FORT WORTH
CONVENTION CENTER
FORT WORTH, TEXAS

APEC® 2014

APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION

Sunday, March 16 –
Thursday, March 20, 2014

APEC 2014 Sponsors

IAS IEEE INDUSTRY APPLICATIONS SOCIETY

PSMA Power Sources Manufacturers Association The Multinational Power Electronics Association

IEEE

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APEC 2014

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Foreword

It is my utmost pleasure to welcome you to the 29th IEEE Applied Power Electronics Conference and Exposition – APEC 2014 at the Fort Worth Convention Center, Fort Worth, Texas. For more than a quarter century, APEC has not only established itself as the leading power electronics conference and exposition, but also evolved as an annual festival for applied power electronics professionals. APEC provides an ideal environment for technical exchange, networking, and exposure of the colorful local culture.

Following its predecessors, APEC 2014 offers a rich and comprehensive program for all power electronics professionals. The exposition hits its record high participation with 221 exhibitors and 337 booths. These global exhibitors will showcase the state-of-art technologies, products, and solutions on applied power electronics.

The technical sessions are selected from a base of 949 digest submissions from 38 countries, by experts from both industry and academia with diversified topics. The plenary session will cover transforming energy management, power electronics in emerging applications, critical power solutions, high efficiency power conversion, 3D packaging of power products, and system reliability and efficiency. 80 industry session presentations make another record for APEC 2014. The popular topics will attract considerable attention from broad audience. This year's rap sessions will focus on smart infrastructures and wide band gap materials. The 18 excellent educational seminars will offer a variety of attractive topics on Devices, Fundamentals, Emerging Technologies, Design, Modeling, and Control. Last but not least, the social event of Jersey and Jeans Party on Wednesday night will complete a full package for technical exchange and networking.

Fort Worth is part of a large cultural and economic Dallas-Fort Worth-Arlington region. Located in northern Texas, this historic Army outpost overlooks the Trinity River. The average high temperature in March is 68°F (20°C), which I hope will lead to pleasant weather and evening walks during your stay. The Convention Center is surrounded by the city's characteristic art deco architecture and numerous fine restaurants I am sure you will enjoy. Also, since Fort Worth is near a major airport hub, I hope you will find transportation for the conference convenient.

Finally, APEC 2014 has been made possible by tremendous support from our sponsors, organizing and steering committee members, reviewers, and volunteers. I would like to take this opportunity to thank each and every one of you.

Regards,

Haidong Yu
General Chair
IEEE Applied Power Electronics Conference 2014

APEC® 2014

APEC 2014 Conference Committee & Management

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Schedule-at-a-Glance

Room assignments are tentative and subject to change.

All events take place at the Fort Worth Convention Center unless otherwise noted

KEY: S – Professional Education Seminars **R – Rap Sessions** **IS – Industry Sessions** **T – Technical Sessions**

Saturday, March 15th

Registration		3:00p.m. – 6:00p.m.	REGISTRATION (HALL A FOYER)

Sunday, March 16th

Registration		8:00 a.m. – 5:00p.m.	REGISTRATION (HALL A FOYER)
S1:	The Design and Application of Wide Energy Bandgap (WBG) Power Switching Devices	9:30 a.m. – 1:00p.m.	ROOM 202CD
S2:	Power Factor Correction: From Basics to Optimization	9:30 a.m. – 1:00p.m.	ROOM 203
S3:	Design of Emerging High Power Density Switch-Mode Power Supplies	9:30 a.m. – 1:00p.m.	ROOM 201
S4:	New Trends in Soft Switching Topologies	9:30 a.m. – 1:00p.m.	ROOM 200
S5:	Advanced Control Design	9:30 a.m. – 1:00p.m.	ROOM 204
S6:	Practical Techniques and Technology to Test Power Devices	9:30 a.m. – 1:00p.m.	ROOM 202AB
S7:	Commercially Viable GaN-Based Power Devices	2:30p.m. – 6:00p.m.	ROOM 201
S8:	Fundamentals of Switched Reluctance Motor and Drives	2:30p.m. – 6:00p.m.	Room 202AB
S9:	Wireless Charging of Electric Vehicles with Extremely High Efficiency & Misalignment Tolerance	2:30p.m. – 6:00p.m.	ROOM 203
S10:	Reliable Converter Design with IGBT Based Power Modules	2:30p.m. – 6:00p.m.	ROOM 202CD
S11:	Impedance Modeling & Analysis of Grid-Connected Three-Phase Converters	2:30p.m. – 6:00p.m.	ROOM 204
S12:	Planar Magnetics for Energy Conversion	2:30p.m. – 6:00p.m.	ROOM 200

Monday, March 17th

Registration		7:30 a.m. – 5:00p.m.	REGISTRATION (LEVEL 1)
Spouse & Guest Welcome Breakfast		8:00 a.m. – 9:00 a.m.	HOSPITALITY SUITE A (OMNI)
S13:	High-Efficiency Silicon Carbide Power Electronics	8:00 a.m. – 12:00p.m.	ROOM 201
S14:	Power Electronic Modules – Applications, Characteristics, and Packaging	8:00 a.m. – 12:00p.m.	ROOM 202CD
S15:	Power Supply on a Chip	8:00 a.m. – 12:00p.m.	ROOM 204
S16:	On-Board Charger Technology for EVs and PHEVs	8:00 a.m. – 12:00p.m.	Room 203
S17:	Small-Signal Modeling at Work with Power Converters	8:00 a.m. – 12:00p.m.	ROOM 202AB
S18:	Reliability of Power Supplies	8:00 a.m. – 12:00p.m.	ROOM 200
Opening Plenary Session		1:30p.m. – 5:00p.m.	GRAND BALLROOM
Exhibit Hall Welcome Reception		5:00p.m. – 8:00p.m.	EXHIBIT HALL A
MicroMouse Contest		8:00p.m. – 10:00p.m.	ROOM 100

SCHEDULE-AT-A-GLANCE

KEY: **S – Professional Education Seminars** **R – Rap Sessions** **IS – Industry Sessions** **T – Technical Sessions**

Tuesday, March 18th

Speaker Breakfast		7:00 a.m. -8:00 a.m.	HALL D
Registration		7:30 a.m. – 5:00p.m.	REGISTRATION (LEVEL 1)
IS1.1:	Breakthrough Technologies Driving Successful Energy Harvesting-Powered Products	8:30 a.m. – 12:00p.m.	ROOM 202AB
IS2.1:	Power Electronics Standards	8:30 a.m. – 12:00p.m.	ROOM 202CD
IS3.1:	High Power Industrial	8:30 a.m. – 12:00p.m.	ROOM 201C
T1:	DC-DC Converter Applications	8:30 a.m. – 12:00p.m.	ROOM 203
T2:	Single-Phase AC-DC Converters	8:30 a.m. – 12:00p.m.	BALLROOM A
T3:	High Speed Devices & Gate Drives	8:30 a.m. – 12:00p.m.	ROOM 204
T4:	Multilevel Converter Modulation & Control Strategy	8:30 a.m. – 12:00p.m.	BALLROOM B
T5:	Multilevel Inverters	8:30 a.m. – 12:00p.m.	ROOM 200
T6:	Utility Interface Converters	8:30 a.m. – 12:00p.m.	ROOM 201
T7:	Renewable Energy System Integration	8:30 a.m. – 12:00p.m.	BALLROOM C
Exhibition		12:00p.m. – 5:00p.m.	EXHIBIT HALL A
Exhibitor Seminars – Session 1		1:30p.m. – 2:00p.m.	See Page xxxx
Exhibitor Seminars – Session 2		2:15p.m. – 2:45p.m.	See Page xxxx
Exhibitor Seminars – Session 3		3:00p.m. – 3:30p.m.	See Page xxxx
Exhibitor Seminars – Session 4		3:45p.m. – 4:15p.m.	See Page xxxx
R1:	Smart Grid Infrastructures	5:00p.m. – 6:30p.m.	BALLROOM A
R2:	R2: Wide Bandgap Semiconductors vs Silicon in Power Electronics – Is there a value proposition or will silicon continue to be good enough cheap?	5:00p.m. – 6:30p.m.	BALLROOM C

Wednesday, March 19th

Speaker Breakfast		7:00 a.m. -8:00 a.m.	HALL D
Registration		8:00 a.m. – 3:00p.m.	REGISTRATION (LEVEL 1)
IS1.2:	Evolving Alternative Energy to Mainstream Energy	8:30 a.m. – 10:15 a.m.	ROOM 202AB
IS2.2:	Emerging Technologies of Power Transmission	8:30 a.m. – 10:10 a.m.	ROOM 202CD
IS3.2:	Marketing and Business	8:30 a.m. – 10:10 a.m.	ROOM 201C
T8:	Non-isolated DC-DC Converters	8:30 a.m. – 10:10 a.m.	BALLROOM B
T9:	Wide Bandgap Devices in DC-DC Converters	8:30 a.m. – 10:10 a.m.	BALLROOM C
T10:	Device and Thermal Modeling	8:30 a.m. – 10:10 a.m.	ROOM 203
T11:	Packaging for Higher Performance	8:30 a.m. – 10:10 a.m.	ROOM 204
T12:	System Integration I	8:30 a.m. – 10:10 a.m.	BALLROOM A
T13:	Multilevel/Matrix Conv	8:30 a.m. – 10:10 a.m.	ROOM 200
T14:	PV Micro-Inverters	8:30 a.m. – 10:10 a.m.	ROOM 201AB
Exhibition		10:00 a.m. – 2:00p.m.	EXHIBIT HALL A
Exhibitor Seminars – Session 5		10:30 a.m. – 11:00 a.m.	See Page xxxx

KEY: S – Professional Education Seminars **R – Rap Sessions** **IS – Industry Sessions** **T – Technical Sessions**

Exhibitor Seminars – Session 6	11:15 a.m. – 11:45 a.m.	See Page xxxx
IS1.3: Latest Advances in Nanotechnology Applications	2:00p.m. – 5:30p.m.	ROOM 202AB
IS2.3: Key Issues in Vehicle Power Electronics	2:00p.m. – 5:30p.m.	ROOM 202CD
IS3.3: Controls and Passive Components	2:00p.m. – 5:30p.m.	ROOM 201C
T15: PV MPPT and Battery Storage	2:00p.m. – 5:30p.m.	ROOM 203
T16: Magnetic Components, Design and Characterization	2:00p.m. – 5:30p.m.	BALLROOM A
T17: AC Motor drives	2:00p.m. – 5:30p.m.	ROOM 201
T18: Industrial Converters	2:00p.m. – 5:30p.m.	ROOM 201C
T19: Three-Phase AC-DC Converters	2:00p.m. – 5:30p.m.	BALLROOM C
T20: Improved Power Quality & Stability Approaches in Power Converter Application	2:00p.m. – 5:30p.m.	ROOM 200
T21: Control Loops for Dc-Dc Converters	2:00p.m. – 5:30p.m.	ROOM 203
Evening Social Event *(ticket required)*	6:30p.m. – 10:00p.m.	DALLAS COWBOYS STADIUM

Thursday, March 21st

Speaker Breakfast	7:00 a.m. -8:00 a.m.	ROOM 100
Poster Presenter	7:00 a.m. -8:00 a.m.	BALLROOM B
Registration	8:00 a.m. – 12:00p.m.	REGISTRATION (LEVEL 1)
IS1.4: Energy Storage and the Power Converters that Control Energy Storage	8:30 a.m. – 11:20 a.m.	ROOM 202AB
IS2.4: Wide Band Gap Devices	8:30 a.m. – 11:20 a.m.	ROOM 202CD
T22: Soft Switching DC-DC Converters	8:30 a.m. – 11:20 a.m.	ROOM 201C
T23: Control of Distributed Systems	8:30 a.m. – 11:30 a.m.	ROOM 201
T24: Control of Novel Dc-Dc Converters	8:30 a.m. – 11:20 a.m.	BALLROOM A
T25: Advanced Topology & Control for Three-phase Power Converters	8:30 a.m. – 11:20 a.m.	BALLROOM C
T26: Advances in Motor Drives and Inverters I	8:30 a.m. – 11:20 a.m.	ROOM 200
T27: Wireless Power Applications	8:30 a.m. – 11:20 a.m.	ROOM 204
T28: LED Lighting	8:30 a.m. – 11:20 a.m.	ROOM 203
Dialogue Sessions	11:30 a.m. – 1:30p.m.	BALLROOM B
IS1.5: 3D Packaging for Power Electronics	2:00p.m. – 5:30p.m.	ROOM 202AB
IS2.5: 2.5 How are Magnetics Catching Up To SiC & GaN?	2:00p.m. – 5:30p.m.	ROOM 202CD
T29: High Frequency DC-DC & Switched Capacitor Converters	2:00p.m. – 5:30p.m.	ROOM 203
T30: Semiconductor Devices	2:00p.m. – 5:30p.m.	BALLROOM A
T31: Advances in Motor Drives and Inverters II	2:00p.m. – 5:30p.m.	BALLROOM C
T32: Power Electronics Applications	2:00p.m. – 5:30p.m.	ROOM 200
T33: Vehicular Electronics I	2:00p.m. – 5:30p.m.	ROOM 201C
T34: PV Inverters and Wind Generation	2:00p.m. – 5:30p.m.	ROOM 201
T35: Control of Grid-tied Systems	2:00p.m. – 5:30p.m.	ROOM 204

CONFERENCE AND EXPOSITION APEC 2014

Conference Highlights

Plenary Session

APEC 2014 Plenary is designed to cover the history of power, the current needs in energy efficiency and the future possibilities. Topics include: Transforming Energy Management; Power Electronics in Emerging Applications; Mission Critical Power: Past, Present and Future; ARPA-E Initiatives in High Efficiency Power Conversion; Significant Developments and Trends in 3D Packaging of Power Products; and finally System Reliability vs. Efficiency: Are we being Redundant?. Come see where Power technology has been, and where it is heading.

Professional Education Seminars

APEC is the premier event in applied power electronics. The APEC Program addresses a broad range of topics in the use, design, manufacture and marketing of all kinds of power electronics equipment. If you are in the power electronics business, here is why you should make APEC a regular part of your career development: The combination of high quality professional education seminars, a full Program of refereed papers and an overflowing Exhibit Hall consistently provides an invaluable education each year. The value of APEC to working power electronics professional is shown by the ever growing number of participants.

Technical Seminars & Sessions

APEC Industry professionals just like you participated in a rigorous peer review process and have carefully picked 534 papers making up APEC's Technical Sessions. This process eliminates the commercial content from the technical sessions, and provides the highest quality possible. The technical Program includes papers of broad appeal scheduled for oral presentation from Tuesday morning to Thursday afternoon. Papers with a more specialized focus are available for discussion with authors at the Dialogue Sessions on Thursday at 11:30a.m. The various technical venues cover all areas of technical interest to the practicing power electronics professional. The papers are sure to give you many new design ideas that you can return home with and apply to your work immediately.

The sessions were selected through a rigorous peer review process and are represented by papers in the APEC Proceedings. Each digest was evaluated using an author-blind process by at least three members of the Program Committee, volunteers from all over the world with expertise in the area of the specific digest.

Industry Sessions

Speakers are invited to make a presentation only without submitting a formal manuscript for the APEC Proceedings. These sessions have been very popular. The target audience for these sessions differs from the engineers in typical technical sessions and may include business oriented people such as purchasing agents, information technologists, regulatory agencies, and other people who support the power electronics industry. These sessions were previously called "Special Presentation Sessions".

These industry sessions will not have papers in the APEC Proceedings and will be available online after the conference concludes at *www.apec-conf.org*.

Rap Sessions

We have two exciting and contentious topics lined up for this year. Admission to all Rap Sessions is free with an Exhibits Only registration and free refreshments will be available.

Exhibitor Seminars & Exposition

Looking for answers to the problems that are waiting for you when you get back to the office or lab? The APEC Exhibitor Seminars may have the answers you are looking for. These half hour presentations give you a more in-depth look at an Exhibitor's products or services than you can get by just dropping by their booth. With presentations on so many topics, you are sure to find several of interest. The seminars will be held Tuesday afternoon and Wednesday morning.

Entrance to the Exhibition is open to all conference attendees, including holders of the free Exhibits Only registration!

MicroMouse Contest

APEC will once again host the World-Famous APEC MicroMouse Competition, the only event of its kind in North America, drawing contestants from all over the world. The contest will take place Monday evening starting at 8:00 P.M. in Room 100 at the Fort Worth Convention Center.

Conference Social Event

On Wednesday March 19, 2014, Join us for APEC's closing night celebration at AT&T Stadium, Home of the Dallas Cowboys! We invite you to wear your favorite football team's jersey as we celebrate on the home field of the Dallas Cowboys. In addition to delicious food and live music, you'll have the unique opportunity to play interactive field games and go behind-the-scenes to tour exclusive areas of the stadium. You'll also be treated to a personal, live performance and meet & greet with the world-famous Dallas Cowboy Cheerleaders!

We are confident that this event will be one of the conference highlights. Tickets to the social event are included in Full Conference and Technical Session registrations. Transportation will be provided from the Convention Center Entrance to the Stadium at 6:30p.m. Attendees may also drive to the stadium. Buses will be available throughout the evening returning to the Convention Center. On-site ticket sales will not be available.

Spouse and Guest Program

APEC welcomes the spouses and guests of the APEC conference participants into the Plenary, Rap Sessions, the Exhibit Hall receptions and the MicroMouse Contest. A welcome breakfast will be held on Monday, March 17th and the Spouse and Guest Hospitality room (Hospitality Suite A – Omni) will be open each morning to provide a place to meet, have coffee and make plans for the day. APEC 2014 has also arranged for two optional tours. Details can be found on page XXXX.

General Information

Conference Location

Fort Worth Convention Center
1201 Houston Street
Fort Worth, TX 76102
Phone: 817-392-6338

In addition, APEC has several host hotels in the area which will be accommodating our participants and hosting functions.

- **Omni Fort Worth Hotel**
  (Across the street from the Convention Center)
  1300 Houston Street
  Fort Worth, Texas, USA 76102
  817-535-6664 or 1-888-444-OMNI (6664)
- **Hilton Fort Worth**
  (One Block to Convention Center)
  815 Main Street
  Fort Worth, Texas, USA 76102
  817-870-2100
- **Sheraton Fort Worth Hotel**
  (Across the street from the Convention Center)
  1701 Commerce Street
  Fort Worth, Texas, USA 76102
  817-335-7000
- **Holiday Inn Express Hotel & Suites**
  (1 mile to Convention Center)
  1111 W. Lancaster Avenue
  Fort Worth, TX 76102
  Phone: 817-698-9595

Ground Transporation

AREA AIRPORTS

- **Dallas/Fort Worth International Airport (DFW)**
- **Dallas Love Field Airport (DAL)**

PARKING

- **Fort Worth Convention Center**
  Parking is $10 per car per entry to either of the Convention Center's parking garages. There is a garage located on Houston Street and the other is located on Commerce Street.
- **Omni Fort Worth**
  $15/day self-parking –$25/day valet

- **Hilton Fort Worth**
  $15/day valet
- **Sheraton Fort Worth**
  $15/day self-parking –$22/day valet

GETTING AROUND TOWN

- Many local attractions are within walking distance
- Molly the Trolley operates complimentary shuttle service
- Please visit *http://mollythetrolley.com/* for more information
- Transportation to the Stockyards is available for a fee

Conference Registration

IIn order to participate in the 2014 APEC Conference you must be registered. Prepaid conference registration is required for the professional educational seminars, presentation sessions and dialogue sessions.

To register or pick up your conference materials please visit the APEC Conference Registration Center in the Fort Worth Convention Center (Hall A Foyer).

Saturday, March 15th . . . . . 3:00p.m. - 6:00p.m.

Sunday, March 16th . . . . . 8:00 a.m. – 5:00p.m.

Monday, March 17th . . . . . 7:30 a.m. – 5:00p.m.

Tuesday, March 18th . . . . . 7:30 a.m. – 5:00p.m.

Wednesday, March 29th . . . . . 8:00 a.m. – 3:00p.m.

Thursday, March 20th . . . . . 8:00 a.m. – . . Noon

Information for Presenters

For presenters in the **Industry Sessions and the Oral Technical Sessions**, you must attend a mandatory speaker breakfast on the morning of your presentation. **On Tuesday and Wednesday the breakfast will be held at 7 a.m. in Hall D at the Fort Worth Convention Center.** On Thursday the breakfast will be held at 7 a.m. in Room 100 at the Fort Worth Convention Center. The Program Chair will host this breakfast at which you will be given your speaker ribbon and provided instructions. If you have not provided your biography to your sessions chair beforehand, you can give it to him or her at the breakfast. Immediately after breakfast you will be able to review your previously uploaded presentation with your session chair.

For those presenters in the **Dialogue Sessions**, a breakfast will be provided for you in the **Ballroom B in the Fort Worth Convention Center at 7 a.m. on Thursday, March 20th**. After breakfast and brief instructions you will be able to mount your presentation on the poster boards in the same room, using thumb tacks we will provide. Please do not go straight to your poster.

Message Center

A bulletin board for messages will be placed near the main conference registration area in the Registration area.

Spouse & Guest Program

APEC welcomes the spouses and guests of the APEC conference participants into conference activities including the Plenary, Rap Sessions, the Exhibit Hall receptions and the MicroMouse Contest.

- **Spouse and Guest Hospitality Room**
  Monday, March 17th – Thursday, March 20th
  8:00 a.m. – 11:00 a.m.
  HOSPITALITY SUITE A, OMNI HOTEL

- **Spouse and Guest Welcome Breakfast**
  Monday, March 17th
  8:00 a.m. – 9:00 a.m.
  HOSPITALITY SUITE A, OMNI HOTEL

Optional Tours

Pickup for all tours will be at the Hospitality Suite A, Omni Hotel

► **TALE OF TWO CITIES: DALLAS AND FORT WORTH**

Monday, March 17, 2014

$85/per person

9:00 a.m. – 4:30p.m. *(7.5 hour tour)*

Join us for a fun and fascinating day showcasing the best of both glamorous Dallas and historical Fort Worth!

First, you will be welcomed to Dallas, the world-renowned city that features a unique blend of modern sophistication, southwestern warmth, cosmopolitan flair, and Old West enchantment. Visitors to Dallas are awe-struck by its diversity: an ultra-modern, visually striking downtown skyline alongside historic and fascinating landmarks recalling visions of Texas past and present.

During this tour, you will enjoy visiting such famous sites as the full size bronze cattle drive at Pioneer Plaza and Fountain Place, where dozens of computer controlled fountains with varying water heights are coordinated to create an incredible visual spectacle. The tour also includes such Dallas highlights as: Dallas City Hall, Union Station, the original Neiman Marcus, and The West End Historical District. As the driving portion comes to a close, you will disembark for a tour of the Old Red Courthouse Museum, an iconic landmark that dates back to Dallas's earliest days.

Next, you'll be transported back to Fort Worth, a city of cowboys and culture. Enjoy a brief tour of the Stockyards Historic District, once the second largest U.S. livestock market and now a major entertainment center. The Stockyards area exemplifies the days of the Old West with lively western saloons, quaint shops and delicious restaurants. After our morning in Dallas, you will have worked up an appetite and will be treated to lunch at Fort Worth's own Cattlemen's Steakhouse.

► **A DAY OF ART IN DALLAS'S ARTS DISTRICT**

Tuesday, March 18, 2014

$90/per person

9:30 a.m. – 4:00p.m. (*6.5 hour tour)*

Dallas is home to a world-class Arts District that attracts visitors from all over the world. During this tour, you will discover the nation's largest arts district and even visit two of the area's prized cultural jewels – the Dallas Museum of Art and the Nasher Sculpture Center.

To start off the tour, you will visit the Nasher Sculpture Center. Start your tour by walking through the private collection and garden in one of Dallas' most unique and utterly modern venues. Before embarking on the next part of your tour, you'll need your energy! Enjoy lunch at Jorge's Mexican Café, a renowned name and long-standing tradition in Texas.

Next, you'll take a guided walking tour through the district to view some of the area's long-standing landmarks as well as the city's newest additions. The tour will take you by the Morton H. Meyerson Symphony Center, designed by Pritzker Prize-winning architect I.M. Pei, the new AT&T Performing Arts Center where you will see the architecturally stunning Margot and Bill Winspear Opera House, designed by Pritzker Prize-winning architect Norman Foster, and the innovative Dee and Charles Wyly Theatre, designed by Pritzker Prize-winning architect Rem Koolhaas. Leaving the Performing Arts Center, you'll proceed to the Trammell Crow Collection of Asian Art, a museum dedicated to the arts and cultures of China, Japan, India and Southeast Asia.

The last stop of the tour takes you to the Dallas Museum of Art, a cultural Dallas gem designed by Edward L. Barnes.

Purchasing of Conference Proceedings and Seminar Workbooks

Only copies on USB of the APEC Proceedings will be provided with the Full or Technical Sessions registration.

Conference registrants can purchase extra copies of the Conference Proceedings and Seminar Workbooks on USB through Early Registration. APEC reserves the right to limit quantities of APEC Proceedings or Seminar Workbooks sold to any one person or institution.

A **LIMITED NUMBER** of copies of the Conference Proceedings and Seminar Workbooks may be available for sale at the Conference Registration Center, starting at noon on Wednesday, March 19th.

	On-site
Conference Proceedings (USB Only)	$180
Seminar Workbook (USB only)	$180

Publications purchased on or before February 21st will be available for pick-up at the registration desk.

► **PURCHASING THROUGH THE IEEE**

Post conference APEC Proceedings may be purchased through the IEEE.

