Permanent Magnet Synchronous Machine
Jiangbiao He, Chad Somogyi, Andrew Strandt, Nabeel A.O. Demerdash, Marquette University, United States

P6705 • Detecting Faults in Inverter-fed Induction Motors during Startup Transient Conditions
M. Dlamini, P.S. Barendse, A.M. Khan, University of Cape Town, South Africa

Poster Session: Machines for Automotive and Renewable Energy Applications
Room: Exhibit Hall C – West
Chair: Julia Zhang

P6901 • A Novel Magnetic Lead Screw Active Suspension System for Vehicles
Nick Ilsøe Berg, Rasmus Koldborg Holm, Peter Omand Rasmussen, Aalborg University, Denmark

P6902 • Design of an Outer Rotor Ferrite Assisted Synchronous Reluctance Machine (Fa-SynRM) for Electric Two Wheeler Application
Yateendra Deshpande, Hamid A. Toliyat, Texas A&M University, United States

P6903 • Investigation and Development of a New Brushless DC Generator System for Extended-range Electric Vehicle Application
Zhuoran Zhang, Li Yu, Chao Dai, Yangguang Yan, Nanjing University of Aeronautics and Astronautics, China

P6904 • Dynamic Modeling of the Trans-rotary Magnetic Gear for the Point-absorbing Wave Energy Conversion Systems
Siavash Pakdelian, Hamid A. Toliyat, Texas A&M University, United States
Poster Session: Assorted Issues in Electric Drives II

Room: Exhibit Hall C – West
Chair: Fernando Briz

P7101 • Efficiency Improvement in Motor Drive System with Single Phase Diode Rectifier and Small DC-link Capacitor
Yeongrack Son, Jung-Ik Ha, Seoul National University, Korea

P7102 • Ground Fault Location Self-diagnosis in High Resistance Grounding Drive Systems
Jiangang Hu, Lixiang Wei, Jeffrey McGuire, Zhijun Liu, Rockwell Automation Inc., United States

P7103 • Single to 2-phase Matrix Converter using GaN-based Monolithic Bidirectional Switch for Driving Symmetrical 2-phase Motor
Yuji Kudoh, Kenji Mizutani, Nobuyuki Otuka, Satoru Takahashi, Masahiko Inamori, Hiroto Yamagiwa, Tatsuo Morita, Tetsuso Ueda, Tsuyoshi Tanaka, Daisuke Ueda, Toshimitsu Morizane, Panasonic Corporation, Japan; Kyoto Institute of Technology, Japan; Osaka Institute of Technology, Japan

P7104 • Low-power Energy Conversion Systems with 2-phase PM Machine and a Rectifier with Reduced Number of Controlled Switches
Cursino B. Jacobina, Victor F.M.B. Melo, Filipe A. da C. Bahia, Italo Roger F.M.P. da Silva, Federal University of Campina Grande, Brazil

P7105 • High Fidelity Nonlinear IPM Modeling based on Measured Stator Winding Flux Linkage
Dakai Hu, Yazan Alsmadi, Longya Xu, Ohio State University, United States

P7106 • Rogowski Current Sensor Design and Analysis based on Printed Circuit Boards (PCB)
Ruxi Wang, Satish Prabhakaran, William Burdick, Raymond Nicholas, General Electric Global Research, United States

P7107 • A Capacitor-less Gate Drive Circuit using Two Parasitic Capacitors Suitable for Non-insulating-gate GaN FETs
Masataka Ishihara, Fumiya Hattori, Hirokatsu Umegami, Masayoshi Yamamoto, Shimane University, Japan

P7108 • Optimal Energy Saving Trajectories of Induction Motor with Suppression of Sudden Acceleration and Deceleration
Kaoru Inoue, Yuji Asano, Keito Kotera, Toshiji Kato, Doshisha University, Japan

P7109 • A High-performance 2x27 MVA Machine Test Bench based on Multilevel IGCT Converters
Jie Shen, Stefan Schröder, Bo Qu, Yingqi Zhang, Kunlun Chen, Fan Zhang, Yulong Li, Yan Liu, Peng Dai, Richard Zhang, GE Global Research, Germany; GE Global Research, China; GE Power Conversion, China

P7110 • Performance Evaluation of Current Control Strategies in LCL-filtered High-power Converters with Low Pulse Ratios
Jingkui Shi, Jie Shen, Qingyun Chen, Stefan Schröder, Hanno Stagge, Rik W. De Doncker, GE Global Research, China; GE Global Research, Germany; Aachen, Germany

P7111 • Analysis and Design of Active Inductor as DC-link Reactor for Lightweight Adjustable Speed Drive Systems
Dibyendu Rana, Bahaa Hafez, Pawan Garg, Somasundaram Essakiappan, Prasad Enjeti, Texas A&M University, United States

P7112 • A Novel Hysteresis Current Control Switching Method for Torque Ripple Minimization in Multi-phase Motors
Jae-Bum Park, Matthew Johnson, Hamid A. Toliyat, Texas A&M University, United States

P7113 • Development of Integrated Bi-directional Inverter for Switched Reluctance Motor Drive
Jianing Liang, Ming Chang, Guoqing Xu, Chinese Academy of Sciences, China; The Chinese University of Hong Kong, Hong Kong; Tongji University, China

P7114 • Influence of Machine Integration on the Thermal Behavior of a PM Drive for Hybrid Electric Traction
Christian Paar, Hendrik Kolbe, Annette Muetze, Magna Powertrain AG & Co KG, Austria; Graz University of Technology, Austria
## Committee Meetings

All of the following meetings will be held at the David L. Lawrence Convention Center (except where otherwise noted).