IEEE Single Copy Sales
445 Hoes Lane
Piscataway, New Jersey 08854 USA
P: (800) 678-4333 (USA & Canada) or
(732) 981-0060
Web site: *http://shop.ieee.org/ieeestore/*

Notes

Sponsor Meetings

SPONSOR MEETINGS

Professional Education Seminars

APEC strives to offer seminars with a practical mix of theory and application for the professional working in power electronics. APEC 2014 features 18 professional education seminars with a broad range of topics.

Session 1: Sunday, March 17th

9:30 am – 1:00 pm

WIDE BANDGAP DEVICES

The Design and Application of Wide Energy Bandgap (WBG) Power Switching Devices

Krishna Shenai, *Argonne National Laboratory*

ROOM 202CD

Silicon carbide (SiC) and gallium nitride (GaN) power devices promise significant energy savings at elevated temperatures than feasible with silicon power devices. Wide bandgap (WBG) power diodes rated up to 1,700 volts and power switches rated up to 1,200 volts are commercially available; WBG power switch modules rated at 1,200 volts and 100amps are also commercially available. However, there is serious disconnect between WBG semiconductor manufacturing and end-user industries. For example, WBG power semiconductor device data sheets often do not specify important reliability parameters including the safe operating area (SOA), and dv/dt- and avalanche ratings. Furthermore, there is a large spread in WBG power device parameters that make it difficult to evaluate the quality and yield of power converters in end-user applications. Likewise, there is no real feedback from end-users to WBG manufacturing industries, thus making technology development and optimization not only difficult, but also time consuming and expensive. The problem is further complicated because standard circuit design approaches used for silicon power devices may not be directly applicable with WBG power switching devices. Thus there is a critical need to understand WBG power devices in order to optimally use them in high-density power converters, and vice versa.

FUNDAMENTALS

S.2 Power Factor Correction: from Basics to Optimization

Joel Turchi, *ON Semiconductor*

Dhaval Dalal, ACP Technologies

ROOM 203

The Power Factor Correction (PFC) requirements have grown from IEC555-2 in early 90's to a more widespread and harmonized set of regulations impacting a large set of electronics equipment today. Simultaneously, PFC implementation approaches have evolved into a set of techniques widely differentiated in terms of sophistication and applicability. The need for a guided tour through these approaches is equally felt by newcomers to the field as well as some industry veterans.

This seminar attempts to provide a contextual overview of this topic and then gives a detailed and structured treatment of design issues for PFC circuits. In addition to the traditional methods of PFC (CCM, DCM and CrM), emergent techniques such as interleaved PFC, bridgeless PFC and single stage PFC are discussed. Some practical issues common to all PFC circuits are covered. Design equations and procedures are provided. The key question of which PFC technique is suitable for a given application or a given power level is addressed in multiple ways. First, by providing a detailed comparison at a specific power level (300 W) and then by presenting selection criteria based on desired attributes and applications.

Intended audience: Power electronics professionals with an interest in understanding basics of PFC as well as those interested in learning about the latest trends in this topic.

EMERGING TECHNOLOGIES

S.3 Design of Emerging High Power Density Switch-Mode Power Supplies

Aleksandar Prodić; *University of Toronto, Canada*

ROOM 201

In this seminar, methods for designing and implementing SMPS with a lower volume and improved power processing efficiency than the existing solutions will be presented. The methods that will be presented include both control and topological based solutions.

Audience: This seminar is designed for engineers with medium and in-depth experience in power electronics.

DESIGN

S.4 New Trends in Soft Switching Topologies

Ionel Dan Jitaru, *Rompower Energy Systems*

ROOM 200

The new developments in the semiconductor technology such as SiC and GaN have created the need for a reevaluation of the most suitable topologies in power conversion. Soft switching topologies have become popular in many power conversion applications in the last twenty years. Some of the soft switching topologies have added complexity and their practical use become more questionable with the availability of more ideal components.

The seminar concentrates on the latest soft switching topologies which are addressing the soft commutation both in the primary and the secondary side without adding complexity. Well known topologies are presented in the light of the latest improvements, as well as new topologies which were recently derived.

The progress in semiconductors, magnetic and packaging will increase the operation frequency, and soft switching topologies will become a necessity for higher efficiency. There will be presented also Intelligent Power Processing techniques, wherein the use of digital control allows us to obtain soft switching over the entire operating conditions.

The presentation will be highlighted with design guidance, design example and experimental results such as 99% efficiency isolated DC-DC Converter.

ADVANCED CONTROL DESIGN

S.5 Advanced Control Design

Dr. Ray Ridley, *Ridley Engineering*

ROOM 204

This seminar will present an in-depth discussion of advanced topics in control design. Whether designing with current-mode or voltage-mode control, with analog or digital controllers, there are invariant aspects of the power stages that limit the control response to transients. We have to work hard to get the best performance out of the given power components.

The relationship between the well-known loop gains, and closed-loop characteristics of power supplies will be discussed in detail. Output impedance, audio susceptibility, and step responses are all interrelated and determined by the base power stage, and the control design.

In modern point-of-load converters, loop designs have become very aggressive in order to minimize overshoot with the smallest possible power components. The limits of loop gain will be explored to find out how far loops can be pushed before instability arises. It will also be shown how large-signal instability can occur even though small-signal measurements show a stable system.

The seminar is recommended to all levels of engineers who work with switching power supplies. Beginning designers will receive a clear picture of how to quickly design loops to optimize closed-loop performance. Advanced designers will learn how to push their loops to the limit to get the most out of their power converters.

COMPONENTS

S.6 Practical Techniques and Technology to Test Power Devices

Ryo Takeda, *Agilent Technology International*

ROOM 202AB

For power circuit designers, characterizing the power devices that they intend to use in their circuits is crucial, since these key components dictate the entire efficiency of the system. The recent trend of increasing power circuit operation frequency, especially using emerging wide band gap power devices such as GaN or SiC, makes device characterization more important than ever. In addition, the growing circulation of counterfeit devices world-wide is also driving the need for increased device characterization. Failure analysis, reliability and incoming inspection engineers need to have tools capable of detecting these devices to prevent catastrophic failures due to counterfeit devices not meeting specifications.

Power device development engineers working at semiconductor companies also face measurement challenges, since conventional test equipment (such as curve tracers) cannot keep up with advances in power device technologies.

This seminar will provide its audience with information that will enable them to perform deep characterization of state-of-the art power devices, including many practical techniques and tips that they can use immediately. The key measurement procedures covering static and dynamic characteristics will be explained from a theoretical point of view, while the practical techniques come from the accumulated knowledge of Agilent Technologies' application engineers from around the world.

PROF. EDUCATION SEMINARS

Session 2: Sunday, March 17th

2:30 p.m. – 6:00p.m.

WIDE BANDGAP DEVICES

S.7 Commercially Viable GaN-Based Power Devices

Michael A Briere, *International Rectifier*

ROOM 201

An in-depth discussion is made of the prospects and present status of commercially viable GaN based power switches, suitable for intermediate and advanced audiences. A comparison is made to state of the art silicon based alternative device technologies in terms of structure, device physics and fundamental performance characteristics. An explanation is provided of the role of p-n junctions, buried and inversion channels, the role of avalanche breakdown and bulk screening and trapping effects. The fundamental advantage of GaN based devices over silicon based alternatives is discussed in terms of critical fields, minority carrier dynamics, switching behavior and current handling capability. A brief review is made of strain engineered hetero- epitaxy on large diameter silicon substrates and CMOS compatible device fabrication. Measured device characteristics of commercially viable large area GaN based HEMTs are presented. Device ruggedness and long term reliability of GaN based HEMTs developed by International Rectifier are discussed in detail. The performance of GaN based HEMTs in a variety of power electronic applications, including POL dc-dc, class-D audio, PFC and motor drives are presented. A perspective on the potential future developments of GaN based power electronics over the next 5-10 years is provided.

FUNDAMENTALS

S.8 Fundamentals of Switched Reluctance Motor and Drives

Wei Wang, Babak Fahimi, *University of Texas at Dallas*

ROOM 202AB

Switched Reluctance Motor (SRM) presents an attractive alternative to induction and permanent magnetic synchronous machines. SRM benefits from a relatively simple and rugged structure. It is also seriously considered as a competitor to the use of rare earth permanent magnet-based drives in electric propulsion of electric and hybrid electric vehicles thanks to its extended constant power region, fault tolerant and modular configuration, and the ability to operate under harsh ambient conditions.

This tutorial is intended to provide a thorough explanation of the operation principle of SRM and its power electronic driver for entry level to intermediate level engineers and graduate students. It covers the principles of operation, machine structure, key features, basic drive topologies, torque and current control methods in the first half of the lecture. The second half will be focused on several advanced topics such as vibration and acoustic noise, fault tolerant operation, and position sensorless control of SRM. Practical examples will be provided for illustrating the characteristics of SRM and validating theoretical analysis.

EMERGING TECHNOLOGIES

S.9 Wireless Charging of Electric Vehicles with Extremely High Efficiency & Misalignment Tolerance

Dr. Chris Mi, *University of Michigan*

ROOM 203

Electric vehicles and plug-in hybrid electric vehicles (PEVs) have attracted worldwide attentions because their capabilities to displace petroleum usage and improve energy and environment sustainability. One of the key constraints for the mass market penetration of PEV is the inconvenience and safety concerns associated with charging. Wireless charging using Wireless Power Transfer (WPT) Technology, as an alternative to plug-in charging and battery- swapping, can provide the convenience and safety requirements. Recently, we have realized an EV battery wireless charger at 8kW with a 30 cm distance, a DC-to-battery efficiency of 97%, and a misalignment of up to 60cm, using magnetic-resonance technology. This breakthrough will have strong impact on PEVs and a variety of other applications, including consumer electronics, home appliances, medical implant devices, and some industry applications. This seminar will focus on the key technical challenges of WPT, including coil design, system analysis using analytical methods, simulations of the WTP system; resonant topologies suitable for various applications, and power electronics circuits associated with WPT. The presentation will be mostly focused on high power applications in the kilowatts and tens of kilowatts range but other wireless power transfer technologies and applications of WPT, as well as environment safety, will be briefly discussed.

This is an in-depth topic that will cover the basic principle as well as design guidelines for the transmission coils and power electronic circuits.

Level of the intended audience: This seminar is suitable for both intermediate and advanced audiences who already have some background in power electronics or elecromagnetics but are new to wireless power transfer, or looking for approaches to enhance their design.

PROF. EDUCATION SEMINARS

DESIGN

S.10 Reliable Converter Design with IGBT Based Power Modules

David Levett, Tim Frank, *Infineon Technologies*
Suresh Chandran, *EPCOS*
ROOM 202CD

The goal of this seminar is to review the key engineering design requirements for IGBT-based power converters. The focus will be on the major facets of power electronics engineering that make up a modern converter, with an emphasis on a practical and "hands-on" approach to real-world product design.

Subjects to be covered include: gate drive circuits, IGBT module electrical and thermal protection, system mechanical layout, bus capacitor technology, capacitor type selection, and lifetime estimation of IGBT modules from product mission profiles. The seminar will be given by design engineers for design engineers. This will benefit power electronics engineers from entry level to veteran.

The seminar will be independent of both topology (for example three level or boost) and industry segment (for example drives or solar) and will be most relevant to converter designs in the 1kW to 1MW power range.

At the end of this seminar the attendees will be equipped with a core design review checklist that they can build on and supplement from their own experience and knowledge. This checklist can then be applied to increase the reliability of existing or new power converters.

CONTROL & MODELING

S.11 Impedance Modeling & Analysis of Grid-Connected Three-Phase Converters

Dr. Jian Sun, Rensselaer Polytechnic Institute
ROOM 204

Three-phase pulse-width modulated converters are used as front-end rectifiers for motor drives, UPS, and telecom power supplies. An increasing number of such converters are also used as inverters to integrate wind, solar and other distributed energy sources into the power grid. Performances of such grid-connected converters depend strongly on the grid. A wind or solar inverter, for example, may become unstable when connected to a weak grid. A converter may also form resonance with the grid, producing high harmonics that deteriorate grid power quality, trig converter and grid protection functions, and cause physical damages to the converter and other devices.

This seminar introduces impedance modeling and analysis techniques for grid- connected three-phase converters. After a review of general impedance-based analysis methods, modeling of three-phase converters by positive- and negative-sequence impedances is presented. Characteristics of the sequence impedances and their relationship to converter circuit and control design are examined. Decomposition of the converter-grid system into a positive- sequence and a negative-sequence subsystem is then introduced and used to study such practical problems as converter control instability under weak grid conditions and harmonic resonances. Different methods to measure three-phase impedances are also presented, and adaptive control based on real-time grid impedance measurement is introduced.

The seminar will treat these topics in-depth and is intended for an audience that is familiar with three-phase converters and circuits, converter modeling, and linear control.

COMPONENTS

S.12 Planar Magnetics for Energy Conversion

W. G. Hurley, *National University of Ireland*
Ziwei Ouyang, *Technical University of Denmark*
ROOM 200

Planar magnetics fabrication and assembly processes have several advantages over conventional magnetics:

Low profile – planar magnetic components has a lower profile that their wire wound counterparts due to the fabrication process;

Automation – based on advanced computer aided manufacturing techniques;

High power densities – planar inductors and transformers are spread out and this gives them a bigger surface-to-volume ratio than conventional components, this enhances the thermal performance;

Predictable parasitics – with planar magnetics, the windings are precise and consistent, yielding magnetic designs with highly controllable and predictable characteristic parameters.

Planar magnetic components take advantage of microelectronic processing. In general the number of turns in planar device tends to be limited by the manufacturing process. The low profile tends to lead to a larger footprint compared with its conventional counterpart. In multilayer devices the interlayer capacitance introduces resonance at high frequencies. When considering planar devices several issues must be addressed: the shape; the tradeoff between magnetic core area and winding window area; the magnetic path length versus the mean length of a turn; and the surface area. Applications include coreless transformers for gate drives, radio frequency (rf) inductors and a Power Supply on Chip (PwrSoC)

Session 3: Monday, March 18th

8:30 a.m. – 12:00 Noon

WIDE BANDGAP DEVICES

S.13 High-Efficiency Silicon Carbide Power Electronics

Hans-Peter Nee, Jacek Rabkowski, Dimosthenis Peftitsis, *KTH Royal Institute of Technology*

ROOM 201

One of the focus areas of the research of the power electronics group at KTH Royal Institute of Technology in Stockholm, Sweden is silicon carbide (SiC) power electronics. The research deals with JFETs, Bipolar transistors, MOSFETs in silicon carbide, and drive circuits for these devices. Several converters exploiting the benefits of these devices have also been designed and evaluated. This professional education seminar provides a description of SiC devices, gate and base drivers for different devices, examples of converter designs employing SiC devices, and an overview of potential future applications. The main benefit of the professional education seminar is knowledge of how to design high-efficiency converters using SiC power transistors of different types. Moreover, design of gate-drive units for SiC transistors on practical examples will also be shown. Another benefit of the professional education seminar is insight how SiC can make a difference in various applications and at what maturity level SiC power electronics is today. High-temperature applications are NOT treated in depth.

Intended audience: Design engineers, PhD students, and professors who want to design high- efficiency converters using SiC transistors. Technical managers, engineers in general, PhD students, and professors who want to get an overview of SiC power electronics.

FUNDAMENTALS

S.14 Power Electronic Modules – Applications, Characteristics, and Packaging

Simon S. Ang, *University of Arkansas*

ROOM 202CD

Power electronic modules are packages that contain several power semiconductor devices to perform specific power electronic functions such as a half bridge or a full bridge switching circuit. This tutorial addresses the applications, characteristics, design and fabrication of power electronic modules, in particular, silicon carbide power electronic modules, for entry-level power electronic engineers. Power electronic modules enhance the performance of many power electronic systems through their abilities to reduce circuit parasitic elements due to reduced current conduction path lengths of their switching positions. The merits of these modules for power electronic applications will be discussed. Simulations will be used to illustrate the principles behind some of these merits. Next, the advantages of silicon carbide power devices over their silicon counterpart are presented. Two application examples of silicon carbide power electronic modules in indirect matrix converter and solid state transformer will be presented. The design and fabrication of these modules will be discussed. Some design considerations such as parasitic mitigation using device layout techniques will be discussed, followed by illustration of typical module fabrication processes. Finally, this tutorial will conclude with the thermal management issues and a discussion of reliability for these modules.

EMERGING TECHNOLOGIES

S.15 Power Supply on a Chip

Cian O'Mathuna, *Tyndall National Institute*
Jose Antonio Cobos, *Technical University of Madrid (UPM)*
Bruno Allard, *ampère-Lab, INSA Lyon*

ROOM 204

The seminar will focus on the integration of switched mode power supplies multiple applications, and address a broad range of technologies. The complete integration on-die and integration within package are of prime interest. It will review the current state of power supply technology platforms and highlights future trends and challenges towards realizing fully-monolithic power converters. An overview of relevant power converter technologies, namely power supply in package (PwrSiP) and power supply on chip (PwrSoC), and the evolving product trends will be given. The focal topics for this workshop are the strategies for addressing circuit and system approaches as well as advanced technologies for the design and manufacture of these passives. The key enabling technologies including integration of passive components on Silicon, CAD tool and new circuits and topologies to facilitate greater granularity and higher efficiency will also be presented. Finally, future trends, key challenges and potential solutions in realizing the 'holy grail' of monolithically-integrated power supplies (PwrSoC) will be given.

DESIGN

S.16 On-Board Charger Technology for EVs and PHEVs

Byoung-Kuk Lee, *Sungkyunkwan University*
Bong-Gi Yoo, *Changsung Corporation*

ROOM 203

The objective of this seminar is to offer various design technologies available for on-board chargers (OBC) in electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) together with state-of-the-art of OBC. Four different types OBC will be introduced and topological

analysis, operational principles, unique control algorithms and design methodologies will be discussed in detail.

This seminar will handle an isolation two-stage OBC, a non-isolation single-stage OBC, a PV- PCS integrated OBC, and a traction motor-inverter utilized OBC and the major design targets of each OBC like PFC capability, power density, and efficiency will be compared through theoretical analysis and power loss estimation. Moreover, core material selection and inductor design guide that is the main factor in OBC to decide performance and efficiency will be presented by the guest speaker from industry.

All experimental verification of the presented four types OBC will be provided from the actually developed testbed that was collaborated with the major motor companies.

This seminar is designed for medium-level power electronics engineers and can be recommended as lecture for graduate students.

CONTROL & MODELING

S.17 Small-Signal Modeling at Work with Power Converters

Christophe Basso, *ON Semiconductor*

ROOM 202AB

Loop control and stability analysis represent an important part of power converters design. If the study cannot be overlooked during design phase, it can only be conducted if a converter small-signal model exists. Introducing the tools and techniques pertinent to small-signal modeling has been the object of last year professional seminar. In this new seminar, we will quickly come back on the PWM switch model in the two popular structures, voltage (VM) and current-mode (CM) operated at a fixed switching frequency. A newly developed version will cover boundary conduction in both CM and VM architectures.

In this seminar, you will learn how to use the PWM switch model and how to step-by- step apply it to various converters types. We will start with a simple structure such as buck converter in current mode and slowly increase in complexity with the small-signal analysis of a DCM boost converter driving a LED string and a current-mode boost converter operated in boundary mode. We will end the session with the small-signal response of an active clamp forward converter operated in voltage mode.

Using mathematical analysis and SPICE, the author maintains a permanent link between theory and practical reality. Balancing analytical aspects and real case examples, the seminar targets an audience with an intermediate background in the presented subject.

COMPONENTS

S.18 Reliability of Power Supplies

Craig Hillman, *DfR Solutions*

ROOM 200

This course will provide attendees detailed understanding on how to design and manufacture power supplies to be reliable over the intended useful service life using Industry Best Practices and Physics of Failure (PoF). PoF is the process of using science-based degradation algorithms to optimize the design of the power supply and predict its long-term performance early in the product development process. This course will introduce the concept of PoF and how to implement it using a critical component approach. The course will identify critical component and interconnect technologies that are common across power supply designs that can have limited lifetimes. Examples will include, but are not limited to, electrolytic capacitors, film capacitors, optocouplers, connectors, and solder joints. The attendees will learn the science behind the degradation of each critical component and interconnect technology and what aspects of design, materials, and environment either accelerate or retard the degradation behavior. Case studies across multiple markets (automotive hybrid inverters, solar microinverters, medical, etc.) will then be provided to demonstrate the process and effectiveness of implementing PoF in a systemic manner.

Plenary Session

Monday, March 17th

1:30 p.m. – 5:00 pm

GRAND BALLROOM

The plenary session leads off with David Freeman who will discuss Transforming Energy Management. This will be followed by Dong F. Tan describing Power Electronics in Emerging Applications. Miguel Chavez will then lead a discussion on Mission Critical Power: Past, Present and Future. After a short break, Tim Heidel will present the ARPA-E Initiatives in High Efficiency Power Conversion. Next, Brian Narveson will give an overview of Significant Developments and Trends in 3D Packaging of Power Products. The plenary session will end with a discussion on System Reliability vs. Efficiency: Are we being Redundant? by Brian Fortenbery.

Transforming Energy Management

1:35 p.m. – 2:05 p.m.

Speaker:

David Freeman

CTO of Power Management, Texas Instruments

WThe topic of power and energy management continues to draw the interests of semiconductor, business and investment communities. Leading technology companies have always respected power, but it is an area that has transcended from the “necessary evil” of the past to the “technology enabler” of today and the future. Power and energy management enable every portable device to be portable, and without it the run-time alone would have limited many markets. Advanced power management strategies developed in the portable world have been transformed into new power technologies used in many transportation and stationary applications. These include new circuit solutions that minimize losses, while improving the response to load variations. Developments in leading-edge semiconductors, circuits, packaging and manufacturing allow designers to now take a systems approach to power and energy management, which will help fuel growth for power electronics in markets, such as portable, transportation, computing and communication. This presentation will cover the challenges for these industries, and describe how new power and energy management technologies are addressing them. For example, the expansion of the wireless Internet will be limited by the need for energy. Efficient power and energy management solutions at each node in the network are required. These solutions will benefit from the new power management technologies to become more power efficient, more power dense, and more responsive to wide dynamic load variations. New power solutions will change the type of products and the way we do business in this diverse power management industry.

Power Electronics In Emerging Applications

2:05 p.m. – 2:35 p.m.

Speaker:

Dong F. Tan (AS)

Northrop Grumman Corporation (NGAS)

Northrop Grumman’s Advanced Electrical Power Systems (AEPS) features modularity and scalability to minimize cost, schedule and technical risk. Its minimum set of five (5) standard electronic slices allows various units and hence the power system to be configured either as regulated or unregulated bus. Its peak power tracking capability, together with high power conversion efficiency and tightly regulated bus voltage, reduces significantly the required solar array capacity and payload power distribution size and weight for a given mission. It supports either Li-Ion or NiH2 batteries to deliver prime bus power from 1kW to 8 kW with scalability and modularity. This presentation focuses on simulated and measured performances of the peak power tracker (PPT) circuit implemented for a flight program. We will start with a brief overview of PPT architecture and implementation. We will also report on simulation and measurement results on steady-state responses. Key performance, such as tracking accuracy and tracking time, will be reported. Transient responses for mode changes under various orbit conditions, such as eclipse entry and eclipse exit, will be presented. Various modes under different illumination conditions will also discussed.

Mission Critical Power: Past, Present and Future"

2:35 p.m. – 3:05 p.m.

SPEAKER:
Miguel Chavez
Director of Engineering, Eaton

A look at mission critical power and how the evolution of industries requiring uninterrupted electric power and advances in power electronics have helped shape its path. From early computer rooms to today's hyper-scale data centers, the demands for safe and reliable power have grown significantly and are part of a world that expects to be interconnected 24/7. What will the future require? We review the trends, technological and otherwise, that will impact how the challenges of supplying the world with mission critical power are addressed.

BREAK

3:05 p.m. – 3:30 p.m.

ARPA-E Initiatives in High Efficiency Power Conversion

3:30 p.m. – 4:00 p.m.

SPEAKER:
Dr. Tim Heidel
Program Director, Advanced Research Projects Agency–Energy (ARPA-E)

Advances in power electronics promise substantial energy efficiency gains across a wide range of power conversion applications. Innovations in wide bandgap power semiconductor devices and magnetic materials developments, in particular, hold enormous potential, but, today, are still at a somewhat early stage of technological maturity. The Advanced Research Projects Agency – Energy (ARPA-E) is an agency of the U.S. Department of Energy that focuses on funding early stage technologies that have the potential to have a transformational and disruptive impact on the United States' energy future. Over the past 4 years, ARPA-E has launched several power electronics focused programs including the agency's ADEPT (2010), Solar ADEPT (2011), and SWITCHES (2013) programs. This talk will give an overview of some of the successes from these programs thus far and some of the challenges that have yet to be overcome.

Significant Developments and Trends in 3D Packaging of Power Products

4:00 p.m. – 4:30 p.m.

SPEAKER:
Brian Narveson and Ernie Parker
Co-Chairmen of the PSMA Packaging Committee

\The packaged and modular power supply industry is constantly challenged by its customers to deliver more power in a smaller volume. This applies whether selling 1W modules or multi kW AC/DC product. The focus on footprint alone is no longer adequate. The efficient use of the z dimension to minimize the volume of the package is now in the forefront. Cost effective, volume efficient 3D packaging is rapidly being adopted by the power industry. The Packaging Committee of the Power Supply Manufactures Association (PSMA) has undertaken a study to obtain an overview of the technology and product trends that are evolving, what the driv-

ers are and what the market opportunities will be over the coming years. This study provides valuable insights into state of the art products and technology roadmaps while identifying R&D and manufacturing challenges that need to be addressed. The study encompasses developments from chip level integration and silicon stacking to Hi- Power Modules (up to 10kW). The study also covers emerging technologies for additive manufacturing such as 3D printing and how it is being used in the power supply industry. The Plenary presentation would verbally and graphically present the results of this study, which includes the state of the industry with identification of key technology, manufacturing and market trends in 3D Power Packaging.

System Reliability vs. Efficiency: Are We Being Redundant?"

4:30 p.m. – 5:00p.m.

SPEAKER:

Brian Fortenbery

The Electric Power Research Institute (EPRI)

System designers often strive to increase reliability by building redundancy into their architectures. Since we know that even the most reliable components must fail eventually, the best approach to overcoming that risk is to add in a redundant component to provide the required functionality in the case of a failure. The problem with this approach is that usually, we like to allow each component to carry equal parts of the load, and switch over in the event of a failure. As such, the efficiency of the system suffers, and energy use is increased. This presentation will discuss the pros and cons of this approach, and suggest some alternatives that can increase efficiency and save energy.

Notes

Rap Sessions

R1: Smart Grid Infrastructures

Tuesday, March 18th

5:00 p.m. – 6:30 p.m.

BALLROOM A

Moderator:

Alix Paultre, *Power Systems Design*

Panelists:

- Bill Radvak, *CEO, American Vanadium*
- Edward Herbert, *Co-chairman, PSMA Energy Efficiency Committee*
- Kris Ardis, *Executive Director, Maxim Integrated*
- Brian Patterson, *Chairman, Emerge Alliance*

Once upon a time power grid infrastructures only concerned large-scale industrial operations, civil engineers, and municipalities. Today we are faced with the convergent pressures of the near-simultaneous advent of the Internet if Things and the Smart Grid. This means that everyone at every level of today's users, distributors, and generators of power must be aware of the technologies, infrastructures, regulations, and protocols involved. These systems range from consumer handheld products and remote service subsystems involved in the "Internet of Things" to the smart-home and micro grid-oriented bridge technologies, to the municipal grid itself.

The real challenge, however, lies in how we integrate not only the systems, but the management protocols, regulatory issues, service priority concerns, and privacy & security. In a world of negotiated power, who decides what facilities and organizations take priority in a brown-out situation? How are the various layers of management, from various sectors of the industry, negotiate and determine priority in a system? How do we address security in a system of interleaved and overlapping devices and systems? There are many aspects of the smart grid beyond simply being "smart" that we must determine and create plans and strategies for in order to properly achieve the lofty goals we have set for the industry.

R2: Wide Bandgap Semiconductors vs Silicon in Power Electronics – Is there a value proposition or will silicon continue to be good enough cheap?

Tuesday, March 18th

5:00 p.m. – 6:30 p.m.

BALLROOM C

Moderator:

Kevin Parmenter, *Mouser Electronics*

Panelists:

- Gaurang Shah, *Vice President, GaN Products, Analog Group Texas Instruments*
- Dr. Gerald Deboy, *Senior Principal Power Semiconductors (COOLMOS) and System*
- Dr. Anup Bhala, *Vice President of Engineering, USCi – United Silicon Carbide*
- Eric Persson, *Executive Director GaN Applications & Marketing*
- Salvatore Coffa, *IPG & AMS R&D General Manager/Group VP – STMicroelectronics*

For several years we keep hearing about how wide band-gap semiconductors are going to provide dramatic improvements in power electronics system performance. Significant resources have been and continue to be expended will this be the year of exponential growth? Will the huge financial investments made thus far pay off soon? Will the technology performance match the rhetoric and when? Will the price – performance ratio be where it needs to be? What applications will be first? Will the innovation, performance, device and circuit techniques and implementation using silicon devices continue to dominate new designs. Will GaN and SiC devices become a higher value proposition for design engineers and enter mainstream adoption displacing silicon power semiconductors in new designs and applications? Will silicon continue to be good enough at a lower price or will wide bandgap devices enter main stream adoption? Hear from the experts in the field and join in the discussions with our panel of experts.

RAP SESSIONS

Saturday
March 15, 2014

3:00 pm – 6:00 pm

Registration

REGISTRATION (LEVEL 1)

Sunday
March 16, 2014

8:00 a.m. – 5:00p.m.

Registration

REGISTRATION (LEVEL 1)

9:30 a.m. – 1:00p.m.

Professional Education Seminars Session 1

(please go to page xx for complete details)

9:30 a.m. – 1:00p.m.

S.1 **The Design and Application of Wide Energy Bandgap (WBG) Power Switching Devices**
Krishna Shenai, *Argonne National Laboratory*
ROOM 202CD

9:30 a.m. – 1:00p.m.

S.2 **Power Factor Correction: from Basics to Optimization**
Joel Turchi, Dhaval Dalal; *ON Semiconductor, ACP Technologies*
ROOM 203

9:30 a.m. – 1:00p.m.

S.3 **Design of Emerging High Power Density Switch-Mode Power Supplies**
Aleksandar Prodić, *University of Toronto, Canada*
ROOM 201

9:30 a.m. – 1:00 p.m.

S.4 **New Trends in Soft Switching Topologies Ionel**
Dan Jitaru, *Rompower Energy Systems*
ROOM 200

9:30 a.m. – 1:00 p.m.

S.5 **Advanced Control Design**
Ray Ridley, *Ridley Engineering*
ROOM 204

9:30 a.m. – 1:00 p.m.

S.6 **Practical Techniques and Technology to Test Power Devices**
Ryo Takeda, *Agilent Technology International*
ROOM 202AB

2:30p.m. – 6:00p.m.

Professional Education Seminars Session 2

(please go to page xx for complete details)

2:30p.m. – 6:00p.m.

S.7 **Commercially Viable GaN-Based Power Devices**
Michael A Briere, *International Recitifier*
ROOM 201

2:30p.m. – 6:00p.m.

S.8 **Fundamentals of Switched Reluctance Motor and Drives**
Wei Wang, Babak Fahimi, *University of Texas at Dallas*
ROOM 202AB

2:30p.m. – 6:00p.m.

S.9 **Wireless Charging of Electric Vehicles with Extremely High Efficiency & Misalignment Tolerance**
Dr. Chris Mi, *University of Michigan*
ROOM 203

2:30p.m. – 6:00p.m.

S.10 **Reliable Converter Design with IGBT Based Power Modules**
David Levett, Tim Frank, Suresh Chandran; *Infineon Technologies, EPCOS*
ROOM 202CD

2:30p.m. – 6:00p.m.

S.11 **Impedance Modeling & Analysis of Grid-Connected Three-Phase Converters**
Dr. Jian Sun, *Rensselaer Polytechnic Institute*
ROOM 204

2:30p.m. – 6:00p.m.

S.12 **Planar Magnetics for Energy Conversion**
W. G. Hurley, Ziwei Ouyang; *National University of Ireland, Technical University of Denmark*
ROOM 200

Monday
March 17, 2014

7:30 a.m. – 5:00p.m.

Registration
Registration (Hall A Foyer)

8:00 a.m. – 9:00 a.m.

Spouse & Guest Welcome Breakfast
Hospitality Suite A (Omni)

8:00 a.m. – 11:00 a.m.

Spouse & Guest Hospitality Room Open
Hospitality Suite A (Omni)

8:30 a.m. – 12:00p.m.

Professional Education Seminars Session 3

(please go to page xx for complete details)

8:30 a.m. – 12:00p.m.

S.13 **High-Efficiency Silicon Carbide Power Electronics**
Hans-Peter Nee, Jacek Rabkowski, Dimosthenis Peftitsis; *KTH Royal Institute of Technology*
ROOM 201

8:30 a.m. – 12:00p.m.

S.14 **Power Electronic Modules – Applications, Characteristics, and Packaging**
Simon S. Ang, *University of Arkansas*
ROOM 202CD

8:30 a.m. – 12:00p.m.

S.15 **Power Supply on a Chip**
Cian O'Mathuna, Jose Antonio Cobos, Bruno Allard; *Tyndall National Institute, Technical University of Madrid (UPM), ampère-Lab, INSA Lyon*
ROOM 204

8:30 a.m. – 12:00p.m.

S.16 On-Board Charger Technology for EVs and PHEVs
Byoung-Kuk Lee, Bong-Gi Yoo;
Sungkyunkwan University, Changsung
ROOM 203

8:30 a.m. – 12:00p.m.

S.17 Small-Signal Modeling at Work with Power Converters
Christophe Basso, *ON Semiconductor*
ROOM 202AB

8:30 a.m. – 12:00p.m.

S.18 Reliability of Power Supplies
Craig Hillman, *DfR Solutions*
ROOM 200

10:00 a.m.

Spouse Tour **"TALE OF TWO CITIES: DALLAS AND FORT WORTH"** *Departs*
HOSPITALITY SUITE A, OMNI

1:30p.m. – 5:00p.m.

Opening Plenary Session
(For more information about the plenary, see page xxx)
GRAND BALLROOM

1:35 p.m. – 2:05p.m.
Transforming Energy Management
David Freeman, *CTO of Power Management, Texas Instruments*

2:05 p.m. – 2:35p.m.
Power Electronics in Emerging Applications
Dong F. Tan (AS), *Northrop Grumman Corporation*

2:35 p.m. – 3:05p.m.
Mission Critical Power: Past, Present and Future
Miguel Chavez, *Director of Engineering, Eaton*

3:05 p.m. – 3:30p.m.
Break

3:30 p.m. – 4:00 p.m.
ARPA-E Initiatives in High Efficiency Power Conversion
Tim Heidel, *Program Director, Advanced Research Projects Agency–Energy (ARPA-E)*

4:00 p.m. – 4:30p.m.
Significant Developments and Trends in 3D Packaging of Power Products
Brian Narveson and Ernie Parker, *Co-Chairman of the PSMA Packaging Committee*

4:30 p.m. – 5:00p.m.
System Reliability vs. Efficiency: Are we being Redundant?
Brian Fortenbery, *The Electric Power Research Institute (EPRI)*

5:00p.m. – 8:00p.m.

Exhibit Hall Welcome Reception
EXHIBIT HALL A

8:00 p.m. – 10:00 p.m.

MicroMouse Contest
ROOM 100

MONDAY

Tuesday
March 18, 2014

7:00 a.m. – 8:00 a.m.

Speaker Breakfast

HALL D

7:30 a.m. – 5:00 p.m.

Registration

REGISTRATION (HALL A FOYER)

8:00 a.m. – 11:00 a.m.

Spouse & Guest Hospitality Room Open

HOSPITALITY SUITE A (OMNI)

8:30 a.m. – 12:00 p.m.

IS1.1 Breakthrough Technologies Driving Successful Energy Harvesting-Powered Products

ROOM 202AB

Session Chairs:

Arnold Alderman; Steve Grady

8:30 a.m. – 8:55 a.m.

IS1.1.1 Energy Harvesting Market Requirements, Economics and Technology Drivers

Steve Grady – *Cymbet*

8:55 a.m. – 9:20 a.m.

IS1.1.2 Latest Advancements in Energy Harvesting Transducers

Henrik Zessin – *Fraunhofer Institute*

9:20 a.m. – 9:45 a.m.

IS1.1.3 How to Design Minimal Footprint High Efficiency Circuits for Energy Conversion, Energy Storage and System Power Management

Brian Shaffer – *Linear Technology*

9:45 a.m. – 10:10 a.m.

IS1.1.4 New Ultralow-power Sensor devices and Control Mechanisms

Roman Budek – *NXP*

Break

10:40 a.m. – 11:05 a.m.

IS1.1.5 Sub-microamp Microcontroller and Wireless Transceivers, Protocols, Network Architectures

Mark Buccini – *Texas Instruments*

11:05 a.m. – 11:30 a.m.

IS1.1.6 Successful commercial Energy Harvesting Deployments in Wearables, Industrial Controls, Transportation, Medicine, Handhelds, Fitness and Building Controls

Dr. Harry Zervos – *IDTechEX*

8:30 a.m. – 12:00p.m.

IS2.1 Power Electronics Standards

ROOM 202CD

Session Chair:

Peter Wilson

8:30 a.m. – 8:55 a.m.

IS2.1.1 Standards for Power Electronic Components and Systems

Dr. Peter R. Wilson – *University of Southampton*

8:55 a.m. – 9:20 a.m.

IS2.1.2 Issues In Modulating Current for High Brightness LED Lighting

Professor Brad Lehman – *Northeastern University*

9:20 a.m. – 9:45 a.m.

IS2.1.3 Transformers and Inductors in Electronic Power Conversion Equipment

Dr. Matt Willkowski

9:45 a.m. – 10:10 a.m.

IS2.1.4 Marine Power Systems

Professor Roger Dugal

Break

10:40 a.m. – 11:05 a.m.

IS2.1.5 An Introduction to Revision 1.3 of the PMBus™ Specification

Travis Summerlin, Mike Jones – *Texas Instrument's Linear Technology*

11:05 a.m. – 11:30 a.m.

IS2.1.6 Grid Connected Power Systems

TBD

11:30 a.m. – 11:55 a.m.

IS2.1.7 Power Semiconductor Modules
Dr. Krishna Shenai

8:30 a.m. – 12:00 p.m.

IS3.1 High Power Industrial

ROOM 201C

Session Chair:
Krishna Shenai

8:30 a.m. – 8:55 a.m.

IS3.1.1 New Techniques for Wide Band Gap High-Power Semiconductor Device Characterization
Alan Wadsworth – *Agilent*

8:55 a.m. – 9:20 a.m.

IS3.1.2 Advanced T-type NPC- 3 level modules: A New Possibility with RB-IGBT's
Nitesh Satheesh – *Fuji Electric Corp of America*

9:20 a.m. – 9:45 a.m.

IS3.1.3 Advancements in AC Power Capacitor Manufacturing Techniques Solve Traditional Industry Application Problems
John Houdek – *Allied Industrial Marketing, Inc.*

9:45 a.m. – 10:10 a.m.

IS3.1.4 Low cost 120kW Non Isolated Medical Power Supply
Korneel Wijnands – *Prodrive B.V.*

Break

10:40 a.m. – 11:05 a.m.

IS3.1.5 How A New Power Stack Communication System Improves IGBT Reliability and Shortens Development Time
Albert Charpentier – *AgileSwitch, LLC*

11:05 a.m. – 11:30 a.m.

IS3.1.6 Linear Motors for Mass Transit Systems, their Merits, Controls and Drive Aspects
Alireza Safaee – *Bombardier Transportation*

11:30 a.m. – 11:55 a.m.

IS3.1.7 Power Quality – Power Engineering vs Power Electronics Perspectives
W. Dunford

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 1: DC-DC Converter Applications

ROOM 203

TRACK: DC-DC Converters

Session Chairs:
Abhijit Pathak, *International Rectifier*
Dave Freeman, *Texas Instruments*

8:30 a.m. – 8:50 a.m.

1.1 A Hybrid Resonant Converter Utilizing a Bidirectional GaN AC Switch for High-Efficiency PV Applications
T. Labella, J. Lai; *Virginia Polytechnic Institute and State University, United States*

8:50 a.m. – 9:10 a.m.

1.2 Output Rectifier Analysis in Parallel and Series-Parallel Resonant Converters with Pure Capacitive Output Filter
N. Shafiei, M. Ordonez, W. Eberle; *University of British Columbia, Canada*

9:10 a.m. – 9:30 a.m.

1.3 Three-Level Frequency-Doubling LLC Resonant Converter with High Step-Down Ratio for High Input Voltage Applications
S. Zong[2], Q. Luo[2], C. Li[2], W. Li[2], X. He[2], S. Su[1]; *[1]Hangzhou State Power Energy and Environment Institute, China; [2]Zhejiang University, China*

9:30 a.m. – 9:50 a.m.

1.4 Resonant Converters with an Adaptive Secondary-Side Digital Control for MHz 48V VRs: Circuit Analysis and Modeling
S. Pan, M. Pahlevaninezhad, P. Jain; *Queen's University, Canada*

9:50 a.m. – 10:10 a.m.

1.5 Online Efficiency Optimization Technique for Digitally Controlled Resonant DC/DC Converters

L. Scandola[2], L. Corradini[2], G. Spiazzi[2], C. Garbossa[1], P. Piersimoni[1], A. Vecchiato[1]; *[1]Infineon Technology, Italy; [2]Università degli Studi di Padova, Italy*

Break

10:40 a.m. – 11:00 a.m.

1.6 CCM and DCM Operation of the Integrated-Magnetic Interleaved Two-Phase Boost Converter

B. Barry[2], J. Hayes[2], M. Egan[2], M. Rylko[1], J. Maslon[1], K. Hartnett[2]; *[1]dtw, Poland; [2]University College Cork, Ireland*

11:00 a.m. – 11:20 a.m.

1.7 Analysis of MOSFET Failure Modes in Bi-Directional Phase-Shift Full-Bridge Converters

C. Oh, Y. Kim, W. Sung, N. Cho, B. Lee; *Sungkyunkwan University, Korea, South*

11:20 a.m. – 11:40 a.m.

1.8 Transformer-Flux-Balancing Control in Isolated Bidirectional DC-DC Converters

Y. Panov[2], M. Jovanovic[2], L. Gang[1], M. Yueyong[1]; *[1]Delta Electronics, China; [2]Delta Products Corporation, United States*

11:40 a.m. – 12:00 p.m.

1.9 A Full-Bridge Three-Port Converter for Renewable Energy Application

W. Hu[1], H. Wu[1], Y. Xing[1], K. Sun[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Tsinghua University, China*

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 2: Single-Phase AC-DC Converters

BALLROOM A

TRACK: AC-DC Converters

Session Chairs:

Gerry Moschopoulos, *Western University, Canada*

Laszlo Balogh, *Fairchild Semicondcutor*

8:30 a.m. – 8:50 a.m.

2.1 A Digitally Controlled DCM Flyback Converter with a Low-Volume Dual-Mode Soft Switching Circuit

B. Mahdavikhah, A. Prodic; *University of Toronto, Canada*

8:50 a.m. – 9:10 a.m.

2.2 Enhanced Constant-on-Time Control for DCM/CCM Boundary Boost PFC Pre-Regulators: Implementation and Performance Evaluation

A. Bianco, C. Adragna, G. Scappatura; *STMicroelectronics, Italy*

9:10 a.m. – 9:30 a.m.

2.3 Combining Peak Current Mode Control with Average Current Mode Control Using Digitally Assisted Analog

S. O'Driscoll, D. Grant; *Texas Instruments, Ireland*

9:30 a.m. – 9:50 a.m.

2.4 A Novel Active Power Decoupling Single-Phase PWM Rectifier Topology

W. Qi[1], H. Wang[1], X. Tan[1], G. Wang[1], K. Ngo[2]; *[1]Shandong University, China; [2]Virginia Polytechnic Institute and State University, United States*

9:50 a.m. – 10:10 a.m.

2.5 Decoupling of Fluctuating Power in Single-Phase Systems Through a Symmetrical Half-Bridge Circuit

Y. Tang, F. Blaabjerg, P. Loh; *aalborg University, Denmark*

Break

10:40 a.m. – 11:00 a.m.

2.6 A Soft-Switching Bridgeless AC-DC Power Factor Correction Converter for Off-Road and Neighborhood Electric Vehicle Battery Charging

M. Alam[2], W. Eberle[2], D. Gautom[1], F. Musavi[1]; *[1]Delta-Q Technologies Corp., Canada; [2]University of British Columbia, Canada*

11:00 a.m. – 11:20 a.m.

2.7 A GaN Transistor Based 90W AC/DC Adapter with a Buck-PFC Stage and an Isolated Quasi-Switched-Capacitor DC/DC Stage

X. Zhang[1], C. Yao[1], X. Lu[1], E. Davidson[1], M. Sievers[2], M. Scott[1], P. Xu[1], J. Wang[1]; *[1]Ohio State University, United States; [2]Technische Universität München, Germany*

11:20 a.m. – 11:40 a.m.

2.8 Using the Loss-Free Resistor Concept to Design a Simple AC-DC HB-LED Driver for Retrofit Lamp Applications

D. Lamar, M. Arias, M. Hernando, J. Sebastian; *Universidad de Oviedo, Spain*

11:40 a.m. – 12:00 p.m.

2.9 A Novel Bridgeless High-Frequency Resonant AC-DC Converter

Y. Tang, A. Khaligh; *University of Maryland, United States*

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 3: High Speed Devices & Gate Drives

ROOM 204

TRACK: Devices and Components

Session Chairs:

Carl Blake, *CBK*

Douglas Hopkins, *NC State University*

8:30 a.m. – 8:50 a.m.

3.1 Investigation of 600 V GaN HEMTs for High Efficiency and High Temperature Applications

Z. Xu, W. Zhang, F. Xu, F. Wang, L. Tolbert, B. Blalock; *University of Tennessee, United States*

8:50 a.m. – 9:10 a.m.

3.2 Internal Self-Damping Optimization in Trench Power FETs for High-Frequency Conversion

J. Roig, C. Tong, F. Bauwens, R. Gillon, H. Massie, C. Hoggatt; *ON Semiconductor, Belgium*

9:10 a.m. – 9:30 a.m.

3.3 Ultrafast Switching Superjunction MOSFETs for Single Phase PFC Applications

J. Hernandez[2], L. Petersen[2], M. Andersen[2], N. Petersen[1]; *[1]Grundfos Holding A/S, Denmark; [2]Technical University of Denmark, Denmark*

9:30 a.m. – 9:50 a.m.

3.4 Coss Related Energy Loss in Power MOSFETs Used in Zero-Voltage-Switched Applications

J. Fedison, M. Fornage, M. Harrison, D. Zimmanck; *Enphase Energy, Inc., United States*

9:50 a.m. – 10:10 a.m.

3.5 Common Source Inductance (CSI) of Power Devices and the Impacts on Synchronous Buck Converters

B. Wang, R. Chen, D. Jauregui; *Texas Instruments, United States*

Break

10:40 a.m. – 11:00 a.m.

3.6 A High Efficiency Inverter Based on SiC MOSFET Without Externally Anti-Paralleled Diodes

H. Liu[1], H. Wu[1], Y. Lu[1], Y. Xing[1], K. Sun[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Tsinghua University, China*

11:00 a.m. – 11:20 a.m.

3.7 Evaluation of High-Voltage Cascode GaN HEMT in Different Packages

Z. Liu, X. Huang, W. Zhang, F. Lee, Q. Li; *Virginia Polytechnic Institute and State University, United States*

11:20 a.m. – 11:40 a.m.

3.8 Dynamic Performances of GaN-HEMT on Si in Cascode Configuration

T. Hirose, M. Imai, K. Joshin, K. Watanabe, T. Ogino, Y. Miyazaki, K. Shono, T. Hosoda, Y. Asai; *Fujitsu Laboratories Ltd., Japan*

11:40 a.m. – 12:00 p.m.

3.9 Feasibility and Performances of BOOST Converter in Automotive Application Using Silicon Power Transistors Operating at 200°C

R. Roder[2], S. Azzopardi[2], F. Le Henaff[2], O. Briat[2], J. Vinassa[2], S. Bontemps[1]; *[1]Microsemi Corporation, France; [2]University of Bordeaux, France*

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 4: Multilevel Converter Modulation & Control Strategy

BALLROOM B

TRACK: Power Electronics for Utility Interface

Session Chairs:

Liming Liu, *ABB Inc., Raleigh, NC*

Jin Wang, *Ohio State University*

8:30 a.m. – 8:50 a.m.

4.1 Switching-Frequency Ripple on DC Link Voltage in a Modular Multilevel Converter with Circulating Current Suppressing Control

Y. Li, E. Jones, F. Wang; *University of Tennessee, United States*

8:50 a.m. – 9:10 a.m.

4.2 Unifying and Generating of Space Vector Modulation Sequences for Multilevel Converter
K. Ma, F. Blaabjerg; *Aalborg University, Denmark*

9:10 a.m. – 9:30 a.m.

4.3 Phase-Shifted Modulation Strategy for Voltage Balancing in Neutral-Point Clamped Converter
S. Lee, M. Ferdowsi; *Missouri University of Science and Technology, United States*

9:30 a.m. – 9:50 a.m.

4.4 Design of H-Bridge Based Converter Module Used in Cascaded DSTATCOM
K. Yang[2], Y. Wang[2], H. Yang[1], H. Tao[2], G. Chen[2]; [1]STSAIL Science-technology Co., LTD., China; [2]Zhejiang University, China

9:50 a.m. – 10:10 a.m.

4.5 Modulation Strategies Suitable for a Large Power Voltage Source Converter Combining 3-Level Neutral Point Clamped Power Electronic Building Blocks
J. Chivite-Zabalza, G. Calvo, D. Madariaga, P. Izurza, M. Rodriguez, A. Guerrero; *Ingeteam Power Technology, United States*

Break

10:40 a.m. – 11:00 a.m.

4.6 Analysis of the Relationship Between Switching Frequency and Sub-Module Capacitor Unbalanced Voltage for a Modular Multilevel Converter
Y. Li, E. Jones, F. Wang; *University of Tennessee, United States*

11:00 a.m. – 11:20 a.m.

4.7 Capacitor Voltage Balancing Using Minimum Loss SVPWM for a Five-Level Diode-Clamped Converter
A. Saha, Y. Sozer; *University of Akron, United States*

11:20 a.m. – 11:40 a.m.

4.8 Reduction of DC-Link Capacitor in Case of Cascade Multilevel Converters by Means of Reactive Power Control
G. Gohil, H. Wang, M. Liserre, T. Kerekes, R. Teodorescu, F. Blaabjerg; *Aalborg University, Denmark*

11:40 a.m. – 12:00 p.m.

4.9 A KARNAUGH Mapping Technique for the Modeling of Single Phase Multi String Multi Level Inverter
B. Angirekula, O. Ojo; *Tennessee Technological University, United States*

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 5: Multilevel Inverters

ROOM 200

TRACK: Motor Drives and Inverters

Session Chairs:

Maryam Saeedifard, *Georgia Institute of Technology*

Behrooz Bahrani, *Purdue University*

8:30 a.m. – 8:50 a.m.