### IAS and IAS/PELS Joint Committee Meetings

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Date</th>
<th>Time</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAS-IPCSD Effective IEEE Fellow Nomination Writing and Strategy Tutorial</td>
<td>Sunday, September 14</td>
<td>4:00 pm – 5:00 pm</td>
<td>330</td>
</tr>
<tr>
<td>IAS-IPCSD Department Meeting</td>
<td>Sunday, September 14</td>
<td>7:00 pm – 8:00 pm</td>
<td>338</td>
</tr>
<tr>
<td>IAS Industrial Power Converter Committee (IPCC)</td>
<td>Monday, September 15</td>
<td>7:00 pm – 8:00 pm</td>
<td>307</td>
</tr>
<tr>
<td>IAS Renewable and Sustainable Energy Conversion Systems (RESC)</td>
<td>Tuesday, September 16</td>
<td>2:00 pm – 3:00 pm</td>
<td>338</td>
</tr>
<tr>
<td>IAS Transportation Systems Committee (TSC) and PELS Technical Committee on Vehicle and Transportation Systems</td>
<td>Tuesday, September 16</td>
<td>3:00 pm – 4:00 pm</td>
<td>338</td>
</tr>
</tbody>
</table>

### ECCE Committee Meetings

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Date</th>
<th>Time</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECCE 2015 Organizing Committee</td>
<td>Wednesday, September 17</td>
<td>8:00 am – 9:00 am</td>
<td>306</td>
</tr>
<tr>
<td>ECCE 2014-2016</td>
<td>Wednesday, September 17</td>
<td>9:00 am – 11:00 am</td>
<td>306</td>
</tr>
<tr>
<td>ECCE Steering Committee (America)</td>
<td>Wednesday, September 17</td>
<td>12:00 pm – 2:00 pm</td>
<td>307</td>
</tr>
<tr>
<td>ECCE/SMMA Meeting</td>
<td>Wednesday, September 17</td>
<td>5:00 pm – 6:00 pm</td>
<td>307</td>
</tr>
</tbody>
</table>

### PELS Committee Meetings

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Date</th>
<th>Time</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>PELS Magazine Editorial Board Meeting</td>
<td>Sunday, September 14</td>
<td>12:00 pm – 3:00 pm</td>
<td>336</td>
</tr>
<tr>
<td>PELS Bylaws Committee Meeting</td>
<td>Sunday, September 14</td>
<td>2:00 pm – 4:00 pm</td>
<td>330</td>
</tr>
<tr>
<td>PELS Industry Advisory Committee</td>
<td>Sunday, September 14</td>
<td>3:00 pm – 6:00 pm</td>
<td>336</td>
</tr>
<tr>
<td>PELS TC 2.8 Technical Subcommittee, IWIPP2015 and IDCM2015 Planning Meetings</td>
<td>Monday, September 15</td>
<td>11:00 am – 1:00 pm</td>
<td>306</td>
</tr>
<tr>
<td>PELS Technical Committee and Standing Committee Chairs</td>
<td>Monday, September 15</td>
<td>12:00 pm – 1:30 pm</td>
<td>307</td>
</tr>
<tr>
<td>PELS Southern Conference Steering Committee (SPEC)</td>
<td>Tuesday, September 16</td>
<td>7:30 am – 9:30 pm</td>
<td>306</td>
</tr>
</tbody>
</table>
PELS Committee Meetings (Continued)

PELS Digital Media
Tuesday, September 16
9:00 am – 10:00 am
Room: 307

IEEE International Future Energy Challenge (IFEC) Organizing Committee Meeting
Tuesday, September 16
10:00 am – 12:00 pm
Room 338

PELS TC6 on High Performance and Emerging Technologies
Tuesday, September 16
12:00 pm – 1:30 pm
Room: 338

PELS TC1 on Power and Control Core Technologies
Tuesday, September 16
12:00 pm – 2:00 pm
Room: 307

PELS TC2 Power Conversion Systems and Components
Tuesday, September 16
2:00 pm – 3:30 pm
Room: 307

PELS Technical Committee on Vehicle and Transportation Systems and IAS Transportation Systems Committee (TSC)
Tuesday, September 16
3:00 pm – 4:00 pm
Room: 338

PELS Standards Committee
Tuesday, September 16
3:30 pm – 5:00 pm
Room: 307

PELS TC7 on Communications Energy Systems (INTELEC)
Tuesday, September 16
4:00 pm – 5:00 pm
Room: 306

PELS Three Editors Meeting
Tuesday, September 16
4:00 pm – 5:00 pm
Room: 338

PELS Student / Young Professionals Reception
(Pre-Registration Required)
Tuesday, September 16
6:30 pm – 9:00 pm
Perlé Restaurant
25 Market Square, Pittsburgh PA

PELS TC5 Sustainable Energy Technical Committee Meeting
Tuesday, September 16
6:30 pm – 7:30 pm
Room: 307

PELS EXEC Team & Fincom (Committee Members Only)
Wednesday, September 17
7:30 am – 9:00 am
Room: 338