5.1 Optimal Control of Modular Multilevel Converters for Low-Speed Operation of Motor Drives
S. Debnath, M. Saeedifard; *Purdue University, United States*

8:50 a.m. – 9:10 a.m.

5.2 A Modified Voltage Balancing Sorting Algorithm for the Modular Multilevel Converter: Evaluation for Staircase and Phase-Disposition PWM
R. Darus[2], J. Pou[2], G. Konstantinou[2], S. Ceballos[1], V. Agelidis[2]; *[1]Tecnalia Corporación Tecnológica, Spain; [2]University of New South Wales, Australia*

9:10 a.m. – 9:30 a.m.

5.3 A Modified Two-Level Three-Phase Quasi-Soft-Switching Inverter
Y. Liu[3], W. Wu[3], F. Blaabjerg[1], H. Chung[2]; *[1]Aalborg University, Denmark; [2]City University of Hong Kong, Hong Kong; [3]Shanghai Maritime University, China*

9:30 a.m. – 9:50 a.m.

5.4 Modelling and Implementation of SVPWM Technique for a Thirteen-Phase Voltage Source Inverter-Sinusoidal Output Waveform
S. Moinoddin[2], H. Abu-Rub[2], A. Iqbal[1]; *[1]Qatar University, Qatar; [2]Texas A&M University at Qatar, Qatar*

TUESDAY

9:50 a.m. – 10:10 a.m.

5.5 A Fault-Tolerant T-Type Three-Level Inverter System

W. Zhang[2], G. Liu[2], D. Xu[2], J. Hawke[1], P. Garg[1], P. Enjeti[1]; *[1]Texas A&M University, United States; [2]Zhejiang University, China*

Break

10:40 a.m. – 11:00 a.m.

5.6 Loss Balancing SVPWM for Active NPC Converters

X. Jing[2], J. He[1], N. Demerdash[1]; *[1]Marquette University, United States; [2]Marquette University / General Motors, United States*

11:00 a.m. – 11:20 a.m.

5.7 A High Resolution Output Voltage Multilevel Inverter Topology with Few Cascade-Connected Cells

S. de Mesquita, F. Antunes, S. Daher; *Universidade Federal do Ceará, Brazil*

11:20 a.m. – 11:40 a.m.

5.8 A PWM Control Strategy for Low-Speed Operation of Three-Level NPC Inverter Based on Bootstrap Gate Drive Circuit

J. Jung, H. Ku, W. Im, J. Kim; *Pusan National University, Korea, South*

11:40 a.m. – 12:00 p.m.

5.9 Engineering Design for Structure and Bus Bar of 1.2MVA Hybrid Clamped Five- Level Converter Module

Y. Dong, H. Luo, P. Sun, C. Li, W. Li, X. He; *Zhejiang University, China*

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 6: Utility Interface Converters

ROOM 201

TRACK: Power Electronics Applications

Session Chairs:

Bilal Akin, *UT Dallas*

Yilmaz Sozer, *University of Akron*

8:30 a.m. – 8:50 a.m.

6.1 Loss Comparison of Different Nine-Switch and Twelve-Switch Energy Conversion Systems

A. Bahman, P. Loh, Z. Qin, F. Blaabjerg; *Aalborg University, Denmark*

8:50 a.m. – 9:10 a.m.

6.2 A New Voltage-Balancing Method for Split-Capacitor Inverters Using Split-Output Front-End Rectifiers in AC-DC-AC Applications

M. Narimani, D. Wijeratne, G. Moschopoulos; *University of Western Ontario, Canada*

9:10 a.m. – 9:30 a.m

6.3 Shunt Active Power Filter with Reduced Number of Inductors

I. Freitas[2], Z. Gomes[2], M. Meira[2], F. Salvadori[2], L. Hartmann[3], C. Jacobina[3], E. dos Santos Jr.[1]; *[1]Purdue School of Engineering and Technology, United States; [2]Universidade Federal da Paraíba, Brazil; [3]Universidade Federal de Campina Grande, Brazil*

9:30 a.m. – 9:50 a.m.

6.4 High Efficiency Switching Sequence and Enhanced Dynamic Regulation for Dab Converters in Solid-State Transformers

G. Oggier[1], M. Ordonez[2]; *[1]Universidad Nacional de Río Cuarto, Argentina; [2]University of British Columbia, Canada*

9:50 a.m. – 10:10 a.m.

6.5 Investigation of Transformer Winding Architectures for High Voltage Capacitor Charging Applications

H. Schneider, P. Thummala, L. Huang, Z. Ouyang, A. Knott, Z. Zhang, M. Andersen; *Technical University of Denmark, Denmark*

Break

10:40 a.m. – 11:00 a.m.

6.6 Design, Measurement and Equivalent Circuit Synthesis of High Power HF Transformer for Three-Phase Composite Dual Active Bridge Topology

K. Mainali[2], A. Tripathi[2], D. Patel[2], S. Bhattacharya[2], T. Challita[1]; *[1]IAP Research, Inc, United States; [2]North Carolina State University, United States*

11:00 a.m. – 11:20 a.m.

6.7 Feasibility Study and Design of Hybrid AC/DC High Power Transmission Considering Unbalanced Line Impedances

B. Liu, X. Shi, F. Wang; *University of Tennessee, United States*

11:20 a.m. – 11:40 a.m.

6.8 Start-Up and Integration of DFIG-Based Wind Farm Using Modular Multilevel VSC-HVDC Transmission System
W. Li[1], Y. Kang[1], G. Tang[2], M. Kong[2]; *[1]Huazhong University of Science and Technology, China; [2]State Grid Company of China, China*

11:40 a.m. – 12:00 p.m.

6.9 Unsymmetrical Fault Correction for Sensitive Loads Utilizing a Current Regulated Inverter
S. Bukhari[1], B. Kwon[1], T. Lipo[2]; *[1]Hanyang University, Korea, South; [2]University of Wisconsin-Madison, United States*

8:30 a.m. – 12:00 p.m.

TECHNICAL SESSION 7: Renewable Energy System Integration

BALLROOM C

TRACK: Renewable Energy Systems

Session Chairs:
Zhong Nie, Chrysler Group LLC
Alex Craig, Fairchild Semiconductor

8:30 a.m. – 8:50 a.m.

7.1 Reactive Power Injection Strategies for Single-Phase Photovoltaic Systems Considering Grid Requirements
Y. Yang, H. Wang, F. Blaabjerg; *Aalborg University, Denmark*

8:50 a.m. – 9:10 a.m.

7.2 Constant Power Generation of Photovoltaic Systems Considering the Distributed Grid Capacity
Y. Yang, F. Blaabjerg, H. Wang; *Aalborg University, Denmark*

9:10 a.m. – 9:30 a.m.

7.3 Fast Voltage Detection Method for the Voltage Ride Through Operation of Grid-Tied Renewable Energy Generation Systems
C. Ma[2], F. Gao[2], G. He[1], G. Li[1]; *[1]China Electric Power Research Institute, China; [2]Shandong University, China*

9:30 a.m. – 9:50 a.m.

7.4 An Active Damping Method Based on Biquad Digital Filter for Parallel Grid-Interfacing Inverters with LCL Filters
X. Lu[3], K. Sun[2], L. Huang[2], M. Liserre[1], F. Blaabjerg[1]; *[1]Aalborg University, Denmark; [2]Tsinghua University, China; [3]University of Tennessee, United States*

9:50 a.m. – 10:10 a.m.

7.5 Comparison of Control Strategies for Doubly Fed Induction Generator Under Recurring Grid Faults
W. Chen[2], F. Blaabjerg[1], N. Zhu[2], M. Chen[2], D. Xu[2]; *[1]Aalborg University, Denmark; [2]Zhejiang University, China*

Break

10:40 a.m. – 11:00 a.m.

7.6 Analysis of the Electromagnetic Transient Time in DFIG During Grid Faults
Q. Huang, X. Zou, L. Tong; *Huazhong University of Science and Technology, China*

11:00 a.m. – 11:20 a.m.

7.7 Virtual Series Impedance Emulation Control for Remote PV or Wind Farms
W. Cao, Y. Ma, J. Wang, F. Wang; *University of Tennessee, United States*

11:20 a.m. – 11:40 a.m.

7.8 A Mode Switching, Multiterminal Converter Topology with Integrated Fluctuating Renewable Energy Source Without Energy Storage
S. Dutta, S. Roy, S. Bhattacharya; *North Carolina State University, United States*

11:40 a.m. – 12:00 p.m.

7.9 A Novel Real-Time and on-Line Computation Algorithm for Characteristic Parameters of Micro-Grids
L. Xiong[1], C. Li[1], F. Zhuo[1], M. Zhu[1], B. Liu[1], H. Zhang[2]; *[1]Xi'an Jiaotong University, China; [2]Xuji Group, China*

9:00 a.m.

Spouse Tour **"A DAY OF ART IN DALLAS'S ARTS DISTRICT"** *Departs*

HOSPITALITY SUITE A (OMNI)

TUESDAY

12:00 p.m. – 5:00 p.m.

Exhibit Hall Open

EXHIBIT HALL A

1:30 p.m. – 2:00 p.m.

Exhibitor Seminars

(For more information, see the Exhibitor Directory)

Mersen
Busbar Technology – Flexbus
ROOM 200

Micrel
Micrel's Micro Power Modules: You Really Can Have It All
ROOM 201

Micrometals
Material Selection and Inductor Design for High Frequency Switching Applications
ROOM 202AB

Semikron
Three-Level Inverter Modules
ROOM 202CD

GMW
Next Generation Rogowski Current Probes
ROOM 203

Yokagawa
Advancements in Dynamic Power Measurement Technology
ROOM 204

2:15 p.m. – 2:45 p.m.

Exhibitor Seminars

VISHAY
Vishay: the Latest Products and Technology
ROOM 200

METHODE
Best Practices for Thermal Management of Power Electronics
ROOM 201

POWEREX
Latest Developments in High Power SiC Modules
ROOM 202AB

COILCRAFT
Innovative Web Tool Dramatically Simplifies Power Inductor Selection
ROOM 202CD

SIMPLIS
Simulation of Digitally Controlled Power Supplies & AC Analysis of PFC Converters
ROOM 203

VENABLE
Stability Analysis of a Digital Controller Based Power Supply using the new Venable Mixed Signal Analyzer.
ROOM 204

3:00 p.m. – 3:30 p.m.

Exhibitor Seminars

MAGNETICS
Advantages of Using Appropriate MAGNETICS Materials
ROOM 200

WURTH
Wireless Power and the Challenges for Power Levels up to 2400 Watts
ROOM 201

EXAR
Universal PMICs to Itelligent Power Systems: The Adoption of Programmable Power
ROOM 202AB

HVR
High Voltage Resistors for Discharge Applications
ROOM 202CD

ANALOG DEVICES
Technological Advancements of Digital Power Controllers
ROOM 203

PICOTEST
New Multi-Port Probe Simplifies Non-Invasive Stability, PDN and Step Load Testing
ROOM 204

3:45 p.m. – 4:15pm

Exhibitor Seminars

INTERSIL
Designing High Bandwidth, Compensation Free, POL Converters with Digital Power
ROOM 200

CREE
Gen 2 Mosfets
ROOM 201

TUESDAY

RIDLEY ENGINEERING
Measuring High Performance Power Supplies
ROOM 202AB

EMWORKS
Transformer Analysis in EMS
ROOM 202CD

COGNIPOWER
PFC AC/DC, More Efficient, Smaller & Less Expensive
ROOM 203

CUI
Solus® Power Topology Applied in a Point-of-Load Dc-Dc Converter
ROOM 204

5:00 p.m. – 6:30 p.m.

Rap Session 1: Smart Grid Infrastructure

(For more information about all of the rap sessions, see page xxx)

BALLROOM A

MODERATOR:
Alix Paultre, *Power Systems Design*

5:00 p.m. – 6:30 p.m.

Rap Session 2: Wide Bandgap Semiconductors vs Silicon in Power Electronics – Is there a value proposition or will silicon continue to be good enough cheap?

BALLROOM B

MODERATOR:
Kevin Parmenter, *Mouser Electronics*

Notes

Wednesday
March 19, 2014

7:00a.m. – 8:00a.m.

Speaker Breakfast

HALL D

8:00a.m. – 3:00 p.m.

Registration

REGISTRATION (HALL A FOYER)

8:00a.m. – 11:00a.m.

Spouse & Guest Hospitality Room Open

HOSPITALITY SUITE A (OMNI)

8:30 a.m. – 10:10a.m.

IS1.2 Evolving Alternative Energy to Mainstream Energy

ROOM 202AB

Session Chairs:
Chavonne Yee
John McManus

8:30a.m. – 8:55a.m.

IS1.2.1 1. Solar Industry Market Overview
Dr. Finlay Colville – Solarbuzz

8:55a.m. – 9:20a.m.

IS1.2.2 Austin Energy Micro-Grid
Dr. Alexis Kaczynksi – Austin Energy

9:20a.m. – 9:45a.m.

IS1.2.3 Utility PV Solar Plant TX
David Devir – KACO

9:45a.m. – 10:10a.m.

IS1.2.4 Skyrocketing Growth in Residential Solar
TBD

8:30 a.m. – 10:10a.m.

IS2.2 Emerging Technologies of Power Transmission

ROOM 202CD

Session Chairs:
Dr. River Li
Dr. Nan Chen

8:30a.m. – 8:55a.m.

IS2.2.1 Grid Connected Converters: Challenges and Future Trends
Dr. Hector Zelaya de la Parra – *ABB Sweden Ltd., Corporate Research*

8:55a.m. – 9:20a.m.

IS2.2.2 STATCOM with Multilevel Converter for AC Transmission Systems
Dr. Martin Pieschel – *Siemens AG, Germany*

9:20a.m. – 9:45a.m.

IS2.2.3 Power Electronic Converter and Protection Solutions for Medium Voltage DC Technologies – DC Interlink From Decentralized Energy Sources to HVDC Transmission
Dr. Daniel Aggeler, Dr. Francisco Canales – *ABB Switzerland Ltd., Corporate Research*

9:45a.m. – 10:10a.m.

IS2.2.4 HV SiC 10kV MOSFET and 15-20kV IGBT Enabled Active Grid Infrastructure
Dr. Subhashish Bhattacharya – *North Carolina State University (NCSU*)

8:30 a.m. – 10:10a.m.

IS3.2 Marketing and Business

ROOM 201C

Session Chairs:
Ada Cheng
Mohan Mankikar

8:30a.m. – 8:55a.m.

IS3.2.1 Predicting Dynamic Markets Demands Frequent Primary Statistics Gathering
Carl Blake – *World Semiconductor Trade Statistics Committee, Power Sources Manufacturers Association, CBK*

WEDNESDAY

8:55a.m. – 9:20a.m.

IS3.2.2 A Comprehensive Assessment of the Indian Power Electronics Market
Dhaval Dalal – *ACP Technologies*

9:20a.m. – 9:45a.m.

IS3.2.3 PSiP & PwrSoC: Taking Stock of the Trials and Triumphs of Adoption that Lie Ahead
Arnold Alderman – *Anagenesis Inc*

9:45a.m. – 10:10a.m.

IS3.2.4 How Preferred Suppliers Meet or Exceed a Customer's Expectation
Randhir Malik – *IBM*

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 8: Non-isolated DC-DC Converters

BALLROOM B

TRACK: DC-DC Converters

Session Chairs:
Cahit Gezgin, *International Rectifier*
Patrick Smeets, *NXP Semiconductors*

8:30a.m. – 8:50a.m.

8.1 FIVR – Fully Integrated Voltage Regulators on 4th Generation Intel® Core™ SoCs
E. Burton, G. Schrom, F. Paillet, J. Douglas, W. Lambert, K. Radhakrishnan, M. Hill; *Intel Corporation, United States*

8:50a.m. – 9:10a.m.

8.2 Adaptive Ripple-Based Constant on-Time Control with Internal Ramp Compensations for Buck Converters
B. Cheng[1], F. Lee[3], P. Mattavelli[2]; *[1]Texas Instruments, United States; [2]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, Italy; [3]Virginia Polytechnic Institute and State University, United States*

9:10a.m. – 9:30a.m.

8.3 1MHz Switching Frequency POL with a Fast Response Digital Controller
Y. Ishizuka[1], K. Mii[1], F. Takenami[1], D. Kanemoto[2]; *[1]Nagasaki University, Japan; [2]University of Yamanashi, Japan*

9:30a.m. – 9:50a.m.

8.4 Optimized Phase Positioning for Minimizing Input Filter Requirements in Single-Input Multiple-Output DC-DC Switch-Mode Power Supplies
J. Weinstein, S. Huerta, Z. Zhao, J. Mincey, Z. Moussaoui; *Exar Corporation, United States*

9:50a.m. – 10:10a.m.

8.5 Constant on-Time DC-DC Converter Using Ripple Injection Filter with Inherent Adaptive Voltage Positioning
T. Miyazaki, T. Ogawa; *Toshiba Corporation, Japan*

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 9: Wide Bandgap Devices in DC-DC Converters

BALLROOM C

TRACK: DC-DC Converters

Session Chairs:
Tom Harvey, International Rectifier
Zhong Nie, Chrysler Group LLC

8:30a.m. – 8:50a.m.

9.1 Evaluation of Gallium Nitride Transistors in High Frequency Resonant and Soft-Switching DC-DC Converters
D. Reusch, J. Strydom; *Efficient Power Conversion Corporation, United States*

8:50a.m. – 9:10a.m.

9.2 A 130 W 95%-Efficiency 1 MHz Non-Isolated Boost Converter Using PWM Zero-Voltage Switching and Enhancement-Mode GaN FETs
J. Xue, L. Cong, H. Lee; *University of Texas at Dallas, United States*

9:10a.m. – 9:30a.m.

9.3 Advantages of GaN in a High-Voltage Resonant LLC Converter
M. Seeman, S. Bahl, D. Anderson, G. Shah; *Texas Instruments, United States*

9:30a.m. – 9:50a.m.

9.4 Normally-Off GaN-on-Si Multi-Chip Module Boost Converter with 96% Efficiency and Low Gate and Drain Overshoot
B. Hughes, J. Lazar, S. Hulsey, M. Musni, D. Zehnder, A. Garrido, R. Khanna, R. Chu, S. Khalil, K. Boutros; *HRL Laboratories LLC, United States*

9:50a.m. – 10:10a.m.

9.5 Design and Experimental Analysis of a 1 kW, 800 kHz All-SiC Boost DC-DC Converter
X. Zhong, X. Wu, W. Zhou, S. Cheng, K. Sheng; *Zhejiang University, China*

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 10: Device and Thermal Modeling

ROOM 203

TRACK: Modeling, Simulation, and Control
Session Chairs:
Pourya Shamsi, *Missouri S&T*
Alex Craig, *Fairchild Semiconductor*

8:30a.m. – 8:50a.m.

10.1 Advanced SPICE Models Applied to High Power GaN Devices and Integrated GaN Drive Circuits
J. Roberts, H. Lafontaine, C. McKnight-MacNeil; *GaN Systems Inc., Canada*

8:50a.m. – 9:10a.m.

10.2 An Inductive-Switching Loss Model Accounting for Source Inductance and Switching Loop Inductance
Z. Chen; *ON Semiconductor, United States*

9:10a.m. – 9:30a.m.

10.3 Analytical Solution for Temperature Distribution of Power Semiconductor Devices Mounted on Rectangular Base Plate
X. Wu, S. Krishnamurthy; *United Technologies Research Center, United States*

9:30a.m. – 9:50a.m.

10.4 An Effective Heat Propagation Path-Based Online Adaptive Thermal Model for IGBT Modules
Z. Wang, W. Qiao, B. Tian, L. Qu; *University of Nebraska-Lincoln, United States*

9:50a.m. – 10:10a.m.

10.5 Modeling, Design and Performance of Integrated Power Electronics Using MEMS Toroidal Inductors
M. Araghchini, J. Lang; *Massachusetts Institute of Technology, United States*

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 11: Packaging for Higher Performance

ROOM 204

TRACK: Packaging and Material Science

Session Chairs:
Khurram Afridi, U*niversity of Colorado Boulder*
Bulent Sarlioglu, *University of Wisconsin – Madison*

8:30a.m. – 8:50a.m.

11.1 Double-Sided Nickel-Tin Transient Liquid Phase Bonding for Double-Sided Cooling
S. Yoon[2], K. Shiozaki[2], T. Kato[1]; *[1]Toyota Motor Corporation, Japan; [2]Toyota Research Institute of North America, United States*

8:50a.m. – 9:10a.m.

11.2 Critical Design Issues of Retrofit Light-Emitting Diode (LED) Light Bulb
S. Li[2], H. Chen[2], S. Tan[2], S. Hui[2], E. Waffenschmidt[1]; *[1]Fachhochschule Köln, Germany; [2]University of Hong Kong, Hong Kong*

9:10a.m. – 9:30a.m.

11.3 Design Considerations for GaN HEMT MultiChip Half-Bridge Module for High-Frequency Power Converters
F. Luo[3], Z. Chen[3], L. Xue[3], P. Mattavelli[2], D. Boroyevich[3], B. Hughes[1]; *[1]HRL Laboratories LLC, United States; [2]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, United States; [3]Virginia Polytechnic Institute and State University, United States*

9:30a.m. – 9:50a.m.

11.4 Misconception of Thermal Spreading Angle and Misapplication to IGBT Power Modules
Y. Xu, D. Hopkins; *North Carolina State University, United States*

9:50a.m. – 10:10a.m.

11.5 Withdrawn

WEDNESDAY

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 12: System Integration I

BALLROOM A

TRACK: System Integration

Session Chairs:

John Vigars, *Fairchild*

Chris Bridge, *Simplis Technologies*

8:30a.m. – 8:50a.m.

12.1 Noise Susceptibility of Delta-Vbe Temperature Sensors in Highly Integrated Power Converters

D. Murray, K. Rinne; *Powervation Ltd., Ireland*

8:50a.m. – 9:10a.m.

12.2 A Flexible and Cost Effective Gate Drive Platform for Rapid Prototyping

A. Shea, D. Ludois; *University of Wisconsin-Madison, United States*

9:10a.m. – 9:30a.m.

12.3 Analysis and Reduction of Common Mode EMI Noise for Resonant Converters

Y. Yang, D. Huang, F. Lee, Q. Li; *Virginia Polytechnic Institute and State University, United States*

9:30a.m. – 9:50a.m.

12.4 On-Chip Integrated Cell-Level Power Manangement Architecture with MPPT for PV Solar System

A. Shawky[1], F. Helmy[1], M. Orabi[1], J. Abu Qahouq[2], Z. Dang[2]; *[1]Aswan University, Egypt; [2]University of Alabama, United States*

9:50a.m. – 10:10a.m.

12.5 Terminal Admittance Based Stability Criterion for Multi-Module DC Distributed System

F. Liu, J. Liu, H. Zhang, D. Xue, Q. Dou; *Xi'an Jiaotong University, China*

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 13: Multilevel/Matrix Conv

ROOM 200

TRACK: Power Electronics Applications

Session Chairs:

Mahesh Krishnamurty, *IIT*

Yilmaz Sozer, *University of Akron*

8:30a.m. – 8:50a.m.

13.1 Realization of a SiC Module-Based Indirect Matrix Converter with Minimum Parasitic Inductances

J. Hayes, A. Escobar-Mejía, J. Balda, A. Dutta, S. Ang; *University of Arkansas, United States*

8:50a.m. – 9:10a.m.

13.2 Space Vector Pulse Width Modulation Scheme for Three to Seven Phase Direct Matrix Converter

K. Rahman[1], A. Iqbal[1], A. Anad Abduallah[1], R. Al-ammari[1], H. Abu-Rub[2]; *[1]Qatar University, Qatar; [2]Texas A&M University at Qatar, Qatar*

9:10a.m. – 9:30a.m.

13.3 A Comprehensive Cell Capacitor Energy Control Strategy of a Modular Multilevel Converter (MMC) Without a Stiff DC Bus Voltage Source

S. Cui, S. Kim, J. Jung, S. Sul; *Seoul National University, Korea, South*

9:30a.m. – 9:50a.m.

13.4 Principle, Conrol and Comparison of Modular Multilevel Converters (MMCs) with DC Short Circuit Fault Ride-Through Capability

S. Cui, S. Kim, J. Jung, S. Sul; *Seoul National University, Korea, South*

9:50a.m. – 10:10a.m.

13.5 1200V Cascaded HVIC Gate Driver for Three-Level Neutral-Point-Clamped Inverter IPM

I. Jeong[1], B. Suh[1], K. Smedley[2]; *[1]Samsung Electro-Mechanics, Korea, South; [2]University of California, Irvine, United States*

8:30 a.m. – 10:10a.m.

TECHNICAL SESSION 14: PV Micro-Inverters

BALLROOM B

TRACK: Renewable Energy Systems

SESSION CHAIRS:
Van Niemela,
Xu She, *NC State*

8:30a.m. – 8:50a.m.

14.1 Enhancing Micro-Inverter Energy Capture with Sub-Module Differential Power Processing
S. Qin, A. Morrison, R. Pilawa-Podgurski; *University of Illinois at Urbana-Champaign, United States*

8:50a.m. – 9:10a.m.

14.2 Fast Reconfigurable Photovoltaic Switching Cell Integrated Within DC-DC Converters
J. Huang, Y. Zhao, B. Lehman; *Northeastern University, United States*

9:10a.m. – 9:30a.m.

14.3 A High Voltage-Gain LLC Micro-Converter with High Efficiency in Wide Input Range for PV Applications
H. Gui[1], Z. Zhang[1], X. He[1], Y. Liu[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Queen's University, Canada*

9:30a.m. – 9:50a.m.

14.4 A Dual-Active-Bridge Based Bi-Directional Micro-Inverter with Integrated Short-Term Li-Ion Ultra-Capacitor Storage and Active Power Smoothing for Modular PV Systems
S. Poshtkouhi[2], M. Fard[2], H. Hussein[2], L. Marcelino Dos Santos[2], O. Trescases[2], M. Varlan[1], T. Lipan[1]; *[1]Solantro Semiconductor, Canada; [2]University of Toronto, Canada*

9:50a.m. – 10:10a.m.

14.5 Variable Boundary Dual Mode Current Modulation Scheme for Three-Phase Micro-Inverter
A. Amirahmadi, U. Somani, L. Chen, N. Kutkut, I. Batarseh; *University of Central Florida, United States*

10:00a.m. – 2:00 p.m.

Exhibit Hall Open

EXHIBIT HALL A

10:30a.m. – 11:00a.m.

Exhibitor Seminars

INTERNATIONAL RECTIFIER
Status of GaNpowIR® Product Development at IR
ROOM 200

MICROCHIP
Maximizing Power Conversion Efficiency Spanning Watts to Kilowatts
ROOM 201

RENESAS
Renesas Next Generation IGBTs: An Up-close Look
ROOM 202AB

OPAL-RT
eFPGAsim, Features & Applications
ROOM 202CD

MOUSER
Power Applications & New Technology Information/ Resources from Mouser Electronics
ROOM 203

FINETEST
Power Supply Testing
ROOM 204

11:15a.m. – 11:45a.m.

Exhibitor Seminars

PLEXIM
Multi-Domain Modeling with PLECS
ROOM 200

UNITED SILICON
Silicon Carbide Transistors: Futuristic Potential or Practical Solution?
ROOM 201

PACIFIC SOWA
Atmix's Soft Magnetic Powders
ROOM 202AB

SONOSCAN
IGBT Inspection Using Acoustic Micro Imaging
ROOM 202CD

PANASONIC
Widegap Semiconductor Technologies- GaN and SiC
ROOM 203

WEDNESDAY

C-MOTIVE
Putting Capacitive Technology to Work: C-Motive's Electrostatic Machinery
ROOM 204

2:00 p.m. – 5:30 p.m.

IS1.3 Latest Advances in Nanotechnology Applications

ROOM 202AB

Session Chairs:
Kevin Parmenter
Chuck Mullett

2:00 p.m. – 2:25 p.m.
IS1.3.1 **Overview of Recent Patent Activity in Nanotech-Enabled Power Systems**
Jeffrey Rosedale – *Baker & Hostetler LLP*

2:25 p.m. – 2:50 p.m.
IS1.3.2 **Tailored Single Wall Carbon Nanotube Materials for Transparent Conductive Film Applications**
Ricardo Prada Silvy – *SouthWest NanoTechnologies*

2:50 p.m. – 3:15 p.m.
IS1.3.3 **Science and Application of Nanosilver Chip-Bonding Material**
Guo-Quan Lu – *Virginia Tech*

3:15 p.m. – 3:40 p.m.
IS1.3.4 **Nano-Devices for Enhanced Thermal Energy Storage, Cooling and Sensing**
Debjyoti Banerjee – *Texas A&M University*

Break

4:10 p.m. – 4:35 p.m.
IS1.3.5 **Enhanced Power Systems Through Nanotechnology**
Dale Teeters – *University of Tulsa*

4:35 p.m. – 5:00 p.m.
IS1.3.6 **Future Electronics: Incorporation of Photonics and Plasmonics at the Nanoscale**
Robert Magnusson – *University of Texas at Arlington*

5:00 p.m. – 5:25 p.m.
IS1.3.7 **PSMA Nanotechnology Education Program**
J. Michael Rice – *Aerolearn, Inc*

2:00 p.m. – 5:30 p.m.

IS2.3 Key Issues in Vehicle Power Electronics

ROOM 202CD

Session Chair:
Ralph Taylor

2:00 p.m. – 2:25 p.m.
IS2.3.1 **Thermal Management for Power Electronics used in Electric Drive Vehicles**
Dr. Sukhvinder Kang – *Aavid Thermalloy*

2:25 p.m. – 2:50 p.m.
IS2.3.2 **Joining Materials for High Reliability Power Electronics in Electric Drive Vehicles**
Dr. Patrick McCluskey – *University of Maryland*

2:50 p.m. – 3:15 p.m.
IS2.3.3 **Power Connectors, General Fundamentals and Design Guide Related to Transportation Power Electronics**
Jay Sandige, Michael Wingard – *Positronics/ Amphenol*

3:15 p.m. – 3:40 p.m.
IS2.3.4 **Planar Magnetics, an Ideal Technology for Automotive Electrification**
Jim Marinos – *Payton Group*

Break

4:10 p.m. – 4:35 p.m.
IS2.3.5 **Developments in Stationary and Dynamic Wireless Charging Applications**
Omer Onar – *Oak Ridge National Laboratory*

4:35 p.m. – 5:00 p.m.
IS2.3.6 **Solving the Safety Problems of Today's EV Battery Charger**
Wally Rippel – *AC Propulsion Inc.*

WEDNESDAY

2:00 p.m. – 5:30 p.m.

IS3.3 Controls and Passive Components

ROOM 201C

Session Chair:

Jim Spangler

2:00 p.m. – 2:25 p.m.

IS3.3.1 **Aluminum Extrusion Design and the Role it Plays in High Performance Cooling Solutions for Power Electronics**
Mike Tozier – *Sapa Extrusion North America*

2:25 p.m. – 2:50 p.m.

IS3.3.2 **Robust CCM Interleaved PFC Controller for Industrial Application**
Wen Chien – *Fairchild Semiconductor*

2:50 p.m. – 3:15 p.m.

IS3.3.3 **Tripling the Power of PoE – Opening New Opportunities and Creating New Challenges**
Mr. Antoun – *Akros Silicon*

3:15 p.m. – 3:40 p.m.

IS3.3.4 **Power Supply Efficiency Estimation in PFM mode for Light-load Applications**
Amod Vaze – *Texas Instruments*

Break

4:10 p.m. – 4:35 p.m.

IS3.3.5 **Behind the Spec of Power Inductors**
Roland Kratz – *Wurth Elecronics*

4:35 p.m. – 5:00 p.m.

IS3.3.6 **MADMIX: The Standard for Measuring SMPS Inductors**
Mike Wens – *MinDCet NV*

5:00 p.m. – 5:25 p.m.

IS3.3.7 **Improved COT Controller with Emulated ESR and DC Correction**
Shahin Maloyan – *Exar*

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 15: PV MPPT and Battery Storage

ROOM 203

TRACK: Renewable Energy Systems

Session Chairs:

Morgan Kiani, *Texas Christian University*

Robert Pilawa, *University of Illinois at Urbana-Champaign*

2:00 p.m. – 2:20 p.m.

15.1 **Single-Output-Sensor on-Chip Integrated MPPT for PV Solar System Power Management**
E. Goma[1], M. Orabi[1], E. Hasaneen[1], J. Abu Qahouq[2]; *[1]Aswan University, Egypt; [2]University of Alabama, United States*

2:20 p.m. – 2:40 p.m.

15.2 **A Global MPPT Algorithm for PV System Under Rapidly Fluctuating Irradiance**
R. Yeung[1], H. Chung[1], S. Chuang[2]; *[1]City University of Hong Kong, Hong Kong; [2]ProVista Technology Limited, Hong Kong*

2:40 p.m. – 3:00 p.m.

15.3 **Individual MPPTs of Single-Phase Three-Level Split DC-Bus Inverter**
H. Shin, J. Ha; *Seoul National University, Korea, South*

3:00 p.m. – 3:20 p.m.

15.4 **A Multi-Stage MPPT Algorithm for PV Systems Based on Golden Section Search Method**
R. Shao, R. Wei, L. Chang; *University of New Brunswick, Canada*

3:20 p.m. – 3:40 p.m.

15.5 **A New Power Stage Architecture and Control Scheme to Optimize Maximum Power Point Tracking for Photovoltaic Systems**
C. Hsu[1], B. Lehman[1], T. Qian[2]; *[1]Northeastern University, United States; [2]Tongji University, China*

Break

4:10 p.m. – 4:30 p.m.

15.6 Distributed PV- Battery Architectures with Reconfigurable Power Conversion Units
I. Mazhari, M. Chamana, B. Chowdhury, B. Parkhideh; *University of North Carolina, Charlotte, United States*

4:30 p.m. – 4:50 p.m.

15.7 A Comprehensive Study of Autonomous PV System with Battery Storage Providing Power for a General AC Load
M. Khayamy, O. Ojo, E. Sota; *Tennessee Technological University, United States*

4:50 p.m. – 5:10 p.m.

15.8 Coordinate Control of Parallel Connected Power Conditioning System for Battery Energy Storage System in Microgrid
M. Lu, S. Duan, C. Chen, J. Cai, L. Sun; *Huazhong University of Science and Technology, China*

5:10 p.m. – 5:30 p.m.

15.9 Capacitor-Less Photovoltaic (PV) Cell-Level Power Balancing Using Diffusion Charge Redistribution
A. Chang, A. Avestruz, S. Leeb; *Massachusetts Institute of Technology, United States*

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 16: Magnetic Components, Design and Characterization

BALLROOM A

TRACK: Devices and Components

Session Chairs:
Steve Carlsen, *Raytheon*
Matt Wilkowski, *Enperion*

2:00 p.m. – 2:20 p.m.

16.1 Method for Introducing Bias Magnetization in Ungaped Cores: "The Saturation-Gap"
A. Revilla Aguilar, S. Munk-Nielsen; *Aalborg University, Denmark*

2:20 p.m. – 2:40 p.m.

16.2 Gapped Transformer Design Methodology and Implementation for LLC Resonant Converters
J. Zhang[2], W. Hurley[2], W. Wolfle[1]; *[1]Convertec Ltd., Ireland; [2]National University of Ireland, Galway, Ireland*

2:40 p.m. – 3:00 p.m.

16.3 Design and Implementation of PCB Inductors with Litz-Wire Structure for Conventional-Size Large-Signal Domestic Induction Heating Applications
I. Lope, C. Carretero, J. Acero, R. Alonso, J. Burdío; *Universidad de Zaragoza, Spain*

3:00 p.m. – 3:20 p.m.

16.4 Realistic Litz Wire Characterization Using Fast Numerical Simulations
R. Zhang[2], J. White[2], J. Kassakian[2], C. Sullivan[1]; *[1]Dartmouth College, United States; [2]Massachusetts Institute of Technology, United States*

3:20 p.m. – 3:40 p.m.

16.5 New Core Loss Measurement Method with Partial Cancellation Concept
D. Hou, M. Mu, F. Lee, Q. Li; *Virginia Polytechnic Institute and State University, United States*

Break

4:10 p.m. – 4:20 p.m.

16.6 Wire Bonded MEMS-Scale on-Chip Transformers
A. Moazenzadeh, N. Spengler, V. Badilita, J. Korvink, U. Wallrabe; *Albert-Ludwigs-Universität Freiburg, Germany*

4:30 p.m. – 4:50 p.m.

16.7 A New Model for Designing Multi-Hole Multi-Permeability Nonlinear LTCC Inductors
L. Wang, Z. Hu, Y. Qiu, H. Wang, Y. Liu; *Queen's University, Canada*

4:50 p.m. – 5:10 p.m.

16.8 Silicon-Embedded Toroidal Inductors with Magnetic Cores: Design Methodology and Experimental Validation
X. Yu, J. Kim, F. Herrault, M. Allen; *Georgia Institute of Technology, United States*

5:10 p.m. – 5:30 p.m.

16.9 Optimization of Windings in PFC Boosts and PWM Inverters to Maximize Converter Efficiency
T. Delaforge[1], H. Chazal[2], R. Pasterczyk[1]; *[1]Schneider Electric, France; [2]Université de Grenoble / G2Elab, France*

WEDNESDAY

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 17: AC Motor drives

ROOM 201

TRACK: Motor Drives and Inverters

Session Chairs:

Pourya Shamsi, *Missouri S&T*

Zobair Roohani, *International Rectifier*

2:00 p.m. – 2:20 p.m.

17.1 Switched Doubly-Fed Machine Propulsion Drive

A. Banerjee, A. Chang, K. Surakitbovorn, S. Leeb, J. Kirtley Jr.; *Massachusetts Institute of Technology, United States*

2:20 p.m. – 2:40 p.m.

17.2 Impact of Stator Grounding in Low Power Single-Phase EC-Motors

S. Schroth[1], D. Bortis[2], J. Kolar[1]; *[1]Eidgenössische Technische Hochschule Zürich, Switzerland; [2]Enertronics GmbH, Switzerland*

2:40 p.m. – 3:00 p.m.

17.3 Inverter Characterization for Intermittent and Peak Duty Motor Drives

V. Buyukdegirmenci, P. Krein; *University of Illinois at Urbana-Champaign, United States*

3:00 p.m. – 3:20 p.m.

17.4 Saturation Controller-Based Ripple Reduction for Direct Torque Controlled Permanent-Magnet Synchronous Machines

Z. Zhang, W. Qiao, L. Qu; *University of Nebraska-Lincoln, United States*

3:20 p.m. – 3:40 p.m.

17.5 EMI Noise Mode Transformation Due to Propagation Path Unbalance in Three-Phase Motor Drive System and its Implication to EMI Filter Design

J. Xue, F. Wang, B. Guo; *University of Tennessee, United States*

Break

4:10 p.m. – 4:30 p.m.

17.6 Space-Vector-Based Hybrid PWM Technique to Reduce Peak-to-Peak Torque Ripple in Induction Motor Drives

P. Hari, G. Narayanan; *Indian Institute of Science, Bangalore, India*

4:30 p.m. – 4:50 p.m.

17.7 Bidirectional PMSM Drive Employing a Three Level ANPC Inverter and a Multi-Phase Interleaved DC/DC Converter for Hybrid Electric Vehicles

S. Bolognani[1], M. Morandin[1], S. Calligaro[2], R. Petrella[2], A. Pevere[2]; *[1]Università degli Studi di Padova, Italy; [2]Università di Udine, Italy*

4:50 p.m. – 5:10 p.m.

17.8 Maximum Torque Per Ampere Control for Interior Permanent Magnet Motors Using DC Link Power Measurement

A. Ahmed[2], Y. Sozer[2], M. Hamdan[1]; *[1]Bendix CVS, United States; [2]University of Akron, United States*

5:10 p.m. – 5:30 p.m.

17.9 Novel Topology and Control of Single Inverter System for Two Permanent Magnet Synchronous Machines

Y. Kim, J. Ha; *Seoul National University, Korea, South*

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 18: Industrial Converters

BALLROOM B

TRACK: Power Electronics Applications

Session Chairs:

Paul Schimel, *International Rectifier*

Bilal Akin, *UT Dallas*

2:00 p.m. – 2:20 p.m.

18.1 Online Frequency Response Analysis: a Powerful Plug-in Tool for Compensation Design & Health Assessment of Digitally Controlled Power Converters

M. Bhardwaj[1], S. Choudhury[1], R. Poley[1], B. Akin[2]; *[1]Texas Instruments, United States; [2]University of Texas at Dallas, United States*

2:20 p.m. – 2:40 p.m.

18.2 Uniform Single-Sided Induction Heating Using Multiphase, Multi-Resonant Halbach Windings

A. Banerjee, A. Avestruz, K. Surakitbovorn, A. Chang, S. Leeb; *Massachusetts Institute of Technology, United States*

2:40 p.m. – 3:00 p.m.

18.3 SiC BJT-Based Full-ZCS Quasi-Resonant Converter with Improved Efficiency for Induction Heating Applications
H. Sarnago, O. Lucía, A. Mediano, J. Burdío; *Universidad de Zaragoza, Spain*

3:00 p.m. – 3:20 p.m.

18.4 General Optimal Design Method for Series-Series Resonant Tank in Loosely-Coupled Wireless Power Transfer Applications
I. Nam, R. Dougal, E. Santi; *University of South Carolina, United States*

3:20 p.m. – 3:40 p.m.

18.5 Resonant Switched-Capacitor Voltage Regulator with Ideal Transient Response
A. Cervera, M. Peretz; *Ben-Gurion University of the Negev, Israel*

Break

4:10 p.m. – 4:30 p.m.

18.6 A Current-Fed Asymmetric LLCC Resonant Converter for DBD Applications
S. Hao, C. Zhang, T. Guo, X. Liu, S. Hu, J. Liu, X. He; *Zhejiang University, China*

4:30 p.m. – 4:50 p.m.

18.7 A New High Efficiency Isolated Bi-Directional DC-DC Converter for DC-Bus and Battery-Bank Interface
X. Yu, P. Yeaman; *Vicor Corporation, United States*

4:50 p.m. – 5:10 p.m.

18.8 Adaptive DC-DC Converter for 4G Macro-Cell Base Station
J. Retrouvey[2], P. Maugars[2], N. Luan Le[2], P. Descamps[1]; *[1]LaMIPS, France; [2]NXP Semiconductors, France*

5:10 p.m. – 5:30 p.m.

18.9 A Negative Voltage Supply for High-Side Switches Using Buck-Boost Bootstrap Circuitry
J. Lee[1], S. Chmielus[1], C. Won[2]; *[1]Infineon Technology, Germany; [2]SungKyunKwan University, Korea, South*

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 19: Three-Phase AC-DC Converters

BALLROOM C

TRACK: AC-DC Converters

Session Chairs:

Dusty Becker, *Emerson Network Power*

Carl Walding, *Fairchild Semiconductor*

2:00 p.m. – 2:20 p.m.

19.1 A New Interleaved Three-Phase Single-Stage PFC AC-DC Converter with Flying Capacitor
M. Narimani, G. Moschopoulos; *University of Western Ontario, Canada*

2:20 p.m. – 2:40 p.m.

19.2 High Efficiency Paralleled Three-Phase Current Source Front-End Rectifiers for Data Center Power Supplies with Current Balancing and Hot-Swap
F. Xu, B. Guo, Z. Xu, L. Tolbert, F. Wang, B. Blalock; *University of Tennessee, United States*

2:40 p.m. – 3:00 p.m.

19.3 Power Distribution in a 13 kW Three-Phase Rectifier System: Impact on Weight, Volume and Efficiency
J. Molina[2], S. Zhao[2], M. Silva[2], J. Oliver[2], P. Alou[2], J. Torres[1], F. Arévalo[1], O. García[2], J. Cobos[2]; *[1]INDRA, Spain; [2]Universidad Politécnica de Madrid, Spain*

3:00 p.m. – 3:20 p.m.

19.4 Input Impedance Improvement by Using Digital Compensation Strategy for High Power Density Rectifiers with Wide Load Operation
S. Geng, F. Wang, L. Hang, Y. Wang; *Shanghai Jiao Tong University, China*

3:20 p.m. – 3:40 p.m.

19.5 Design and Experimental Verification of a Third Harmonic Injection Rectifier Circuit Using a Flying Converter Cell
M. Hartmann[1], R. Fehringer[1], M. Makoschitz[2], H. Ertl[2]; *[1]Schneider Electric, Austria; [2]Technische Universität Wien, Austria*

Break

4:10 p.m. – 4:30 p.m.

19.6 Three-Phase Unidirectional Buck-Type Third Harmonic Injection Rectifier Concepts
T. Soeiro[1], G. de Sousa[2], M. Ortmann[2], M. Heldwein[2]; *[1]ABB Switzerland Ltd., Switzerland; [2]Universidade Federal de Santa Catarina, Brazil*

4:30 p.m. – 4:50 p.m.

19.7 Performance Comparison of PI and P Compensation in Average-Current-Controlled Three-Phase Six-Switch Boost PFC Rectifier
L. Huber, M. Kumar, M. Jovanovic; *Delta Products Corporation, United States*

4:50 p.m. – 5:10 p.m.

19.8 Three-Level TAIPEI Rectifier
Y. Jang, M. Jovanovic, J. Ruiz; *Delta Products Corporation, United States*

5:10 p.m. – 5:30 p.m.

19.9 Isolated Swiss-Forward Three-Phase Rectifier for Aircraft Applications
M. Silva, N. Hensgens, J. Oliver, P. Alou, O. García, J. Cobos; *Universidad Politécnica de Madrid, Spain*

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 20: Improved Power Quality & Stability Approaches in Power Converter Application

ROOM 200

TRACK: Power Electronics for Utility Interface

Session Chairs:

Yaosuo Xue, *Siemens Corporate Research*

Shuo Wang, *University of Texas at San Antonio*

2:00 p.m. – 2:20 p.m.

20.1 Indirect Voltage Control Method for Single Phase DC/AC Converters
M. Karimi-Ghartemani; *Mississippi State University, United States*

2:20 p.m. – 2:40 p.m.

20.2 A Unified Control Scheme for Harmonic Elimination in the Front End Converter of a 13.8 kV, 100 kVA Transformerless Intelligent Power Substation Grid Tied with LCL Filter
S. Madhusoodhanan[2], S. Bhattacharya[2], K. Hatua[1]; *[1]Indian Institute of Technology Madras, India; [2]North Carolina State University, United States*

2:40 p.m. – 3:00 p.m.

20.3 Efficient Single Phase Power Factor Improvement Strategy for Microgrid Operation
S. Anwar, A. Elrayyah, Y. Sozer; *University of Akron, United States*

3:00 p.m. – 3:20 p.m.

20.4 New Current Control Strategy for Local Converter Under Distorted Grid Conditions
K. Lee, Y. Lee, J. Ha; *Seoul National University, Korea, South*

3:20 p.m. – 3:40 p.m.

20.5 A Single-Phase Shunt Active Power Filter with an Improved Modulated Carrier Control
G. Son, H. Kim, B. Cho; *Seoul National University Power Electronics Center, Korea, South*

Break

4:10 p.m. – 4:30 p.m.

20.6 Distributed Power Balance Strategy for DC/DC Converters in Solid State Transformer
X. Yu[2], X. She[2], A. Huang[2], L. Liu[1]; *[1]ABB Inc., United States; [2]North Carolina State University, United States*

4:30 p.m. – 4:50 p.m.

20.7 A Distribution System Harmonic Compensation Approach Using DG-Grid Interfacing Converters at Low Switching Frequency
X. Wen, Y. Li, J. He; *University of Alberta, Canada*

4:50 p.m. – 5:10 p.m.

20.8 Single-Phase Active Power Filter for Selective Harmonic Elimination Based on Synchronous Frame Control System
I. Freitas[2], Z. Gomes[2], M. Meira[2], F. Salvadori[2], L. Hartmann[2], F. Carvalho[2], D. Fernandes[2], E. dos Santos Jr.[1]; *[1]Purdue School of Engineering and Technology, United States; [2]Universidade Federal da Paraíba, Brazil*

5:10 p.m. – 5:30 p.m.

20.9 Small-Signal Modeling of a Three-Phase Isolated Inverter with Both Voltage and Frequency Droop Control
M. Rasheduzzaman, J. Mueller, J. Kimball; *Missouri University of Science and Technology, United States*

WEDNESDAY

2:00 p.m. – 5:30 p.m.

TECHNICAL SESSION 21: Control Loops for Dc-Dc Converters

ROOM 204

TRACK: Modeling, Simulation, and Control

Session Chair:

Omer Onar, *Oak Ridge National Laboratory*

2:00 p.m. – 2:20 p.m.

21.1 Unified Equivalent Circuit Model of V² Control

S. Tian, F. Lee, Q. Li, Y. Yan; *Virginia Polytechnic Institute and State University, United States*

2:20 p.m. – 2:40 p.m.

21.2 Frequency Compensation and Power Stage Design for Buck Converters to Meet Load Transient Specifications

S. Bag[1], S. Mukhopadhyay[1], R. Sheehan[3], S. Samanta[2], T. Roy[4]; *[1]Indian Institute of Technology, Kharagpur, India; [2]National Institute of Technology Rourkela, India; [3]Texas Instruments, United States; [4]University of Central Florida, United States*

2:40 p.m. – 3:00 p.m.

21.3 Small-Signal Modeling and Controller Design of an Isolated Quasi-Switched-Capacitor DC/DC Converter

X. Zhang, F. Guo, C. Yao, H. Li, P. Xu, J. Wang; *Ohio State University, United States*

3:00 p.m. – 3:20 p.m.

21.4 Design Considerations and Small Signal Modeling of the Flyback Converter Using Second Stage LC Filtering Circuit

L. Hua, J. Guo, R. Chung; *Fairchild Semiconductor, United States*

3:20 p.m. – 3:40 p.m.

21.5 State-Trajectory Control of LLC Converter Implemented by Microcontroller

C. Fei, W. Feng, F. Lee, Q. Li; *Virginia Polytechnic Institute and State University, United States*

Break

4:10 p.m. – 4:30 p.m.

21.6 A Multivariable Auto-Tuning Digital Controller for Switching Power Converters

W. Huang, J. Abu Qahouq; *University of Alabama, United States*

4:30 p.m. – 4:50 p.m.

21.7 Autotuning Technique for Digital Constant on-Time Controllers

S. Saggini[3], M. Loghi[3], O. Zambetti[1], A. Zafarana[1], L. Corradini[2]; *[1]STMicroelectronics, Italy; [2]Università degli Studi di Padova, Italy; [3]Università di Udine, Italy*

4:50 p.m. – 5:10 p.m.

21.8 Modeling and Autotuning of AVP Control with Inductor DCR Current Sensing

P. Liu, F. Lee, Q. Li; *Virginia Polytechnic Institute and State University, United States*

5:10 p.m. – 5:30 p.m.

21.9 Modeling, Dynamic Analysis and Digital Control Design of a New Current Auto Zero Master-Less Current Shared Converters

B. AlMukhtar, K. Rinne, E. Sheridan; *Powervation Ltd., Ireland*

6:30 p.m. – 10:30 p.m.