PELS JSTPE Editorial Board
Wednesday, September 17
8:00 am – 10:00 am
Room: 307

PELS / ECCE Global Partnership Coordinating Committee
Wednesday, September 17
10:00 am – 12:00 pm
Room: 307

PELS Editorial Board Meeting IEEE Transactions on Power Electronics
Wednesday, September 17
11:30 am – 1:30 pm
Room: 306

PELS Nominations Committee Meeting
(by invitation only)
Wednesday, September 17
12:00 pm – 2:00 pm
Room: 311

PELS Meetings Committee Meeting
Wednesday, September 17
2:00 pm – 5:00 pm
Room: 307

PELS Membership Committee: Students/Liaisons & Chapter Chairs
Wednesday, September 17
3:00 pm – 4:30 pm
Room: 338

PELS Awards Committee Meeting
(Committee Members and Nominations Only)
Thursday, September 18
8:30 am – 9:30 am
Room: 306

PELS Awards Reception

Thursday, September 18
10:30 am – 11:30 am
Room: 307

PELS Operations & Products Committee
Thursday, September 18
1:30 pm – 6:00 pm
Room: 307

PELS Administrative Committee Dinner
Thursday, September 18
6:30 pm – 1:00 pm
LeMont Restaurant
1114 Grandview Avenue, Pittsburgh, PA

PELS Administrative Breakfast
Friday, September 19
7:00 am – 8:00 am
Westin Convention Center Pittsburgh
Room: Pennsylvania East

PELS Administrative Committee Meeting
Friday, September 19
8:00 am – 3:00 pm
Westin Convention Center Pittsburgh
Room: Pennsylvania West

PELS Administrative Lunch
Friday, September 19
11:30 am – 12:30 pm
Westin Convention Center Pittsburgh
Room: Pennsylvania East

PELS Awards Reception

Thursday, September 18
10:30 am – 11:30 am
Room: 307

PELS Operations & Products Committee
Thursday, September 18
1:30 pm – 6:00 pm
Room: 307

PELS Administrative Committee Dinner
Thursday, September 18
6:30 pm – 1:00 pm
LeMont Restaurant
1114 Grandview Avenue, Pittsburgh, PA

PELS Administrative Breakfast
Friday, September 19
7:00 am – 8:00 am
Westin Convention Center Pittsburgh
Room: Pennsylvania East

PELS Administrative Committee Meeting
Friday, September 19
8:00 am – 3:00 pm
Westin Convention Center Pittsburgh
Room: Pennsylvania West

PELS Administrative Lunch
Friday, September 19
11:30 am – 12:30 pm
Westin Convention Center Pittsburgh
Room: Pennsylvania East

PELS Awards Reception
## Exhibitor Listing

### Alphabetical Listing by Company Name:

<table>
<thead>
<tr>
<th>Company</th>
<th>Booth(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5S Components</td>
<td>301</td>
</tr>
<tr>
<td>Advanced MotorTech</td>
<td>502</td>
</tr>
<tr>
<td>ANSYS, Inc.</td>
<td>322</td>
</tr>
<tr>
<td>Aperam Alloys USA</td>
<td>504</td>
</tr>
<tr>
<td>CD-adapco</td>
<td>406</td>
</tr>
<tr>
<td>CPS Technologies</td>
<td>225</td>
</tr>
<tr>
<td>CURENT</td>
<td>506</td>
</tr>
<tr>
<td>Elantas PDG, Inc.</td>
<td>307</td>
</tr>
<tr>
<td>Electronic Concepts, Inc.</td>
<td>305</td>
</tr>
<tr>
<td>Ford Motor Company</td>
<td>325</td>
</tr>
<tr>
<td>GaN Systems Inc.</td>
<td>419</td>
</tr>
<tr>
<td>GMW Associates</td>
<td>323</td>
</tr>
<tr>
<td>How2Power.com</td>
<td>321</td>
</tr>
<tr>
<td>ICE Components, Inc.</td>
<td>405</td>
</tr>
<tr>
<td>IEEE ECCE 2015</td>
<td>500</td>
</tr>
<tr>
<td>IEEE Industry Applications Society (IAS)</td>
<td>423</td>
</tr>
<tr>
<td>IEEE Power Electronics Society (PELS)</td>
<td>422</td>
</tr>
<tr>
<td>Infolytica Corporation</td>
<td>319</td>
</tr>
<tr>
<td>Keysight Technologies</td>
<td>510</td>
</tr>
<tr>
<td>LORD Corporation</td>
<td>324</td>
</tr>
<tr>
<td>MagneForce Software Systems, Inc.</td>
<td>421</td>
</tr>
<tr>
<td>Magnetics</td>
<td>403</td>
</tr>
<tr>
<td>Magnesoft Corporation</td>
<td>410</td>
</tr>
<tr>
<td>Mersen</td>
<td>121</td>
</tr>
<tr>
<td>NORWE, Inc.</td>
<td>513</td>
</tr>
<tr>
<td>OPAL RT</td>
<td>400</td>
</tr>
<tr>
<td>Payton America Inc.</td>
<td>411</td>
</tr>
<tr>
<td>Plexim, Inc.</td>
<td>401</td>
</tr>
<tr>
<td>Powerex, Inc.</td>
<td>407</td>
</tr>
<tr>
<td>Powersim, Inc.</td>
<td>311</td>
</tr>
<tr>
<td>Powersys (JMAG Division, JSOL Corporation)</td>
<td>404</td>
</tr>
<tr>
<td>Proto Laminations</td>
<td>318</td>
</tr>
<tr>
<td>Shin-Etsu Magnetics Inc.</td>
<td>420</td>
</tr>
<tr>
<td>SMMA - The Motor and Motion Association</td>
<td>221</td>
</tr>
<tr>
<td>TDK-Lambda Americas</td>
<td>202</td>
</tr>
<tr>
<td>Tektronix, Inc.</td>
<td>320</td>
</tr>
<tr>
<td>University of Pittsburgh Swanson School of Engineering</td>
<td>418</td>
</tr>
<tr>
<td>VAC Sales USA, LLC</td>
<td>413</td>
</tr>
<tr>
<td>Wiley</td>
<td>511</td>
</tr>
</tbody>
</table>

### Numerical Listing by Booth Number:

<table>
<thead>
<tr>
<th>Company</th>
<th>Booth(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mersen</td>
<td>121</td>
</tr>
<tr>
<td>TDK-Lambda Americas</td>
<td>202</td>
</tr>
<tr>
<td>SMMA - The Motor and Motion Association</td>
<td>221</td>
</tr>
<tr>
<td>CPS Technologies</td>
<td>225</td>
</tr>
<tr>
<td>5S Components</td>
<td>301</td>
</tr>
<tr>
<td>Electronic Concepts, Inc.</td>
<td>305</td>
</tr>
<tr>
<td>Elantas PDG, Inc.</td>
<td>307</td>
</tr>
<tr>
<td>Powerex, Inc.</td>
<td>311</td>
</tr>
<tr>
<td>Proto Laminations</td>
<td>318</td>
</tr>
<tr>
<td>Infolytica Corporation</td>
<td>319</td>
</tr>
<tr>
<td>Tektronix, Inc.</td>
<td>320</td>
</tr>
<tr>
<td>How2Power.com</td>
<td>321</td>
</tr>
<tr>
<td>ANSYS, Inc.</td>
<td>322</td>
</tr>
<tr>
<td>GMW Associates</td>
<td>323</td>
</tr>
<tr>
<td>LORD Corporation</td>
<td>324</td>
</tr>
<tr>
<td>Ford Motor Company</td>
<td>325</td>
</tr>
<tr>
<td>OPAL RT</td>
<td>400</td>
</tr>
<tr>
<td>Plexim, Inc.</td>
<td>401</td>
</tr>
<tr>
<td>Magnetics</td>
<td>403</td>
</tr>
<tr>
<td>Powersys (JMAG Division, JSOL Corporation)</td>
<td>404</td>
</tr>
<tr>
<td>ICE Components, Inc.</td>
<td>405</td>
</tr>
<tr>
<td>CD-adapco</td>
<td>406</td>
</tr>
<tr>
<td>Powerex, Inc.</td>
<td>407</td>
</tr>
<tr>
<td>Magnesoft Corporation</td>
<td>410</td>
</tr>
<tr>
<td>Payton America Inc.</td>
<td>411</td>
</tr>
<tr>
<td>VAC Sales USA, LLC</td>
<td>413</td>
</tr>
<tr>
<td>University of Pittsburgh Swanson School of Engineering</td>
<td>418</td>
</tr>
<tr>
<td>GaN Systems Inc.</td>
<td>419</td>
</tr>
<tr>
<td>Shin-Etsu Magnetics Inc.</td>
<td>420</td>
</tr>
<tr>
<td>MagneForce Software Systems, Inc.</td>
<td>421</td>
</tr>
<tr>
<td>IEEE Power Electronics Society (PELS)</td>
<td>422</td>
</tr>
<tr>
<td>IEEE Industry Applications Society (IAS)</td>
<td>423</td>
</tr>
<tr>
<td>IEEE ECCE 2015</td>
<td>500</td>
</tr>
<tr>
<td>Advanced MotorTech</td>
<td>502</td>
</tr>
<tr>
<td>Aperam Alloys USA</td>
<td>504</td>
</tr>
<tr>
<td>CURENT</td>
<td>506</td>
</tr>
<tr>
<td>Keysight Technologies</td>
<td>510</td>
</tr>
<tr>
<td>Wiley</td>
<td>511</td>
</tr>
<tr>
<td>NORWE, Inc.</td>
<td>513</td>
</tr>
</tbody>
</table>
5S Components

Booth 301

5S Components is the US and Canadian distributor for ABB Power Semiconductors, ABB Current and voltage sensors, ICAR power film capacitors and Concept IGBT gate drivers. Stop by our booth to see the latest developments in power electronics components for demanding applications.

Advanced MotorTech

Booth 502

Advanced MotorTech leads in advanced electric motor and generator design engineering, including analysis, prototyping, testing and training, all from one industrial location. All machine types, all sizes, all speeds. We have unique, practical experience and expertise, based on academic theory, world-class CAE tools, manufacturing knowledge, and building what we design.

ANSYS, Inc.

Booth 322

ANSYS, Inc. develops and globally markets engineering simulation software used by designers and engineers across a broad spectrum of industries. The company develops open and flexible simulation solutions that enable users to simulate design performance directly on the desktop, providing a common platform for fast, efficient and cost-effective product development, from design concept to final-stage testing and performance validation. Solutions from ANSYS for the electronics industry include: Signal and power integrity (SI/PI), electromagnetic interference and compatibility (EMI/EMC), microwave system design (RF/MW), electromechanical and system design, electronics cooling and mechanical reliability.