Jersey & Jeans Evening Social Event

Buses will depart from the Convention Center Entrance at 6:30 p.m.

AT&TSTADIUM

Thursday
March 20, 2014

7:00 a.m. – 8:00 a.m.

Speaker Breakfast

HALL D

7:00 a.m. – 8:00 a.m.

Poster Presenter Breakfast

BALLROOM B

8:00 a.m. – 12:00 p.m.

Registration

REGISTRATION (HALL A FOYER)

8:30 a.m. – 11:20 a.m.

IS1.4 Energy Storage and the Power Converters that Control Energy Storage

ROOM 202AB

Session Chair:

Dusty Becker

8:30 a.m. – 8:55 a.m.

IS1.4.1 **The Role of Energy Storage in Power Management**
Edward Herbert – *PSMA Energy Efficiency Committee*

8:55 a.m. – 9:20 a.m.

IS1.4.2 **Batteries and Their Control**
Logan Motloch – *Xtreme Power*

9:20 a.m. – 9:45 a.m.

IS1.4.3 **Using Ultracapacitors for Frequency Regulation**
Bryce Gregory – *Ioxus, Inc.*

9:45 a.m. – 10:10 a.m.

IS1.4.4 **Other Energy Storage Devices**
Laszlo Lakatos – *HYXOS Innovations*

Break

10:40 a.m. – 11:05 a.m.

IS1.4.5 **Using DC Microgrids for Energy Storage Integration Zero-Net-Energy Buildings**
Brian Patterson – *Emerge Alliance*

11:05 a.m. – 11:30 a.m.

IS1.4.6 **Energy Storage and its Control in "The Smart Grid."**
Joe Matamoros – *STEM*

8:30 a.m. – 11:20 a.m.

IS2.4 Wide Band Gap Devices

ROOM 202CD

Session Chair:

Dennis Stephens

8:30 a.m. – 8:55 a.m.

IS2.4.1 **Wide Band Gap (WBG) Power Devices for High-Density Power Converters – Excitement and Reality**
Dr. Krishna Shenai – *Argonne National Laboratory*

8:55 a.m. – 9:20 a.m.

IS2.4.2 **Moving Beyond Qualification to Verify the Long-Term Reliability of GaN Devices**
Carl Blake – *Transphorm*

9:20 a.m. – 9:45 a.m.

IS2.4.3 **GaN: Raising the Bar for Power Conversion Performance**
David Reusch – *Efficient Power Conversion*

9:45 a.m. – 10:10 a.m.

IS2.4.4 **GaAs PowerStages for Granular Power**
Greg J. Miller, Robert Conner – *Sarda Technologies*

Break

10:40 a.m. – 11:05 a.m.

IS2.4.5 **Normally-Off GaN-on-Si Bi-Directional Automobile Battery-to -Grid 6.6kW Charger Switching at 500kHz**
Brian Hughes – *HRL Laboratories*

11:05 a.m. – 11:30 a.m.

IS2.4.6 **Next-Generation Power SiC Devices for High-Volume Applications – Trench Schottky Barrier Diode and Trench MOSFET**
David Doan – *Rohm Semiconductor*

8:30 a.m. – 11:20a.m.

TECHNICAL SESSION 22: Soft Switching DC-DC Converters

BALLROOM B

TRACK: DC-DC Converters

Session Chairs:

Ray Orr, *Solantro Semiconductor*

Reza Ahmadi, *Southern Illinois University*

8:30 a.m. – 8:50 a.m.

22.1 Modular Dual Active Bridge Converter Architecture

P. Zumel[2], L. Ortega[1], A. Lazaro[2], C. Fernández[2], A. Barrado[2], A. Rodriguez[3], M. Hernando[3]; *[1]Escuela Politécnica Nacional, Ecuador; [2]Universidad Carlos III de Madrid, Spain; [3]Universidad de Oviedo, Spain*

8:50 a.m. – 9:10 a.m.

22.2 Hybrid Ps Full Bridge and LLC Half Bridge DC-DC Converter for Low-Voltage and High-Current Output Applications

M. Yu, D. Sha, Z. Guo, X. Liao; *Beijing Institute of Technology, China*

9:10 a.m. – 9:30 a.m.

22.3 A Variable Switching Frequency Hybrid Control for ZVS Dual Active Bridge Converters to Achieve High Efficiency in Wide Load Range

X. He[1], Z. Zhang[1], Y. Cai[1], Y. Liu[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Queen's University, Canada*

9:30 a.m. – 9:50 a.m.

22.4 Phase Shift Controlled Modular DC/DC Converter with Input Voltage Auto Balance Ability

Q. Jiang, H. Yang, C. Li, W. Li, X. He; *Zhejiang University, China*

9:50 a.m. – 10:10 a.m.

22.5 A Fully Soft-Switched Single Switch Isolated DC-DC Converter

M. Kim, D. Yang, S. Choi; *Seoul National University of Science and Technology, Korea, South*

Break

10:40 a.m. – 11:00 a.m.

22.6 A Soft-Switching Dual-Phase-Shift Controlled Full-Bridge Converter with Voltage-Doubler for Wide Voltage Range Applications

Y. Lu[1], H. Wu[1], Y. Xing[1], T. Mu[1], H. Liu[1], X. Ma[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Southeast University, China*

11:00 a.m. – 11:20 a.m.

22.7 LLC Resonant Converter with Matrix Transformer

D. Huang, S. Ji, F. Lee; *Virginia Polytechnic Institute and State University, United States*

8:30 a.m. – 11:20 a.m.

TECHNICAL SESSION 23: Control of Distributed Systems

ROOM 201

TRACK: Modeling, Simulation, and Control

Session Chair:

Ali Davoudi, U*niversity of Texas at Arlington*

8:30 a.m. – 8:50 a.m.

23.1 Distributed Battery Energy Storage System Architecture with Energy Sharing Control for Charge Balancing

W. Huang, J. Abu Qahouq; *University of Alabama, United States*

8:50 a.m. – 9:10 a.m.

23.2 Modeling Closed-Loop Input and Output Impedances of DC-DC Power Converters Operating Inside DC Distribution Systems

R. Ahmadi[2], M. Ferdowsi[1]; *[1]Missouri University of Science and Technology, United States; [2]Southern Illinois University Carbondale, United States*

9:10 a.m. – 9:30 a.m.

23.3 Stabilizing Positive Feed-Forward Control Design for a DC Power Distribution System Using a Passivity-Based Stability Criterion and System Bus Impedance Identification

A. Riccobono, J. Siegers, E. Santi; *University of South Carolina, United States*

9:30 a.m. – 9:50 a.m.

23.4 Distributed Adaptive Droop Control for DC Microgrids

V. Nasirian, A. Davoudi, F. Lewis; *University of Texas at Arlington, United States*

9:50 a.m. – 10:10 a.m.

23.5 A Decoupled and Adaptive Power Sharing Strategy Based on Droop Method for Parallel Inverters
Z. You, J. Liu, X. Zhang, X. Wang; *Xi'an Jiaotong University, China*

Break

10:40 a.m. – 11:00 a.m.

23.6 Simulation Platform Development for the Analysis of Power Electronic Converter Systems with Plant and Network Coupling
J. Jimenez, S. Jayasuriya, C. Nwankpa; *Drexel University, United States*

11:00 a.m. – 11:20 a.m.

23.7 Monitoring of Multiple Loads in Wireless Power Transfer Systems Without Direct Output Feedback
J. Yin, D. Lin, C. Lee, S. Hui; *University of Hong Kong, Hong Kong*

8:30 a.m. – 11:20 a.m.

TECHNICAL SESSION 24: Control of Novel Dc-Dc Converters

BALLROOM A

TRACK: Modeling, Simulation, and Control

Session Chairs:
Jaber Abu Qahouq, *University of Alabama*
Jonathan Kimball, *Missouri University of Science and Technology*

8:30 a.m. – 8:50 a.m.

24.1 Discrete Time Modeling of Output Disturbances in the Dual Active Bridge Converter
D. Costinett[2], R. Zane[3], D. Maksimovic[1]; *[1]University of Colorado at Boulder, United States; [2]University of Tennessee, United States; [3]Utah State University, United States*

8:50 a.m. – 9:10 a.m.

24.2 Design of a Multi-Port Converter Using Dual-Frequency PWM Control for Satellite Applications
F. Li, X. You, Y. Li; *Beijing Jiaotong University, China*

9:10 a.m. – 9:30 a.m.

24.3 Effect of Output Capacitor Structure on the Input Impedance of Stacked Boost Converter
Q. Chen, T. Zheng, Y. Li; *Beijing Jiaotong University, China*

9:30 a.m. – 9:50 a.m.

24.4 Average Natural Trajectories (ANTs) for Boost Converters: Centric-Based Control
I. Galiano Zurbriggen, M. Ordonez; *University of British Columbia, Canada*

9:50 a.m. – 10:10 a.m.

24.5 Improved Power Hardware-in-the-Loop Interface Algorithm Using Wideband System Identification
J. Siegers, E. Santi; *University of South Carolina, United States*

Break

10:40 a.m. – 11:00 a.m.

24.6 Phase Jump Technique for Minimization of Load Voltage Transients in SSSC-Based Voltage Regulator
S. Cheung[2], H. Chung[2], W. Lo[1]; *[1]Chu Hai College of Higher Education, Hong Kong; [2]City University of Hong Kong, Hong Kong*

11:00 a.m. – 11:20 a.m.

24.7 A New Simple and High Performance Digital Peak Current Mode Controller for DC-DC Converters
F. Taeed, M. Nymand; *University of Southern Denmark, Denmark*

8:30 a.m. – 11:20 a.m.

TECHNICAL SESSION 25: Advanced Topology & Control for Three-phase Power Converters

BALLROOM C

TRACK: Power Electronics for Utility Interface

Session Chairs:
Huai Wang, *AAlborg Univeristy*
Zhan Wang, *Transphorm Inc.*

8:30 a.m. – 8:50 a.m.

25.1 Dyna-C: a Topology for a Bi-Directional Solid-State Transformer
A. Prasai[2], H. Chen[1], D. Divan[2]; *[1]Georgia Institute of Technology, United States; [2]Varentec, Inc., United States*

THURSDAY

8:50 a.m. – 9:10 a.m.

25.2 Output Current Balancing Method for Three-Phase Interleaved LLC Resonant Converter Employing Y-Connected Rectifier

H. Kim[1], J. Baek[1], J. Jung[2]; *[1]Korea Electrotechnology Research Institute, Korea, South; [2]Ulsan National Institue of Science and Technology, Korea, South*

9:10 a.m. – 9:30 a.m.

25.3 Impedance-Based Analysis of Grid-Synchronization Stability for Three-Phase Paralleled Converters

B. Wen[2], D. Boroyevich[2], P. Mattavelli[1], R. Burgos[2], Z. Shen[2]; *[1]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, Italy; [2]Virginia Polytechnic Institute and State University, United States*

9:30 a.m. – 9:50 a.m.

25.4 3-Phase AC-DC Converter Topologies with Higher Frequency Transformer Isolation for Utility Grid Interface

H. Krishnamoorthy, P. Garg, P. Kunwor, P. Enjeti; *Texas A&M University, United States*

9:50 a.m. – 10:10 a.m.

25.5 Experimental Studies on a Three Phase Improved Switched Z-Source Inverter

M. Ismeil[1], M. Orabi[1], R. Kennel[2], O. Ellabban[3], H. Abu-Rub[3]; *[1]Aswan University, Egypt; [2]Technische Universität München, Germany; [3]Texas A&M University at Qatar, Qatar*

Break

10:40 a.m. – 11:00 a.m.

25.6 A New Delta Inverter System for Grid Integration of Large Scale Photovoltaic Power Plants

J. Sandoval, J. Ramos-Ruiz, M. Daniel, S. Essakiappan, P. Enjeti; *Texas A&M University, United States*

11:00 a.m. – 11:20 a.m.

25.7 Phase Locked Loop with Fast Tracking Over Wide Stability Range Under Grid Faults

A. Morsy[2], P. Enjeti[2], S. Ahmed[3], A. Massoud[1]; *[1]Qatar University, Qatar; [2]Texas A&M University, United States; [3]Texas A&M University at Qatar, Qatar*

8:30 a.m. – 11:30 a.m.

TECHNICAL SESSION 26: Advances in Motor Drives and Inverters I

ROOM 200

TRACK: Motor Drives and Inverters

SESSION CHAIRS:

Babak Fahimi, *UT Dallas*

Ali Mehrizi, *Washington State University*

8:30 a.m. – 8:50 a.m.

26.1 Single-Stage Soft-Switching AC-Link AC-AC and DC-AC Buck-Boost Converters with Unrestriced Load Power Factor

M. Amirabadi[3], H. Toliyat[2], W. Alexander[1]; *[1]Ideal Power Converters, United States; [2]Texas A&M University, United States; [3]University of Illinois at Chicago, United States*

8:50 a.m. – 9:10 a.m.

26.2 Modified Phasor Pulse Width Modulation Method for Three-Phase Single-Stage Boost Inverter

A. Singh, A. Milani, B. Mirafzal; *Kansas State University, United States*

9:10 a.m. – 9:30 a.m.

26.3 LCL Filter Design for Grid-Connected Inverters by Analytical Estimation of PWM Ripple Voltage

A. Sahoo, A. Shahani, K. Basu, N. Mohan; *University of Minnesota, United States*

9:30 a.m. – 9:50 a.m.

26.4 A Power Loss Characterization Method for Semiconductor Switching Devices Based on Inverter-Level DC Measurements

K. Zou, C. Chen; *Ford Motor Company, United States*

9:50 a.m. – 10:10 a.m.

26.5 A Novel FPGA Implementation of a Model Predictive Controller for Sic-Based Quasi-Z-Source Inverters

M. Mosa[1], G. Dousoky[2], H. Abu-Rub[2]; *[1]Aswan University, Egypt; [2]Texas A&M University at Qatar, Qatar*

Break

10:40 a.m. – 11:00 a.m.

26.6 Full-Bridge Quasi-Resonant Class-DE Inverter for Optimized High Frequency Operation with GaN HEMT Devices
H. Sarnago, O. Lucía, A. Mediano, J. Burdío; *Universidad de Zaragoza, Spain*

11:00 a.m. – 11:20 a.m.

26.7 The Extra L Opposed Current Converter
E. Lemmen, J. Schellekens, K. Wijnands, J. Duarte; *Technische Universiteit Eindhoven, NetherlandS*

8:30 a.m. – 11:30 a.m.

TECHNICAL SESSION 27: Wireless Power Applications

ROOM 204

TRACK: Power Electronics Applications

Session Chairs:

Manish Bhardwaj, *Texas Instruments*

Robert Pilawa, *University of Illinois at Urbana-Champaign*

8:30 a.m. – 8:50 a.m.

27.1 A Voltage Ratio-Based Efficiency Control Method for 3 kW Wireless Power Transmission
H. Ishihara, F. Moritsuka, H. Kudo, S. Obayashi, T. Itakura, A. Matsushita, H. Mochikawa, S. Otaka; *Toshiba Corporation, Japan*

8:50 a.m. – 9:10 a.m.

27.2 Modeling and Investigation of Magnetic Resonance Coupled Wireless Power Transfer System with Lateral Misalignment
Z. Dang, J. Abu Qahouq; *University of Alabama, United States*

9:10 a.m. – 9:30 a.m.

27.3 Design and Realization of a Four Coils Excited Wireless Power Transmission Region via Magnetic Resonances
J. Huang[1], Q. Chen[1], W. Chen[1], X. Ren[1], X. Ruan[1], H. Zhang[2]; *[1]Nanjing Aeronautics and A3stronautics University, China; [2]Nanjing Engineering Institute of Aircraft Systems, China*

9:30 a.m. – 9:50 a.m.

27.4 Investigation for High Output of 2.5MHz Power Supply Constructed from Multi-Core Transformers and a Multi-Phase Inverter and Application for Wireless Power Transfer
K. Orikawa, Y. Fujita, J. Itoh; *Nagaoka University of Technology, Japan*

9:50 a.m. – 10:10 a.m.

27.5 Active Resonance Wireless Power Transfer System Using Phase Shift Control Strategy
C. Zhao, Z. Wang, J. Du, J. Wu, S. Zong, X. He; *Zhejiang University, China*

Break

10:40 a.m. – 11:00 a.m.

27.6 Contactless USB – a Capacitive Power and Bidirectional Data Transfer System
K. Wang, S. Sanders; *University of California, Berkeley, United States*

11:00 a.m. – 11:20 a.m.

27.7 Magnetic Couplers in Kickstands for Wireless Charging of Electric Bicycles
H. Beh, G. Covic, J. Boys; *University of Auckland, New Zealand*

8:30 a.m. – 11:30 a.m.

TECHNICAL SESSION 28: LED Lighting

ROOM 203

TRACK: Power Electronics Applications

Session Chairs:

Jim Spangler, *Spangler Prototype*

Joao Andres, *General Electric*

8:30 a.m. – 8:50 a.m.

28.1 A Novel Isolated Electrolytic Capacitor-Less Single-Switch AC-DC Offline LED Driver with Power Factor Correction
J. Lam, P. Jain; *Queen's University, Canada*

8:50 a.m. – 9:10 a.m.

28.2 A Comparison Between Open- and Daisy-Chain Transformer Structures for Current-Balancing Multiple LED Strings
R. Zhang, H. Chung; *City University of Hong Kong, Hong Kong*

9:10 a.m. – 9:30 a.m.

28.3 Transformer-Isolated Resonant Driver for Parallel Strings with Robust Balancing and Stabilization of Individual LED Current
R. Zhang, H. Chung; *City University of Hong Kong, Hong Kong*

9:30 a.m. – 9:50 a.m.

28.4 A 25W 97%-Efficiency 3.5MHz Integrated Dimmable LED Driver with Lossless Synchronous Current Control and Floating NMOS-Sensing Scheme
Z. Liu, H. Lee; *University of Texas at Dallas, United States*

9:50 a.m. – 10:10 a.m.

28.5 A Resonant LED Driver with Capacitive Power Transfer
D. Shmilovitz[1], S. Ozeri[1], M. Ehsani[2]; *[1]Tel-Aviv University, Israel; [2]Texas A&M University, United States*

Break

10:40 a.m. – 11:00 a.m.

28.6 Single Stage Dual Purpose Offline HB-LED Driver with Power Factor Correction for Illumination and Visible Light Communication
K. Modepalli, L. Parsa; *Rensselaer Polytechnic Institute, United States*

11:00 a.m. – 11:20 a.m.

28.7 An Electrolytic Capacitor-Free Single Stage Buck-Boost LED Driver and its Integrated Solution
P. Fang, Y. Liu; *Queen's University, Canada*

11:30 – 1:30p.m.

Dialogue Sessions

(See page xxx) for more information

GRAND BALLROOM

2:00 p.m. – 5:30p.m.

IS1.5 3D Packaging for Power Electronics

ROOM 202AB

Session Chair:
Ernie Parker

2:00p.m. – 2:25p.m.

IS1.5.1 Increase Power Density and Performance Using 3D Packaging
Ernie Parker – *Crane Aerospace & Electronics*

2:25p.m. – 2:50p.m.

IS1.5.2 Power Packaging Considerations for High End Servers
Rick Fishbune – *IBM Corporation*

2:50p.m. – 3:15p.m.

IS1.5.3 Integrated Power Conversion with Thin-Film Magnetic Core Inductors
Dr. Noah Sturcken – Ferric Semiconductor

3:15p.m. – 3:40p.m.

IS1.5.4 Printed Interfacial Interconnects in High Power Modules
Doug Hopkins – *NC State*

Break

4:10p.m. – 4:35p.m.

IS1.5.5 Deployment of 3D Printing in Power Conversion Products
Peter Resca – *Astrodyne Inc*

4:35p.m. – 5:00p.m.

IS1.5.6 Integration of Cooling Function into 3-D Power Module Packaging
Zhenxian Liang – *ORNL*

5:00p.m. – 5:25p.m.

IS1.5.7 Three-Dimensional Packaging for Wide Bandgap Based Discrete and Multi-Chip Power Packages
Brandon Passmore – *Arkansas Power Electronics International, Inc*

2:00 p.m. – 5:30p.m.

IS2.5 How are Magnetics Catching Up To SiC & GaN

ROOM 202CD

Session Chair:
Edward Herbert

2:00p.m. – 2:25p.m.

IS2.5.1 Frequency, Where We are Today, and Where We Need to Go
Dan Jitaru – *Rompower*

2:25p.m. – 2:50p.m.

IS2.5.2 How are SiC & GaN Catching Up to Planar Magnetics?
Jim Marinos – Payton America Inc.

2:50p.m. – 3:15p.m.

IS2.5.3 A GaN Speaker, What He Needs
YiFeng Wu – *Transphorm*

3:15p.m. – 3:40p.m.

IS2.5.4 A SiC Speaker, What He Needs
Ranbir Singh – *GeneSiC Semiconductor, Inc.*

Break

4:10p.m. – 4:35p.m.

IS2.5.5 New Magnetic Materials
Lowell Bosley – *Ferroxcube, Yageo Corporation*

4:35p.m. – 5:00p.m.

IS2.5.6 Windings for High Frequency
Dr. Charles Sullivan – *Dartmouth College*

5:00p.m. – 5:25p.m.

IS2.5.7 "Solid State" Transformers for the Smart Grid
Dr. Subhashish Bhattacharya – *North Carolina State University*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 29: High Frequency DC-DC & Switched Capacitor Converters

ROOM 203

TRACK: DC-DC Converters

Session Chairs:

Olivier Trescases, *University of Toronto*

Wenduo Liu, *International Rectifier*

2:00p.m. – 2:20p.m.

29.1 A VHF Interleaved Self-Oscillating Resonant SEPIC Converter with Phase-Shift Burst-Mode Control
M. Kovacevic, A. Knott, M. Andersen; *Technical University of Denmark, Denmark*

2:20p.m. – 2:40p.m

29.2 Very High Frequency Half Bridge DC/DC Converter
M. Madsen, A. Knott, M. Andersen; *Technical University of Denmark, Denmark*

2:40p.m. – 3:00p.m.

29.3 A 30-W Flyback Converter Operating at 5 MHz
Z. Zhang[2], K. Ngo[2], J. Nilles[1]; *[1]Texas Instruments, United States; [2]Virginia Polytechnic Institute and State University, United States*

3:00p.m. – 3:20p.m.

29.4 A VHF-Level Fully Integrated Multi-Phase Switching Converter Using Bond-Wire Inductors, on-Chip Decoupling Capacitors and DLL Phase Synchronization
M. Song, M. Dehghanpour, J. Sankman, D. Ma; *University of Texas at Dallas, United States*

3:20p.m. – 3:40p.m.

29.5 5MHz PWM-Controlled Current-Mode Resonant DC-DC Converter with GaN-Fets
A. Hariya[2], Y. Ishizuka[2], K. Matsuura[3], H. Yanagi[3], S. Tomioka[3], T. Ninomiya[1]; *[1]International Centre for the Study of East Asian Development, Japan; [2]Nagasaki University, Japan; [3]TDK-Lambda Corporation, Japan*

Break

4:10p.m. – 4:30p.m

29.6 A New 3X Interleaved Bidirectional Switched Capacitor Converter
B. Wu[2], K. Smedley[2], S. Singer[1]; *[1]Tel-Aviv University, Israel; [2]University of California, Irvine, United States*

4:30p.m. – 4:50p.m.

29.7 Primary Parallel Secondary Series Flyback Converter (PPSSFC) with Multiple Transformers for Very High Step-Up Ratio in Capacitive Load Charging Applications
R. Pittini, L. Huang, Z. Zhang, M. Andersen; *Technical University of Denmark, Denmark*

4:50p.m. – 5:10p.m.

29.8 A Deep Trench Capacitor Based 2:1 and 3:2 Reconfigurable on-Chip Switched Capacitor DC-DC Converter in 32 nm SOI CMOS
T. Andersen[2], F. Krismer[1], J. Kolar[1], T. Toifl[3], C. Menolfi[3], L. Kull[3], T. Morf[3], M. Kossel[3], M. Brändli[3], P. Buchmann[3], P. Francese[3]; *[1]Eidgenössische Technische Hochschule Zürich, Switzerland; [2]Eidgenössische Technische Hochschule Zürich / IBM Research Zurich, Switzerland; [3]IBM Research Zurich, Switzerland*

5:10p.m. – 5:30p.m.

29.9 A 30-MHz Isolated Push-Pull VHF Resonant Converter

W. Cai[1], Z. Zhang[1], X. Ren[1], Y. Liu[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Queen's University, Canada*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 30: Semiconductor Devices

BALLROOM A

TRACK: Devices and Components

Session Chair:

Chris Siegl, *Fairchild Semiconductor*

2:00p.m. – 2:20p.m.

30.1 A Compact Drive-by-Microwave Gate Driver with Coupler Integrated in a Package

S. Nagai, Y. Kawai, O. Tabata, H. Fujiwara, N. Otsuka, D. Ueda, N. Negoro, M. Ishida; *Panasonic Corporation, Japan*

2:20p.m. – 2:40p.m.

30.2 Self-Contained Control for Turn-on Transition of an Optically Driven IGBT

H. Riazmontazer, S. Mazumder; *University of Illinois at Chicago, United States*

2:40p.m. – 3:00p.m.

30.3 Active Compensation of Current Unbalance in Paralleled Silicon Carbide MOSFETs

Y. Xue, J. Lu, Z. Wang, L. Tolbert, B. Blalock, F. Wang; *University of Tennessee, United States*

3:00p.m. – 3:20p.m.

30.4 Dynamic and Static Behavior of Packaged Silicon Carbide MOSFETs in Paralleled Applications

G. Wang, J. Mookken, J. Rice, M. Schupbach; *Cree, Inc., United States*

3:20p.m. – 3:40p.m.