Aperam Alloys USA

Booth 504

Aperam Alloys is an integrated mill source, leader in the design, development, manufacture, and marketing of advanced specialty nickel and cobalt alloys, in cold rolled, long and hot rolled forms, in particular magnetic rotor and stator grades (ASTM-801). Our products are primarily focused on aerospace, electrical safety, and automotive markets.

CD-adapco

Booth 406

CD-adapco is the world’s largest independent CFD-focused provider of engineering simulation software, support and services. It has over 30 years of experience in delivering industrial strength engineering simulation to a wide range of industries and application.

CPS Technologies

Booth 225

CPS Technologies Corporation is the worldwide leader in the design and high-volume production of AlSiC (aluminum silicon carbide) for high thermal conductivity (up to 1000 W/mK with embedded Pyrolytic Graphite) and device compatible thermal expansion. AlSiC thermal management components manufactured by CPS include Hermetic electronic packages, Heat sinks, Microprocessor & Flip chip heat spreader lids, Thermal substrates, IGBT base plates, Cooler baseplates, Pin Fin baseplates for Hybrid Electric Vehicles (HEV), Microwave & Optoelectronic Housings.

CURENT

Booth 506

CURENT is a NSF Engineering Research Center established at University of Tennessee in 2011 that is jointly supported by NSF and the DOE. The partner schools include RPI, Northeastern University, and Tuskegee University. CURENT focuses on developing power systems and power electronics technologies for future transmission grids with high penetration of renewable energy sources.
Elantas PDG, Inc.  
5200 N. Second Street  
St. Louis, MO 63147  
USA  
+1 314.622.8748  
dana.roschnafsky@altana.com  
www.elantas.com/pdg

ELANTAS PDG, Inc. (formerly The P.D. George Co.) is the global leader in liquid electrical insulation products, including magnet wire enamel, insulating resins, potting compounds, conformal coatings and a wide range of specialty resin systems and adhesives. ISO 9001, TS 16949. A Heritage of Innovation since 1919.

Electronic Concepts, Inc.  
526 Industrial Way West  
Eatontown, NJ 07724  
USA  
+1 732.542.7880  
syuen@ecicaps.com  
www.ecicaps.com

Electronic Concepts, Inc. is the recognized leader in film capacitor design and manufacture. With our extensive experience in all aspects of film capacitors, we are always developing new products and innovations. Our vertical integration and innovative design capability offers the flexibility to meet your most demanding requirements and applications.

Ford Motor Company  
2400 Village Road  
Dearborn, MI 48124  
USA  
+1 313.815.9420  
ctavi1@ford.com  
www.ford.com

Ford Motor Company, a global automotive industry leader based in Dearborn, Michigan, manufactures or distributes automobiles across six continents. With about 171,000 employees worldwide, the company’s automotive brands include Ford and Lincoln. Our mission is to deliver great products, create a strong business and make the world a better place.

GaN Systems Inc.  
1145 Innovation Drive  
Suite 101  
Ottawa, ON K2K 3G8  
Canada  
+1 613.686.1996  
www.gansystems.com

GaN Systems is the first place systems designers go to realize all the benefits of gallium nitride in their power conversion and control applications. To overcome silicon’s limitations in switching speed, temperature, voltage and current, using its unique Island Technology®, the company has developed the most complete range of gallium nitride power switching solutions for a variety of markets.

IEEE ECCE 2015  
1165 Allgood Road  
Suite 20  
Marietta, GA 30062  
USA  
+1 678.560.9172  
www.icecomponents.com

Helping to Engineer the Technology of Power: ICE Components is a supplier of standard and custom products for the power electronics market. Our product line includes current sensors, inductors, reactors, transformers and power supplies. At ICE we strive to offer the best value from the product design through final production.
IEEE Industry Applications Society (IAS)  
Booth 423

Piscataway, NJ 08854
USA
phone +1 732.465.6627
l.m.bernstein@ieee.org
www.ias.ieee.org

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 422

445 Hoes Lane
Piscataway, NJ 08854
phone +1 732.465.6480
peels@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 25 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.

Infolytica Corporation  
Booth 319

300 Leo-Pariseau
Suite 2222
Montreal, QC H2X4B3
Canada
phone +1 514.849.8752
chad@infolytica.com
www.infolytica.com

Accurate design & analysis software: MagNet 2D/3D for electromagnetic field & ElecNet 2D/3D for electric field simulations. MotorSolve is the easy to use template based design software for electric machines. Generate system models for use in PSIM, Simulink®, SystemVision®, Opal-RT and more. Visit our booth to learn about the new MagNet for SOLIDWORKS add-in. MagneForce Software Systems, Inc.

Keysight Technologies  
Booth 510

3750 Brookside Parkway
Alpharetta, GA 30022
USA
phone +1 404.244.3137
www.keysight.com

At ECCE 2014 Keysight will show its new B1506A power device analyzer for circuit design. The B1506A, which can source 1500 A and 3 kV, can evaluate all power device datasheet parameters (including capacitance and gate charge) across a wide range of operating conditions to improve power circuit design performance.
Mersen integrates its extensive expertise in cooling, laminated bus bar, semiconductor fuses, and patented heatsink technology in Power Electronics applications to make them safe, reliable and profitable. With industrial operations in all three major economic regions of the globe, Mersen offers global service with close-to-the-customer support.