30.5 Gate Drive Design Considerations for High Voltage Cascode GaN HEMT

W. Zhang, X. Huang, F. Lee, Q. Li; *Virginia Polytechnic Institute and State University, United States*

Break

4:10p.m. – 4:30p.m.

30.6 4A Isolated Half-Bridge Gate Driver with 4.5V to 18V Output Drive Voltage

S. Ma, T. Zhao, B. Chen; *Analog Devices Inc., United States*

4:30p.m. – 4:50p.m.

30.7 Design Considerations and Development of Gate Driver for 15 kV SiC IGBT

A. Kadavelugu, S. Bhattacharya; *North Carolina State University, United States*

4:50p.m. – 5:10p.m.

30.8 Recent Developments in GaAs Power Switching Devices Including Device Modeling

R. White[2], G. Miller[1], B. Duduman[1], R. Erickson[2]; *[1]Sarda Technologies, United States; [2]University of Colorado at Boulder, United States*

5:10p.m. – 5:30p.m.

30.9 Design and Evaluation of a 10 MHz Gallium Nitride Based 42 V DC-DC Converter

J. Strydom, D. Reusch; *Efficient Power Conversion Corporation, United States*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 31: Advances in Motor Drives and Inverters II

BALLROOM C

TRACK: Motor Drives and Inverters

Session Chairs:

Mahshid Amirabadi, *University of Illinois in Chicago*

Wei Wang, *UT Dallas*

2:00p.m. – 2:20p.m.

31.1 Induction Motor Drive Design for Traction Application Based on Drive-Cycle Energy Minimization

S. Sridharan, P. Krein; *University of Illinois at Urbana-Champaign, United States*

2:20p.m. – 2:40p.m.

31.2 A Post-Fault Modulation Strategy to Control the Matrix Converter Under an Open-Switch Failure

J. Dasika, M. Saeedifard; *Purdue University, United States*

2:40p.m. – 3:00p.m.

31.3 Flux Vector Modulation for Single-Phase Inverter with LC Output Filter
D. Patel[3], R. Chattopadhyay[3], S. Madhusoodhanan[3], S. Bhattacharya[3], R. Sawant[2], M. Chandorkar[1]; *[1]Indian Institute of Technology Bombay, India; [2]Khurana Sawant Institute of Engineering and Technology-Hingoli, India; [3]North Carolina State University, United States*

3:00p.m. – 3:20p.m.

31.4 Control of an Open-End Winding Induction Machine via a Two-Output Indirect Matrix Converter
J. Riedemann[1], R. Peña[1], R. Cárdenas[4], M. Rivera[2], R. Blasco-Gimenez[3], J. Clare[5], P. Wheeler[5]; *[1]Universidad de Concepción, Chile; [2]Universidad de Talca, Chile; [3]Universitat de València, Spain; [4]University of Chile, Chile; [5]University of Nottingham, United Kingdom*

3:20p.m. – 3:40p.m.

31.5 A Correction to the State-Machine-Decoder for Stacked Multicell Converters
R. Naderi[2], A. Rahmati[1]; *[1]Iran University of Science and Technology, Iran; [2]University of California, Irvine, United States*

Break

4:10p.m. – 4:30p.m.

31.6 Accurate Modeling, Compensation and Self-Commissioning of Inverter Voltage Distortion for High-Performance Motor Drives
N. Bedetti[1], S. Calligaro[2], R. Petrella[2]; *[1]Gefran s.p.a., Italy; [2]Università di Udine, Italy*

4:30p.m. – 4:50p.m.

31.7 An Improved Single-Phase Active Front End Rectifier System for Use with Three-Phase Variable Frequency Drives
M. Swamy, C. Guddanti; *Yaskawa America, Inc., United States*

4:50p.m. – 5:10p.m.

31.8 Analysis and Calculation of DC-Link Current and Voltage Ripple for Three-Phase Inverter with Unbalanced Loads
X. Pei, Y. Kang, J. Chen; *Huazhong University of Science and Technology, China*

5:10p.m. – 5:30p.m.

31.9 Design and Analysis of Analog Filtering Method for Signal Injection Based Sensorless Control
S. Jung, J. Ha; *Seoul National University, Korea, South*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 32: Power Electronics Applications

ROOM 200

TRACK: Power Electronics Applications

Session Chairs:

Zhong Ye, *Texas Instruments*

Jim Spangler, *Spangler Prototype*

2:00p.m. – 2:20p.m.

32.1 Assisting Converter Based Integrated Battery Management System for Low Power Applications
M. Shousha[2], T. McRae[2], A. Prodic[2], V. Marten[1]; *[1]Sendyne Corp, United States; [2]University of Toronto, Canada*

2:20p.m. – 2:40p.m

32.2 Parallel Operation of Three-Phase Bi-Directional Isolated Interleaved DC-DC Converters for Battery Test System
H. Jo, H. Cha; *Chungnam National University, Korea, South*

2:40p.m. – 3:00p.m.

32.3 Design and Control of Battery Charger for Portable Human Powered Generator
S. Moon[2], J. Lai[2], B. Park[1], J. Lee[1], D. Koo[1]; *[1]Korea Electrotechnology Research Institute, Korea, South; [2]Virginia Polytechnic Institute and State University, United States*

3:00p.m. – 3:20p.m.

32.4 Finite-Element-Based Computationally-Efficient Electric Machine Model Suitable for Use in Electrified Vehicle Powertrain Design Optimization
K. Zhou[2], A. Ivanco[1], Z. Filipi[1], H. Hofmann[2]; *[1]Clemson University, United States; [2]University of Michigan, United States*

3:20p.m. – 3:40p.m.

32.5 Detection of EVs on IPT Highways
G. Nagendra, L. Chen, G. Covic, J. Boys; *University of Auckland, New Zealand*

THURSDAY

Break

4:10p.m. – 4:30p.m.

32.6 An on-Line Fast Model Predictive Control of High-Power Ultracapacitors Charging Current for Renewable Energy Urban Rail Vehicle
Z. Huang, H. Li, J. Hu, W. Liu, J. Liu; *Central South University, China*

4:30p.m. – 4:50p.m.

32.7 Double-Coupled Systems for Roadway IPT Systems
L. Chen, G. Nagendra, J. Boys, G. Covic; University of Auckland, New Zealand

4:50p.m. – 5:10p.m.

32.8 Fault Tolerant Drive Module via Electromechanical Alteration of Circuit Topology
L. Maharjan, N. Arbab, B. Fahimi; *University of Texas at Dallas, United States*

5:10p.m. – 5:30p.m

32.9 Design and Development of Autonomous High Voltage Driving System for DEAP Actuator in Radiator Thermostat
L. Huang, Z. Zhang, M. Andersen; *Technical University of Denmark, Denmark*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 33: Vehicular Electronics I

BALLROOM B

TRACK: Vehicular Electronics

Session Chairs:

Bulent Sarlioglu, *University of Wisconsin – Madison*

Khurram Afridi, *University of Colorado Boulder*

2:00p.m. – 2:20p.m.

33.1 A Hybrid Resonant Bridgeless AC-DC Power Factor Correction Converter for Off-Road and Neighborhood Electric Vehicle Battery Charging
M. Alam[2], W. Eberle[2], F. Musavi[1]; *[1]Delta-Q Technologies Corp., Canada; [2]University of British Columbia, Canada*

2:20p.m. – 2:40p.m.

33.2 Accurate Finite-Element Modeling and Experimental Verification of Inductive Power Transfer Coil Design
R. Bosshard[3], J. Kolar[2], B. Wunsch[1]; *[1]ABB Corporate Research Center, Switzerland; [2]Eidgenössische Technische Hochschule Zürich, Switzerland; [3]Eidgenössische Technische Hochschule Zürich / IBM Research Zurich, Switzerland*

2:40p.m. – 3:00p.m.

33.3 Analysis and Parameters Optimization of a Contactless IPT System for EV Charger
R. Chen[2], C. Zheng[2], Z. Zahid[2], W. Faraci[2], W. Yu[2], J. Lai[2], M. Senesky[1], D. Anderson[1], G. Lisi[1]; *[1]Texas Instruments, United States; [2]Virginia Polytechnic Institute and State University, United States*

3:00p.m. – 3:20p.m.

33.4 Bi-Directional PHEV Battery Charger Based on Normally-Off GaN-on-Si Multi-Chip Module
L. Xue[3], Z. Shen[3], M. Mu[3], D. Boroyevich[3], R. Burgos[3], B. Hughes[1], P. Mattavelli[2]; *[1]HRL Laboratories LLC, United States; [2]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, Italy; [3]Virginia Polytechnic Institute and State University, United States*

3:20p.m. – 3:40p.m.

33.5 SiC MOSFET Based Single Phase Active Boost Rectifier with Power Factor Correction for Wireless Power Transfer Applications
L. Tang, M. Chinthavali, O. Onar, S. Campbell, J. Miller; *Oak Ridge National Laboratory, United States*

Break

4:10p.m. – 4:30p.m

33.6 Feasibility Study on Bipolar Pads for Efficient Wireless Power Chargers
T. Nguyen[2], S. Li[2], W. Li[1], C. Mi[2]; *[1]Hefei University of Technology, China; [2]University of Michigan-Dearborn, United States*

4:30p.m. – 4:50p.m.

33.7 A Novel Approach to Design EV Battery Chargers Using SEPIC PFC Stage and Optimal Operating Point Tracking Technique for LLC Converter
H. Wang, S. Dusmez, A. Khaligh; *University of Maryland, United States*

THURSDAY

4:50p.m. – 5:10p.m.

33.8 A SiC MOSFET Based Inverter for Wireless Power Transfer Applications

O. Onar[2], M. Chinthavali[2], S. Campbell[2], P. Ning[1], C. White[2], J. Miller[2]; *[1]Institute of Electrical Engineering, Chinese Academy of Sciences, China; [2]Oak Ridge National Laboratory, United States*

5:10p.m. – 5:30p.m.

33.9 Bidirectional Power Flow with Constant Power Load in Electric Vehicles: a Non-Linear Strategy for Buck+Boost Cascade Converters

M. Anun[2], M. Ordonez[2], I. Galiano Zurbriggen[2], G. Oggier[1]; *[1]Universidad Nacional de Rio Cuarto, Argentina; [2]University of British Columbia, Canada*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 34: PV Inverters and Wind Generation

ROOM 201

TRACK: Renewable Energy Systems

Session Chairs:

Juan Carlos Balda, *University of Arkansas*

Xu She, *NC State*

2:00p.m. – 2:20p.m.

34.1 Dual Multi-String PV Topology Fed Three Level Grid Connected Inverter

D. Yelaverthi, S. Das; *Indian Institute of Technology Kanpur, India*

2:20p.m. – 2:40p.m.

34.2 Performance Characteristics of Grid-Tie Solar Inverter with Series Voltage Compensator for Reduction of High-Voltage DC Link Capacitance

W. Liu[1], K. Wang[1], H. Chung[1], S. Chuang[2]; *[1]City University of Hong Kong, Hong Kong; [2]Provista Technology Limited, Hong Kong*

2:40p.m. – 3:00p.m.

34.3 Independent Control Strategy of Two DC-Link Voltages for Separate MPPTs in Transformerless Photovoltaic Systems Using Neutral-Point-Clamped Inverters

U. Choi[1], F. Blaabjerg[1], K. Lee[2]; *[1]Aalborg University, Denmark; [2]Ajou University, Korea, South*

3:00p.m. – 3:20p.m.

34.4 A Soft-Switched Highly Reliable Grid-Tied Inverter for PV Applications

H. Keyhani, M. Johnson, H. Toliyat; *Texas A&M University, United States*

3:20p.m. – 3:40p.m.

34.5 An Effective Control Method for Quasi-Z-Source Cascade Multilevel Three-Phase Grid-Tie Photovoltaic Power System

Y. Liu[3], H. Abu-Rub[3], B. Ge[1], F. Peng[2]; *[1]Beijing Jiaotong University, United States; [2]Michigan State University, United States; [3]Texas A&M University at Qatar, Qatar*

Break

Time?

34.6 Dithering Digital Ripple Correlation Control with Digitally-Assisted Windowed Sensing for Solar Photovoltaic MPPT

C. Barth, R. Pilawa-Podgurski; *University of Illinois at Urbana-Champaign, United States*

4:30p.m. – 4:50p.m.

34.7 An Energy Stored Quasi-Z Source Cascaded Multilevel Inverter Based Photovoltaic Power Generation System

D. Sun[1], B. Ge[1], H. Zhang[1], X. Yan[1], D. Bi[4], H. Abu-Rub[3], F. Peng[2]; *[1]Beijing Jiaotong University, China; [2]Michigan State University, United States; [3]Texas A&M University at Qatar, Qatar; [4]Tsinghua University, China*

4:50p.m. – 5:10p.m.

34.8 A Wind Energy Conversion System with Enhanced Power Harvesting Capability for Low Cut-in Speeds

A. Moallem, A. Bakhshai, P. Jain; *Queen's University, Canada*

5:10p.m. – 5:30p.m.

34.9 Adaptive Passivity-Based Nonlinear Controller for Wind Energy Conversion Systems

J. Mash, M. Pahlevaninezhad, P. Jain; *Queen's University, Canada*

2:00 p.m. – 5:30p.m.

TECHNICAL SESSION 35: Control of Grid-tied Systems

ROOM 204

TRACK: Modeling, Simulation, and Control

Session Chairs:

Ali Mehrizi, *Washington State University*

Nathan Weise, *University of Maine*

2:00p.m. – 2:20p.m.

35.1 New Hysteresis Current Control for Grid Connected Single-Phase Three-Level Quasi-Z-Source Inverter

O. Husev[1], D. Vinnikov[1], C. Roncero-Clemente[3], E. Romero-Cadaval[2]; *[1]Tallinn University of Technology, Estonia; [2]Universidad de Extremadura, Spain; [3]University of Extremadura, Spain*

2:20p.m. – 2:40p.m.

35.2 Dynamic Characteristics of Boost Inverter with Waveform Control

G. Zhu[2], C. Xiao[2], H. Wang[2], W. Chen[2], S. Tan[1]; *[1]University of Hong Kong, Hong Kong; [2]Wuhan University of Technology, China*

2:40p.m. – 3:00p.m.

35.3 Model Predictive Control of Modular Multilevel Converter with Reduced Computational Load

Y. Wang, W. Cong, M. Li, N. Li, M. Cao, W. Lei; *Xi'an Jiaotong University, China*

3:00p.m. – 3:20p.m.

35.4 Space Vector Modulation for 3-Level NPC Converter with Neutral Voltage Balancing and Switching Loss/Noise Reduction

Y. Jiao, F. Lee, S. Lu; *Virginia Polytechnic Institute and State University, United States*

3:20p.m. – 3:40p.m.

35.5 Control of Electrolyte-Free Microinverter with Improved MPPT Performance and Grid Current Quality

B. Gu, J. Dominic, J. Zhang, L. Zhang, B. Chen, J. Lai; *Virginia Polytechnic Institute and State University, United States*

Break

4:10p.m. – 4:30p.m.

35.6 A Single-Stage Three-Phase Grid-Connected Photo-Voltaic System with Fractional Order MPPT

H. Malek[2], Y. Chen[1]; *[1]University of California, Merced, United States; [2]WAVE Inc., United States*

4:30p.m. – 4:50p.m.

35.7 Modeling the Output Impedance Negative Incremental Resistance Behavior of Grid-Tied Inverters

B. Wen[2], D. Boroyevich[2], P. Mattavelli[1], R. Burgos[2], Z. Shen[2]; *[1]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, Italy; [2]Virginia Polytechnic Institute and State University, United States*

4:50p.m. – 5:10p.m.

35.8 High Quality Output Current Control for Single Phase Grid-Connected Inverters

S. Khajehoddin[3], M. Karimi-Ghartemani[1], A. Bakhshai[2], P. Jain[2]; *[1]Mississippi State University, United States; [2]Queen's University, Canada; [3]University of Alberta, Canada*

5:10p.m. – 5:30p.m.

35.9 A State Space Model of Paralleled Inverters Based on Droop Control in Grid-Connected Microgrid

X. Zhang, J. Liu, Z. You; *Xi'an Jiaotong University, China*

Dialogue Session Floor Plan

DIALOGUE SESSION FLOOR PLAN

Dialogue Sessions

Dialogue Session papers have been selected through the same rigorous peer review process as papers in the Presentation Sessions. They are represented by papers in the APEC Proceedings.

In the Dialogue Sessions you will have the opportunity to talk at length with the authors about their work, something that is not possible in the oral presentation sessions.

SESSION D1: AC-DC Converters

Thursday, March 20, 11:30 a.m. – 1:30 p.m.
Ballroom B
Chair(s):
Nathan Weise, *University of Maine*
Alberto Guerra, *International Rectifier*

D1.1 Input Current Control for Bridgeless PFC Converter Without Sensing Current
H. Chen[1], C. Chung[1], J. Liao[1], S. Yu[2]; *[1]National Chiao Tung University, Taiwan; [2]Texas Instruments, United States*

D1.2 Efficiency of Converters and Amorphous Core AC-Filters in an LVDC Distribution
J. Rekola, H. Tuusa; *Tampere University of Technology, Finland*

D1.3 Fully SiC Based High Efficiency Boost Converter
L. Abbatelli[2], M. Macauda[1], G. Catalisano[2]; *[1]STMicroelectroincs, Italy; [2]STMicroelectronics, Italy*

D1.4 Power Conversion Architecture for Grid Interface at High Switching Frequency
S. Lim, D. Otten, D. Perreault; *Massachusetts Institute of Technology, United States*

D1.5 Tolerance Controls for Open-Switch Fault in a Grid-Connected T-Type Rectifier at Low Modulation Index
J. Lee, K. Lee; *Ajou University, Korea, South*

D1.6 Start-Up Procedure for Three-Phase Six-Switch Boost PFC Rectifier
M. Kumar, L. Huber, M. Jovanovic; *Delta Products Corporation, United States*

D1.7 A Novel Single Stage AC/DC Converter for Fast Charging Applications with Unity Power Factor
F. Wang, A. Huang; *North Carolina State University, United States*

D1.8 A New Control Scheme for an AC-DC Single-Stage Buck-Boost PFC Converter with Improved Output Ripple Reduction and Transient Response
K. Rezaei, N. Golbon, G. Moschopoulos; *University of Western Ontario, Canada*

D1.9 A Generalized DQ Impedance Model of ATRU System
Q. Lei[2], M. Shen[3], V. Blasko[3], S. Liang[1], F. Peng[1]; *[1]Michigan State University, United States; [2]Michigan State University / United Technology Research Center, United States; [3]United Technology Research Center, United States*

D1.10 Novel Techniques to Suppress the Common Mode EMI Noise in Class II Off-Line SMPS Applications
C. Sun, M. Xu; *FSP-Powerland Technology Inc., China*

D1.11 DQ Current Control of a Bidirectional, Isolated Single-Stage AC-DC Converter
N. Weise, L. Doiron; *University of Maine, United States*

D1.12 A Two-Stage AC/DC SST Based on Modular Multilevel Converterfeasible to AC Railway Systems
D. Oliveira[1], D. de A. Honório[1], L. Barreto[1], P. Praca[1], A. Kunzea[2], S. Carvalho[1]; *[1]Universidade Federal do Ceará, Brazil; [2]Universität Kassel, Germany*

D1.13 Quantification Analysis of Input / Output Current of Interleaved Power Factor Correction (PFC) Boost Converter
S. Zhang, R. Garner, Y. Zhang, S. Bakre; *Osram Sylvania, United States*

D1.14 Efficiency Evaluation of Two-Level and Three-Level Bridgless PFC Boost Rectifiers
Q. Wang[2], B. Wen[2], R. Burgos[2], D. Boroyevich[2], A. White[1]; *[1]United Technology Aerospace Systems, United States; [2]Virginia Polytechnic Institute and State University, United States*

D1.15 A New Phase Shedding Scheme for Improved Transient Behavior of Interleaved Boost PFC Converters
Y. Chen, J. Hsu, Y. Ang, T. Yang; *Fairchild Semiconductor, Taiwan*

DIALOGUE SESSIONS

SESSION D2: DC-DC Converters I

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

William Dunford, *University of British Columbia*

Davide Giacomini, *International Rectifier*

D2.2 A Passive Level-Shifter for Elimination of Spurious Turn-on in the Bridge-Leg Configuration
J. Wang, H. Chung; *City University of Hong Kong, Hong Kong*

D2.3 System Optimization of a High-Power and High-Step-Down Accessory Power Module for Electric Vehicles
Z. Nie[1], W. Williams[1], C. Duan[2], W. Guo[2], K. Bai[2]; *[1]Chrysler Group, LLC, United States; [2]Kettering University, United States*

D2.4 A 600 mA, Constant on-Time Controlled DC-DC Converter with 67% Conversion Efficiency at an Output Current of 23 µA
T. Ueno, T. Miyazaki, T. Ogawa, T. Itakura; *Toshiba Corporation, Japan*

D2.5 On High Frequency High Voltage Generators with Planar Transformers
C. Loef[2], R. De Doncker[2], B. Ackermann[1]; *[1]Philips Research, Netherlands; [2]Rheinisch-Westfaelische Technische Hochschule Aachen, Germany*

D2.6 Bidirectional Secondary LLC Resonant Converter Using Auxiliary Switches and Inductor
E. Kim[1], J. Park[1], Y. Jeon[1], Y. Kong[3], S. Lee[2], K. Kim[2]; *[1]Jeonju University, Korea, South; [2]KACO new-energy, Korea, South; [3]National Forensic Service, Korea, South*

D2.7 Low-Volume Stackable Flyback Converter with Near Minimum Deviation Controller
A. Radic, A. Straka, A. Prodic; *University of Toronto, Canada*

D2.9 Dual-Frequency SIMO Power Converters for Low-Power on-Chip Power Grids in SoCs
C. Chen[1], J. Morroni[2], D. Anderson[2], A. Fayed[1]; *[1]Iowa State University, United States; [2]Texas Instruments, United States*

D2.10 Modular DC/DC Converter with Improved Efficiency for Electric Vehicles Applications
M. Galek, G. Mondal; *Siemens AG, Germany*

D2.11 Open-Circuit Fault Detection and Tolerant Operation for a Parallel-Connected SAB DC-DC Converter
K. Park, Z. Chen; *Aalborg University, Denmark*

D2.12 Improved Modulation Technique for Voltage Fed Quasi-Z-Source DC/DC Converter
Y. Siwakoti, G. Town; *Macquarie University, Australia*

D2.13 Distributed Multi-Agent Control of Parallel Cúk Converters Using Feedback Linearization
H. Behjati, A. Davoudi, F. Lewis; *University of Texas at Arlignton, United States*

D2.14 Sneak Circuit Analysis of Boost Converter Considering Parasitic Parameters
M. Li, B. Zhang, D. Qiu; *South China University of Technology, China*

D2.16 High Step-Up Active-Clamp Converter with Input Current Doubler and Output Switched-Capacitor Circuit: Analysis, Design, Experiment
L. He[2], W. Zhou[2], J. Lei[1]; *[1]Huazhong University of Science and Technology, China; [2]Xiamen University, China*

D2.18 Asymmetrical Interleaving Strategy and AVP Concept for Interleaved LLC Resonant DC/DC
F. Duan[3], M. Xu[2], X. Yang[3], Y. Yao[1]; *[1]FSP-Powerland Technology Inc, China; [2]FSP-Powerland Technology Inc., China; [3]Xi'an Jiaotong University, China*

SESSION D3: DC-DC Converters II

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Brian Lynch, *Texas Instruments*

Pietro Scalia, *Texas Instruments*

D3.1 Seamless Operation of Bi-Directional LLC Resonant Converter for PV System
S. Abe[1], T. Ninomiya[2], T. Zaitsu[3], J. Yamamoto[3], S. Ueda[3]; *[1]International Center for the Study of East Asian Development, Japan; [2]International Centre for the Study of East Asian Development, Japan; [3]Texas Instruments, Japan*

D3.2 Optimal Negative Current Control for Four-Phase Interleaved Bi-Directional Buck/Boost Converters to Achieve ZVS and ZCS
T. Wu[2], J. Yang[1], C. Kuo[1], M. Kuo[1]; *[1]National Chung Cheng University, Taiwan; [2]National Tsing Hua University, Taiwan*

D3.3 Optimized Switching Control Strategy for Current-Fed Half-Bridge Converter
D. Nayanasiri, M. Vilathgamuwa, D. Maskell; *Nanyang Technological University, Singapore*

D3.4 Self-Oscillating Resonant Gate Drive for Resonant Inverters and Rectifiers Composed Solely of Passive Components
M. Madsen, J. Pedersen, A. Knott, M. Andersen; *Technical University of Denmark, Denmark*

D3.7 LLC Performance Enhancements with Frequency and Phase Shift Modulation Control
B. McDonald, F. Wang; *Texas Instruments, United States*

D3.9 Zero Voltage Switching Forward-Flyback Converter with Efficient Active LC Snubber Circuit
F. Chen, A. Amirahmadi, I. Batarseh; *University of Central Florida, United States*

D3.10 Design and Optimization of Parallel DC-DC System Based on Current-Driven Phase Shift Full Bridge Converter
L. Sun, Y. Chen, X. Xia, L. Peng, Y. Kang; *Huazhong University of Science and Technology, China*

D3.11 Combination of DCM and CCM DC/DC Converters for Input-Series Output-Series Connection
C. Fernández, P. Zumel, M. Sanz, A. Lazaro, A. Barrado; *Universidad Carlos III de Madrid, Spain*

D3.12 Current Adaptive Resonant Loop Soft Switching PWM Converters
T. Zheng, T. Shao, N. Han, Y. Li, J. Liu; *Beijing Jiaotong University, China*