NORWE, Inc.

For over 50 years NORWE is a Manufacturer of Standard and Custom designed thermoplastic Bobbins for Ferrite Cores & Metric Transformer Laminations, Components for SMD and PLANAR Technology, Potting Boxes for Toroidal Cores, Safety-Class bobbins and Accessories. All Products comply with the RoHS Directive 2002/95/EC (Lead-Free). The company is certified according to EN ISO 9001:2008, to DIN EN ISO 14001:2009 and to UL 746D.

OPAL RT

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.

Payton Planar Magnetics is the world leader in designing and manufacturing of Planar transformers and inductors. Payton is specializing in custom made inductive components as well as standard transformers and inductors. The group has worldwide sales offices and manufacturing facilities. Our top level quality management system including ISO 9001, ISO 14001, AS9100 and TS16949 position us as the top custom designer and producer of planar transformers and inductors in the world.

Plexim, Inc.

Plexim’s electrical engineering software PLECS is a complete power electronics system simulation package that yields robust and fast results. Available in two versions, PLECS Blockset works in the MATLAB/Simulink environment while PLECS Standalone offers an independent solution. Included with PLECS is a comprehensive component library, which covers not only the electrical, but also the magnetic, mechanical, and thermal aspects of power conversion systems and their controls.

Powerex, Inc.

Powerex, Inc. (www.pwrx.com) 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.

Powersim is specialized in simulation and design tools for research and product development in power supplies, motor drives, and power conversion and control systems. Our mission is to provide the finest analysis and design tools to the industry. We strive to increase customers’ efficiency and productivity by delivering software that reduces the development cost and time-to-market. With its comprehensive simulation and design capabilities, our flagship product PSIM offers a complete solution for research and development in various power electronics applications.

Powersys (JMAG Division, JSOL Corporation)

JMAG is a simulation software for electromechanical design and development. Many companies and universities have supported and used JMAG since 1983. JMAG can accurately capture and quickly evaluate complex physical phenomena inside of machines. New and experienced users in simulation analysis can easily perform the simple operations required to obtain precise results.
Proto Laminations specializes in the manufacture of laser cut and stamped short-run laminations for rotating machinery in support of the development, prototype evaluation and limited production needs of academic institutions and motor and generator manufacturers worldwide.

Shin-Etsu Magnetics Inc.

Shin-Etsu is the world’s leading producer of advanced high energy sintered NdFeB and SmCo magnets. Please visit our booth to learn more about Shin-Etsu’s new NdFeB products including; Dy Free, Reduced Dy and Grain Boundary Diffusion Process (GBDP) grades. These technologies cut cost through the elimination or reduction of heavy rare-earths, while improving or maintaining performance!

SMMA — The Motor and Motion Association

The Motor & Motion Association is the manufacturing trade association for the electric motor and motion control industries. More than 120 member companies include manufacturers, suppliers, users, consultants and universities. Markets served, both consumer and commercial, include appliance, transportation, medical equipment, office automation and computers, aerospace and industrial automation.

TDK-Lambda Americas

TDK-Lambda Americas High Power Division is a leading manufacturer of Programmable, High Density Power Supplies located in Neptune, N.J.. The Genesys™ series of Programmable Power Supplies has the highest density in power levels from 750W through 15KW, with output ranges up to 600V and 1,000A.

Tektronix, Inc.

For more than sixty-five years, engineers have turned to Tektronix for test, measurement and monitoring solutions to solve design challenges, improve productivity and dramatically reduce time to market. Tektronix is a leading supplier of test equipment for engineers focused on electronic design, manufacturing, and advanced technology development.

University of Pittsburgh Swanson School of Engineering

The University of Pittsburgh’s Post-Baccalaureate/Graduate Certificate in Electric Power Engineering is designed expressly for professionals. This distance-enabled program allows students to participate in real time via the Internet. The 15-credit program is rooted in core principles and focuses on expansion and enhanced reliability of electric power grid infrastructure.

VAC Sales USA, LLC

VACUUMSCHMELZE — a manufacturer of advanced magnetic materials — produces Rare Earth Permanent Magnets, Soft Magnetic Materials & Parts, and Cores & Inductive Components. A world leader in development, production and application know-how of magnetic materials, VAC supports customers selecting innovative materials and customizes unique materials for optimized solutions.

Wiley

Wiley is the leading society publisher, publishing on behalf of more societies and membership associations than anybody else. We offer 1250 online journals, thousands of books and e-books, reviews, reference works and databases. Stop by our booth to learn about what’s new at Wiley and receive 20% off your order.
## Student Demonstrations

**Exhibit Hall C**

In this event, nine 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 C during the following times:

**Monday, September 15, 4:00 pm – 6:30 pm** | **Tuesday, September 16, 12:00 pm – 2:00 pm**

### The demos are as follows:

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Demonstrator</th>
<th>University</th>
<th>Advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Semiconductor Filter: Use of Series-Pass Device in Switching Converters for Input Filtering</strong></td>
<td>Po Wa Chow</td>
<td>City University of Hong Kong, China</td>
<td>Dr. Henry S. H. Chung</td>
</tr>
<tr>
<td><strong>A High-Frequency Data Aggregation and Communications Metering Node for Smart DC Microgrids</strong></td>
<td>Matthew Backes</td>
<td>Iowa State University, USA</td>
<td>Dr. Seth Sanders (UC-Berkeley)</td>
</tr>
<tr>
<td><strong>An Electrolytic-Free Offline LED Driver with a Ceramic-Capacitor-Based Compact Stacked Switched Capacitor (SSC) Energy Buffer</strong></td>
<td>Saad Pervaiz</td>
<td>University of Colorado Boulder, USA</td>
<td>Dr. Khurram Afridi</td>
</tr>
<tr>
<td><strong>Compact and Efficient Wireless Power Charger for Electric Vehicle Applications</strong></td>
<td>Lebing Jin</td>
<td>KTH Royal Institute of Technology, Sweden</td>
<td>Dr. Staffan Norrga</td>
</tr>
<tr>
<td><strong>Reducing the cost of PV micro-inverter system with system-level and inverter-level innovations</strong></td>
<td>Ghazal Falahi</td>
<td>North Carolina State University, USA</td>
<td>Dr. Alex Q. Huang</td>
</tr>
<tr>
<td><strong>100 MHz Buck converter tracking 20 MHz LTE envelope signal</strong></td>
<td>Yuanzhe Zhang</td>
<td>University of Colorado at Boulder, USA</td>
<td>Dr. Dragan Maksimović</td>
</tr>
<tr>
<td><strong>Megahertz-Switched Induction Cooking for Aluminum Cookware</strong></td>
<td>Andrew Amrhein</td>
<td>Virginia Tech, USA</td>
<td>Dr. Jason Lai</td>
</tr>
<tr>
<td><strong>Grid Operation of Medium Voltage Solid State Transformer with 13kV SiC MOSFET &amp; JBS Diode</strong></td>
<td>Fei Wang</td>
<td>North Carolina State University, USA</td>
<td>Dr. Jason Lai</td>
</tr>
<tr>
<td><strong>Advanced Integrated Electric Drives for Electric and Hybrid Electric Vehicles</strong></td>
<td>Lebing Jin</td>
<td>KTH Royal Institute of Technology, Sweden</td>
<td>Dr. Staffan Norrga</td>
</tr>
</tbody>
</table>
ECCE 2015 Call for Papers

The Seventh Annual IEEE Energy Conversion Congress and Exposition (ECCE 2015) will be held in Montreal, Canada, on September 20 - 24, 2015. ECCE 2015 is the pivotal international conference and exposition event on electrical and electromechanical energy conversion field. To be held for the first time outside the USA in Montreal, Canada, ECCE 2015 will feature both industry-driven and application-oriented technical sessions, as well as industry expositions and seminars. ECCE 2015 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.

Technical papers are solicited on any subject pertaining to the scope of the conference that includes, but is not limited to, the following topics:

**Energy Conversion Systems and Technologies**
- Renewable energy systems — solar, wind, wave, energy harvesting, and energy storage
- Smart grid and utility applications — renewable energy integration, distributed resources and micro-grids, HVDC, FACTS, V2G-G2V, and electronic transformers
- Energy efficiency and industrial applications — lighting, smart appliances, high efficiency motor drives, smart buildings, consumer electronics and others
- Computer and telecommunication applications — power supplies, UPS, energy storage, and system architectures
- Transportation applications — electric and hybrid vehicles, infrastructure, traction, marine and aerospace
- Power conversion systems stability and power quality
- Special track on emerging power electronics technology: wireless power transfer, sustainable buildings, DC micro grid, energy harvesting, bio-medical applications, 3D power packaging

**Components and Subsystems for Energy Conversion**
- Electric machines and actuators
- Electric motor drives
- Power converters
- Power semiconductor devices and packaging
- Magnetic materials and other passive components
- Converter-level packaging and integration
- Converter and components modeling, control and EMI, focused on circuits, advanced controls, measurement and sensing, reliability and thermal modeling
- Reliability, diagnostics and prognostics

Visit http://2015.ecceconferences.org for more information or contact the ECCE 2015 Technical Program Chairs at ecce2015tpc@gmail.com. For exhibiting at ECCE 2015, please contact Exhibition Chair, Steve Sprague at ssprague@protolam.com. To learn about Montreal, please visit http://www.tourisme-montreal.org/.

**ECCE 2015 Technical Program Chairs**
Dan Ionel, Regal Beloit Corp., USA
Xinbo Ruan, Nanjing University of Aero. & Astro., China
Nasir Uddin, Lakehead University, Canada
Bin Wu, Ryerson University, Canada

**Important Dates**

- **January 15th, 2015**: Digest submitted via the website.
- **May 1st, 2015**: Notification of acceptance or rejection.
- **July 1st, 2015**: Final papers with IEEE copyright forms.

**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.

**About Montreal**: A breathtaking combination of European charm and North American energy, Montreal is a major global metropolitan celebrated not only for its international-calibre culture, history, entertainment, cuisine and shopping, but also as a world leader in industries such as biotechnology, manufacturing, energy, information, and finance. Nestled on the majestic St. Lawrence River, Montreal has direct flights from major cities worldwide. ECCE 2015 will be held in the Palais des congrès (Montreal Convention Centre) in downtown, known for its ultramodern facilities and superior sustainable energy performance, as well as the hub linking Montreal’s international district, Old Montreal and Chinatown.
ECCE 2015 Call for Tutorials

The Seventh Annual IEEE Energy Conversion Congress and Exposition (ECCE 2015) will be held in Montreal, Canada on September 20-24, 2015. 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 has grown to become 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.

Important Dates

February 16th, 2015: Submission of completed one-page Tutorial Proposal Form.

March 27th, 2015: Notification of acceptance. Accepted tutorials will be advertised by the committee after this date.

July 1st, 2015: Full tutorial materials must be submitted for publication in the tutorials book.

Tutorial Proposal Submission Guidelines

Tutorial proposals should be submitted as a digest summarizing the content of the tutorial. Please follow the tutorial proposal form on the next page as the tutorial submission guideline.

Please submit the completed Tutorial Proposal Form and any questions regarding this call directly to the Tutorials Chair, Wei Qiao, via email at wqiao@engr.unl.edu. For more conference information, please visit http://2015.ecceconferences.org

ECCE 2015 Plenary and Tutorials Chairs

Dehong Xu, Zhejiang University, China,
Sudip K. Mazumder, University of Illinois at Chicago, USA
Wei Qiao, University of Nebraska-Lincoln, USA

The ECCE organizing committee invites proposals for half-day tutorials to be presented on Sunday September 20, 2015. 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 grid and utility applications, e.g., renewable energy integration, distributed resources, microgrids, HVDC, FACTS, V2G-G2V, solid state transformers.
• Energy storage systems.
• Energy conversion systems for Information Technologies (IT), e.g., communication, computing, data centers, etc.
• Technologies and systems for energy harvesting.
• Energy efficiency and industrial applications, e.g., lighting, smart appliances, smart buildings, consumer electronics, etc.
• Wireless power transfer (WPT), e.g., WPT for appliances and electric vehicles.
• Transportation systems, e.g., electric-drive vehicles, infrastructure, marine and aerospace applications.
• High power conversion and applications, e.g., multilevel inverter, MMC converter.

Materials, Components, and Subsystems for Energy Conversion

• Advanced Si devices and applications.
• Wide band-gap devices and applications.
• Power conversion topologies, modulation, and control.
• New materials for energy conversion.
• Electric machines and actuators.
• Electric motor drives.
• Passive components and their constitutive materials.
• Packaging and integration for energy conversion components and systems.
• Modeling of energy conversion components and systems.
• Reliability, diagnostics, prognostics, and health management for energy conversion components and systems.
• Measurement and sensing techniques, 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.
ECCE 2015 Tutorial Proposal Form

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)

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>Phone</td>
</tr>
</tbody>
</table>

5. Other Instructor[s] if applicable

(Name, affiliation, and contact information)

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>Phone</td>
</tr>
</tbody>
</table>

6. Instructor Bios: ~150 words each

(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)
The Seventh Annual IEEE Energy Conversion Congress and Exposition (ECCE 2015) will be held in Montreal, Canada, on September 20-24, 2015. ECCE is the pivotal international conference and exposition event on electrical and electromechanical energy conversion field. To be held for the first time outside USA, ECCE 2015, in Montreal, Canada, will feature both industry-driven and application-oriented technical sessions, as well as industry expositions and seminars. ECCE 2015 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 interests of industry, as well as towards the interaction of it with academia. Presentations might be of a somewhat more overview and commercial nature than those related to the papers in the standard technical sessions.

Presentations are solicited on any subject pertaining to the scope of the conference described in its Call for Papers (obtainable from http://2015.ecceconferences.org). 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.

Proposal Submission Guidelines

Special Session organizers are requested to submit a maximum five page proposal summarizing the proposed Special Session with 4 or 8 presentations. The proposal should contain the session title, session organizer, title of each presentation, presenter for each presentation (with a short biography) and a summary of each presentation. Please submit the proposal directly to ECCE 2015 Technical Program Committee Chairs via email at ecce2015tpc@gmail.com.

Important Dates

March 31<sup>st</sup>, 2015: Special Session proposal submissions deadline (maximum five pages).

May 1<sup>st</sup>, 2015: Notification of session acceptance.

For more conference information, please visit http://2015.ecceconferences.org. For exhibiting at ECCE 2015, please contact conference Exhibition Chair at ssprague@protolam.com. For more about Montreal and its surrounding areas, please visit http://www.tourisme-montreal.org/. For submission and information regarding the ECCE 2015 Special Sessions, please contact the ECCE Technical Program Committee Chairs (ecce2015tpc@gmail.com).

ECCE 2015 Technical Program Chairs

Dan Ionel, Regal Beloit Corp., USA
Xinbo Ruan, Nanjing University of Aero. & Astro., China
Nasir Uddin, Lakehead University, Canada
Bin Wu, Ryerson University, Canada
SAVE THE DATE

Conference
September 20-24, 2015

Exposition
September 21-22, 2015

2015.ecceconferences.org
David L. Lawrence Convention Center
1000 Fort Duquesne Blvd.
Pittsburgh, PA 15222
Phone: (412) 565-6000
www.pittsburghcc.com

CONFERENCE MANAGEMENT
ECCE 2014

c/o Courtesy Associates
2025 M Street, NW
Suite 800
Washington, DC 20036
USA
Phone: (202) 973-8744
Fax: (202) 973-8716
ecce@courtesyassoc.com
2014.ecceconferences.org