D3.13 Dynamical Modeling of the Non-Isolated Single-Inductor Three-Port Converter
Y. Chen, P. Zhang, X. Zou, Y. Kang; *Huazhong University of Science and Technology, China*

D3.14 Digital Implementation and Performance Evaluation of a Time-Shift-Controlled LLC Resonant Half-Bridge Converter
C. Adragna[2], D. Ciambellotti[2], M. Dell'Oro[2], F. Gallenda[1]; *[1]STmicroelectoincs, Italy; [2]STMicroelectronics, Italy*

D3.15 A Novel Push-Pull Forward Converter with a Passive Resonant Network Introduced in the Secondary Winding
D. Sha, T. Luo; *Beijing Institute of Technology, China*

D3.16 High Frequency Resonant Bidirectional SEPIC Converter Suitable for Battery Equalization and Charger Applications
T. Florencki, Y. Han; *University of Wisconsin-Madison, United States*

D3.17 A 10-MHz Resonant Gate Driver Design for LLC Resonant DC-DC Converters Using GaN Devices
Y. Long, W. Zhang, B. Blalock, L. Tolbert, F. Wang; *University of Tennessee, United States*

D3.18 Optimization of a 96% Efficient 12-1 V Gallium Nitride Based Point of Load Converter
L. Jenkins, C. Wilson, J. Moses, J. Aggas, B. Rhea, R. Dean; *Auburn University, United States*

D3.19 Quasi-Parallel Switched-Capacitor and Regulating PWM DC-DC Converter
K. Yeates, Y. Han; University of Wisconsin-Madison, United States

D3.20 Soft-Charging Operation of Switched-Capacitor DC-DC Converters with an Inductive Load
Y. Lei, R. Pilawa-Podgurski; *University of Illinois at Urbana-Champaign, United States*

D3.21 Control and Performance of a Single-Phase Dual Active Half Bridge Converter Based on 15kV SiC IGBT and 1200V SiC MOSFET
A. Tripathi2, K. Mainali[2], D. Patel[2], S. Bhattacharya[2], K. Hatua[1]; *[1]Indian Institute of Technology Madras, India; [2]North Carolina State University, United States*

DIALOGUE SESSIONS

SESSION D4: Power Converter Control in Grid Application

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Liming Liu, *ABB Inc., Raleigh, NC*

Jin Wang, *Ohio State University*

D4.1 A utonomous Active and Reactive Power Distribution Strategy in Islanded Microgrids
D. Wu1, F. Tang[2], J. Guerrero[1], J. Vasquez[1], G. Chen[3], L. Sun[3]; *[1]Aalborg university, Denmark; [2]Beijing Jiaotong University, China; [3]ShangHai Solar Energy & Technology, Co.Ltd., China*

D4.3 A Novel Harmonic Control Approach of Distributed Generation Converters in a Weak Microgrid
G. Ding[2], F. Gao[2], Y. Tang[1], L. Zhang[2], S. Zhang[3]; *[1]Aalborg University, Denmark; [2]Shandong University, China; [3]State Grid of China Technology College, China*

D4.4 Electric Spring for Power Quality Improvement
Y. Shuo, S. Tan, C. Lee, S. Hui; *University of Hong Kong, Hong Kong*

D4.5 Decoupled Closed-Loop Power Flow Control for the Controllable Network Transformers (CNT)
H. Chen, A. Iyer, R. Harley, D. Divan; *Georgia Institute of Technology, United States*

D4.7 Investigating the Influence of Semiconductor Device Voltage Drops on Harmonic and Reactive Current Compensation with Cascaded Multilevel Inverters
D. Wu[1], S. Wang[2], L. Peng[1]; *[1]Huazhong University of Science and Technology, China; [2]University of Texas at San Antonio, United States*

D4.9 Versatile Unidirectional AC-DC Converter with Harmonic Current and Reactive Power Compensation for Smart Grid Applications
S. Park, S. Park; *University of Connecticut, United States*

D4.10 Fuzzy-Logic-Based Gain-Scheduling Control for State-of-Charge Balance of Distributed Energy Storage Systems for DC Microgrids
N. Diaz, T. Dragicevic, J. Vasquez, J. Guerrero; *Aalborg University, Denmark*

D4.11 Control Loop Design of a Two-Stage Bidirectional AC/DC Converter for Renewable Energy Systems
F. Chen, R. Burgos, D. Boroyevich, D. Dong; *Virginia Polytechnic Institute and State University, United States*

D4.12 An Active Damper to Suppress Multiple Resonances with Unknown Frequencies
X. Wang, F. Blaabjerg, M. Liserre; *Aalborg University, Denmark*

D4.13 Single-Phase Soft-Switching AC-Link Buck-Boost Inverter
M. Amirabadi[3], H. Toliyat[2], W. Alexander[1]; *[1]Ideal Power Converters, United States; [2]Texas A&M University, United States; [3]University of Illinois at Chicago, United States*

D4.14 Single-Phase Current Source Converter with New Modulation Approach and Power Decoupling
M. Vitorino[2], L. Hartmann[1], D. Fernandes[1], E. Silva[2], M. Corrêa[2]; *[1]Universidade Federal da Paraíba, Brazil; [2]Universidade Federal de Campina Grande, Brazil*

D4.15 A Review of Passive Filters for Grid-Connected Voltage Source Converters
R. Beres[1], X. Wang[1], F. Blaabjerg[1], C. Bak[1], M. Liserre[2]; *[1]Aalborg University, Denmark; [2]Christian-Albrechts-Universität zu Kiel, Germany*

D4.16 Research of the Voltage and Current Sharing Issue of an H-Bridge Based Power Electronic Transformer
X. Wang, S. Ouyang, J. Liu, F. Meng, R. Javed; *Xi'an Jiaotong University, China*

SESSION D5: Power Converter Modeling and Design in Grid Application

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

Chair(s):

Miaosen Shen, *United Technologies Research Center*

Yi Huang, *AMETEK*

D5.1 WattsWorth: Monitor Electric Power Anywhere
J. Donnal, S. Leeb; *Massachusetts Institute of Technology, United States*

D5.2 Bidirectinal Switched Boost Converter for AC-DC Hybrid Microgrid
M. Sahoo, S. K; *Indian Institute of Technology, Hyderabad, India*

D5.3 Solid-State Transformer Stability and Control Considerations
M. Khazraei, A. Prabhala, R. Ahmadi, M. Ferdowsi; *Missouri University of Science and Technology, United States*

D5.4 A Rapid Prototyping Tool for Load and Source Emulation in a Microgrid Test Laboratory
D. Hogan[2], M. Egan[2], J. Hayes[2], G. Lightbody[2], F. Gonzalez-Espin[1]; *[1]United Technologies Research Centre, Ireland; [2]University College Cork, Ireland*

D5.5 Grid Current Shaping of Single Phase Diode Rectifier with Small DC-Link Capacitor for Three Phase Motor Drive
Y. Son, J. Ha; *Seoul National University, Korea, South*

D5.6 Filter-Capacitor Current Compensation for Division-Summation Digital Controlled Single-Phase Bi-Directional Inverter with LCL Filter to Reduce Grid-Current Distortion
T. Wu[4], L. Lin[3], C. Chang[1], P. Lee[2]; *[1]Nation Chung Cheng University, Taiwan; [2]Nation Tsing Hua University, Taiwan; [3]National Chung Cheng University, Taiwan; [4]National Tsing Hua University, Taiwan*

D5.7 A High Power Density Grid Connected Soft Switched Inverter
B. Koushki[1], S. Khajehoddin[2], A. Safaee[1], P. Jain[1], A. Bakhshai[1]; [1]Queen's University, Canada; [2]University of Alberta, Canada

D5.8 Dyna-C: Experimental Results for a 50 kVA 3-Phase to 3-Phase Solid State Transformer
A. Prasai[2], H. Chen[1], R. Moghe[2], Z. Wolanski2, K. Chintakrinda[2], A. Zhou[2], J. Llambes[2], D. Divan[2]; *[1]Georgia Institute of Technology, United States; [2]Varentec, Inc., United States*

D5.9 Stacked Modular Isolated Dynamic Current Source Converters for Medium Voltage Applications
H. Chen[1], A. Prasai[2], D. Divan[2]; *[1]Georgia Institute of Technology, United States; [2]Varentec, Inc., United States*

D5.10 Instantaneous Fault Current Limiter for PWM-Controlled Voltage Source Converters
S. Babaei, M. Ghapandar Kashani, S. Bhattacharya; *North Carolina State University, United States*

D5.11 Rainflow Algorithm Based Lifetime Estimation of Power Semiconductors in Utility Applications
L. GopiReddy[3], L. Tolbert[3], B. Ozpineci[1], J. Pinto[2]; *[1]Oak Ridge Natinal Laboratory, United States; [2]Universidade Federal de Mato Grosso do Sul, Brazil; [3]University of Tennessee, United States*

D5.12 Development of Solid State Arc-Free Socket for DC Distribution System
K. Tan, A. Huang, A. Martin; *North Carolina State University, United States*

D5.13 Modular and Compact Design for an Isolated High-Frequency-Link Inverter Using Hybrid-Modulation Scheme
A. Rahnamaee, S. Mazumder; *University of Illinois at Chicago, United States*

D5.14 Grid-Connected Single-Phase Multi-Level Inverter
M. Sayed[3], M. Elsheikh[1], M. Orabi[1], E. Ahmed[1], T. Takeshita[2]; *[1]Aswan University, Egypt; [2]Nagoya Institute of Technology, Japan; [3]South Valley University, Egypt*

SESSION D6: Inverters

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Behrooz Bahrani, *Purdue University*

Maryam Saeedifard, *Georgia Institute of Technology*

D6.1 Feedforward Control of Output Current for Three-Phase Voltage Source Inverter (VSI) with Transformer
Y. Qi, L. Peng, Z. Huang, M. Chen, L. Sun; *Huazhong University of Science and Technology, China*

D6.2 Model Predictive Current Control of a Three-Level Five-Phase NPC VSI Using Simplified Computational Approach
A. Iqbal[1], H. Abu-Rub[3], S. Ahmed[3], P. Cortes[2], J. Rodriguez[4]; *[1]Qatar University, Qatar; [2]Santa Maria University, Chile; [3]Texas A&M University at Qatar, Qatar; [4]Universidad Tecnica Federico Santa Maria, Qatar*

D6.4 A High-Performance Z-Source Inverter with Low Capacitor Voltage Stress and Small Inductance
L. Yang, D. Qiu, B. Zhang, G. Zhang; *South China University of Technology, China*

DIALOGUE SESSIONS

D6.5 Comprehensive Analysis on Carrier-Based PWM Modulations for Advanced Composited Clamping Five-Level Converter
H. Yang, H. Luo, P. Sun, C. Li, W. Li, X. He; *Zhejiang University, China*

D6.6 Efficiency Characterization and Thermal Study of GaN Based 1 kW Inverter
D. Han, A. Ogale, S. Li, Y. Li, B. Sarlioglu; University of Wisconsin-Madison, United States

D6.7 A Low Frequency Input Current Reduction Scheme of a Two-Stage Single-Phase Inverter with DC-DC Boost Converter
J. Kim, K. Choi, R. Kim; *Hanyang University, Korea, South*

D6.8 Soft-Switching Z-Source Inverters with Coupled Inductor
X. Ding[1], H. Yuan[1], C. Zhang[2], J. Zhang[3]; *[1]Qingdao Technological University, China; [2]Shandong University, China; [3]Zhejiang University, China*

D6.9 Two-Layer Distributed Cooperative Control of Multi-Inverter Microgrids
A. Bidram, A. Davoudi, F. Lewis; *University of Texas at Arlignton, United States*

D6.10 A New Nested Neutral Point Clamped (NNPC) Converter for Medium-Voltage (MV) Power Conversion
M. Narimani[2], B. Wu[2], G. Cheng[1], N. Zargari[1]; *[1]Rockwell Automation, Canada; [2]Ryerson University, Canada*

D6.11 Direct Parallel Operation of Cascaded H-Bridge Multilevel Inverters
S. Sheng, B. Lehman; *Northeastern University, United States*

D6.12 Interleaved Carrier-Based Modulations for Reducing Low-Frequency Neutral Point Voltage Ripple in the Three-Phase Neutral Point Clamped Inverter
R. Petrella, A. Pevere; *Università di Udine, Italy*

D6.13 A Capacitor Voltage Balancing Method with Zero-Voltage Switching for Split Phase Inverter
L. Zhang, B. Gu, J. Dominic, B. Chen, J. Lai; *Virginia Polytechnic Institute and State University, United States*

D6.14 Effective Dithering Technique for EMI Reduction in Three Phase DC/AC Inverters
A. Elrayyah, Y. Sozer; *University of Akron, United States*

D6.15 Charging Method for the Second Battery in Dual Inverter Drive Systems for Electric Vehicles
J. Hong, H. Lee, K. Nam; *Pohang University of Science and Technology, Korea, South*

D6.16 Control and Analysis of the High Efficiency Split Phase PWM Inverter
S. Guo, A. Huang; *North Carolina State University, United States*

SESSION D7: Motor Drives

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Behrooz Mirafzal, *Kansas State University*

D7.1 An Improved Direct Torque Control Method for PMSM
X. Qiu, W. Huang, F. Bu; *Nanjing Aeronautics and Astronautics University, China*

D7.2 Design of a Novel Filter Topology with Active Impedance Regulator for Three-Phase Motor Drive System
W. Chen, X. Yang; *Xi'an Jiaotong University, China*

D7.3 Initial Rotor Position Estimation of Permanent Magnet Synchronous Machines Using Square-Wave Voltage Injection with a Single Current Sensor
S. Yang; *Texas Instruments, United States*

D7.4 Comparative Evaluation of Direct Torque Control Strategies for Permanent Magnet Synchronous Machines
F. Niu[1], K. Li[1], B. Wang[2], E. Strangas[2]; *[1]Hebei University of Technology, China; [2]Michigan State University, United States*

D7.5 Fast Control of PWAM Boost-Converter-Inverter System for HEV/EV Motor Drives
Y. Liu, F. Peng; *Michigan State University, United States*

D7.6 A Simplified Method to Estimate the Rotor Position Using the High Frequency Voltage Signal Injection
T. Yoon, H. Sim, J. Lee, K. Lee; *Ajou University, Korea, South*

D7.7 Adaptive PWM Algorithm Using Digital-Signal Processing Based THD Measurement for Electric Vehicle Application
J. Baek[3], S. Choi[1], S. Kwak[2]; *[1]Akron University, United States; [2]Chungang University, Korea, South; [3]Samsung Advanced Institute of Technology, Korea, South*

D7.8 Sensorless Control of Non-Salient PMSM Using Simultaneous Injection of Two HF Signals
M. Ghazi Moghadam[1], M. Yaghoubi[2], F. Tahami[2], A. Bakhshai[1], P. Jain[1]; *[1]Queen's University, Canada; [2]Sharif University of Technology, Iran*

D7.10 The Excitation Control Strategy of the Three-Stage Synchronous Machine in the Start Mode
J. Wei[2], Q. Zheng[2], M. Shi[1], B. Zhou[2], J. Li[2]; *[1]Jiangsu Electric Power Research Institute, China; [2]Nanjing Aeronautics and Astronautics University, China*

D7.11 A 2-D Fuzzy Logic Based MRAS Scheme for Sensorless Control of Interior Permanent Magnet Synchronous Motor Drives with Cyclic Fluctuating Loads
K. Sun, Y. Shi, L. Huang, Y. Li, X. Xiao; *Tsinghua University, China*

D7.12 Asymmetrical Multi-Lane Multi-Phase Motor Drives
A. Mohammadpour, L. Parsa; *Rensselaer Polytechnic Institute, United States*

D7.13 Control of Independent Multi-Phase Transverse Flux Linear Synchronous Motor Based on Magnetic Levitation
S. Hwang[2], J. Kim[3], D. Bang[1], J. Kim[1], D. Koo[1], D. Kang[1]; *[1]Korea Electrotechnology Research Institute, Korea, South; [2]Kyungnam University, Korea, South; [3]Pusan National University, Korea, South*

D7.14 A Low Cost Sensorless Drive for Hybrid Stepper Motors Based on Back-EMF Observer and d-Axis Current Injection for Industrial Labelling Machines
A. Antonioli[1], M. Antonioli[1], S. Calligaro[2], R. Petrella[2]; *[1]Elta Elettronica, Italy; [2]Università di Udine, Italy*

D7.15 Torque Control for IPMSM in the High Speed Range Based on Voltage Angle
H. Lee, J. Kim, J. Hong, K. Nam; *Pohang University of Science and Technology, Korea, South*

SESSION D8: Higher Power Device Switching

Thursday, March 20
11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Alberto Guerra, *International Rectifier*

D8.1 1000V Wide Input Auxiliary Power Supply Design with 1700V Silicon Carbide (SiC) MOSFET for Three-Phase Applications
J. Liu, K. Wong, J. Mookken; *Cree, Inc., United States*

D8.2 Comparison of High Power Semiconductor Devices Losses in 5MW PMSG MV Wind Turbines
K. Lee[1], K. Jung[1], Y. Suh[1], C. Kim[2], H. Yoo[2], S. Park[2]; *[1]Chonbuk National University, Korea, South; [2]Dawonsys Co., Korea, South*

D8.3 A High-Speed Protection Circuit for IGBTs Subjected to Hard-Switching Faults
T. Horiguchi[2], S. Kinouchi[2], Y. Nakayama[2], T. Oi[2], H. Urushibata[1], S. Okamoto[3], S. Tominaga[3], H. Akagi[3]; *[1]Kanazawa Institute of Technology, Japan; [2]Mitsubishi Electric Corporation, Japan; [3]Tokyo Institute of Technology, Japan*

D8.4 Thermal Stress and High Temperature Effects on Power Devices in a Fault-Resilient NPC IGCT-Based Converter
A. Rocha[1], B. de Jesus Cardoso Filho[3], G. Karimi Moghaddam[2], R. Gould[2], S. Bhattacharya[2]; *[1]Centro Federal de Educação Tecnológica de Minas Gerais, Brazil; [2]North Carolina State University, United States; [3]Universidade Federal de Minas Gerais, Brazil*

D8.6 Methodology for Switching Characterization Evaluation of Wide Band-Gap Devices in a Phase-Leg Configuration
Z. Zhang[2], B. Guo[2], F. Wang[2], L. Tolbert[2], B. Blalock[2], Z. Liang[1], P. Ning[1]; *[1]Oak Ridge National Laboratory, United States; [2]University of Tennessee, United States*

D8.7 Impact of Ringing on Switching Losses of Wide Band-Gap Devices in a Phase-Leg Configuration
Z. Zhang[2], B. Guo[2], F. Wang[2], L. Tolbert[2], B. Blalock[2], Z. Liang[1], P. Ning[1]; *[1]Oak Ridge National Laboratory, United States; [2]University of Tennessee, United States*

DIALOGUE SESSIONS

D8.8 Monitoring IGBT's Health Condition via Junction Temperature Variations
B. Tian, W. Qiao, Z. Wang, T. Gachovska, J. Hudgins; *University of Nebraska-Lincoln, United States*

D8.9 Optimization of Bi-Directional Flyback Converter for a High Voltage Capacitor Charging Application
P. Thummala, H. Schneider, Z. Zhang, A. Knott, M. Andersen; *Technical University of Denmark, Denmark*

D8.10 Study on Case Temperature Distribution for Condition Monitoring of Multidie IGBT Modules
B. Tian, Z. Wang, W. Qiao; *University of Nebraska-Lincoln, United States*

SESSION D9: Lower Power Device Switching

Thursday, March 20
11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Liang Zhou, *Transphorm*

D9.1 Three-Level Driving Method for GaN Transistor with Improved Efficiency and Reliability Within Whole Load Range
T. Sun, X. Ren, H. Dang, Z. Zhang, X. Ruan; *Nanjing Aeronautics and Astronautics University, China*

D9.2 Advantage of the Use of an Added Driver Source Lead in Discrete Power MOSFETs
C. Stella, M. Laudani, A. Gaito, M. Nania; *STMicroelectronics, Italy*

D9.3 Effects on Power Transistors of Terrestrial Cosmic Rays: Study, Experimental Results and Analysis
G. Consentino[2], M. Laudani[2], G. Privitera[1], C. Pace[3], C. Giordano[3], A. Hernandez[3], M. Mazzeo[3]; *[1]STMicroelectroincs, Italy; [2]STMicroelectronics, Italy; [3]Università della Calabria, Italy*

D9.4 Study of SiC Vertical JFET Behavior During Unclamped Inductive Switching
X. Li, A. Bhalla, P. Alexandrov, L. Fursin; *United Silicon Carbide, Inc., United States*

D9.5 Contour Mode Piezoelectric Ring Micro-Resonators on Si for Series Resonant Converters
A. Imtiaz, F. Khan, J. Walling; *University of Utah, United States*

D9.7 Design and Analysis of a Buck-Type Class-D Gate Driver IC
T. Kang, J. Kim; *Seoul National University, Korea, South*

SESSION D10: Magnetics & Component Aplications

Thursday, March 20
11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Edward Herbert

D10.1 Power Losses Calculations in Windings of Gapped Magnetic Components
F. Holguín, R. Prieto, R. Asensi, J. Cobos; *Universidad Politécnica de Madrid, Spain*

D10.2 Simple Analytical Approach for the Calculation of Winding Resistance in Gapped Magnetic Components
F. Holguín, R. Asensi, R. Prieto, J. Cobos; *Universidad Politécnica de Madrid, Spain*

D10.3 Prediction and Experimental Verification of Core Loss and Temperature Distribution for Geometrically Scaled FINEMET Toroids Using Finite Element Analysis
B. Grainger[2], O. Scioscia[2], T. McDermott[2], G. Reed2, E. Lin[1]; *[1]ANSYS, Inc, United States; [2]University of Pittsburgh, United States*

D10.4 An Axial Magnetic Gearbox with an Electric Power Output Port
H. Zaytoon[1], A. Abdel-Khalik[1], A. Massoud[2], S. Ahmed[3]; *[1]Alexandria University, Egypt; [2]Qatar University, Qatar; [3]Texas A&M University at Qatar, Qatar*

D10.5 Analysis of High-Speed PCB with SiC Devices by Investigating Turn-Off Overvoltage and Interconnection Inductance Influence
J. Noppakunkajorn, D. Han, B. Sarlioglu; *University of Wisconsin-Madison, United States*

D10.6 A New Coupled Inductors Used in Interleaving Bidirectional DC/DC Converter
Y. Yang, J. Ma, J. Ye, Z. Han; *Liaoning Technical University, China*

D10.7 High Current Planar Magnetics for High Efficiency Bidirectional DC-DC Converters for Fuel Cell Applications
R. Pittini, Z. Zhang, M. Andersen; *Technical University of Denmark, Denmark*

DIALOGUE SESSIONS

D10.8 Data Driven Modeling and Verification for Silicon Carbide JFET with Thermal Effects
L. Ruan, P. Zhu, L. Wang; *Nanjing Aeronautics and Astronautics University, China*

D10.9 Performance Evaluation of Graphite Thin Slabs for Induction Heating Domestic Applications
J. Acero, I. Lope, J. Burdío, C. Carretero, R. Alonso; *Universidad de Zaragoza, Spain*

D10.10 Genetic Algorithm Based High Density Inductor Optimization
T. Fan, P. Ning, X. Wen, Y. Li, Q. Ge; *Institute of Electrical Engineering, Chinese Academy of Sciences, China*

D10.11 Simplified Design Method for Litz Wire
C. Sullivan[1], R. Zhang[2]; *[1]Dartmouth College, United States; [2]Massachusetts Institute of Technology, United States*

SESSION D11: System Integration II

Thursday, March 20
11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
John Vigars, *Fairchild*
Chris Bridge, *Simplis Technologies*

D11.1 Thermal Analysis of a Submodule for Modular Multilevel Converters
M. Wu Cong[4], Y. Avenas[3], M. Miscevic[5], M. Wang[2], R. Mitova[2], J. Lavieville[2], P. Lasserre[1]; *[1]PRIMES Platform, France; [2]Schneider Electric, France; [3]Université de Grenoble / G2Elab, France; [4]Université de Grenoble / Schneider Electric – PRIMES, France; [5]Université de Toulouse, France*

D11.2 Analysis of the Stability of Power Electronics Systems: a Practical Approach
M. Sanz, V. Valdivia, P. Zumel, D. López Del Moral, C. Fernández, A. Lázaro, A. Barrado; *Universidad Carlos III de Madrid, Spain*

D11.3 Designing and Testing Battery Charger Systems for California's New Efficiency Regulations
C. Botting, R. Stockton, D. Gautam, M. Edington, F. Musavi; *Delta-Q Technologies Corp., Canada*

SESSION D12: Modeling and Control I

Thursday, March 20
11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Ali Davoudi, *University of Texas at Arlington*
Ali Mehrizi, *Washington State University*

12.2 Research on DC Capacitor Voltage Self-Balancing Space Vector Modulation Strategy of Five-Level NPC Converter
Y. Wang, N. Li, S. Li, W. Cong, W. Lei, Z. Wang; *Xi'an Jiaotong University, China*

D12.3 Fast DC Component Suppression Method for Phase Locked Loop
C. Ma[2], F. Gao[2], G. He[1], G. Li[1]; *[1]China Electric Power Research Institute, China; [2]Shandong University, China*

D12.4 Ride-Through Capability Enhancement of VSC-HVDC Based Wind Farms Using Low Speed Flywheel Energy Storage System
M. Daoud[2], A. Massoud[2], S. Ahmed[3], A. Abdel-Khalik[1], A. Elserougi[1]; *[1]Alexandria University, Egypt; [2]Qatar University, Qatar; [3]Texas A&M University at Qatar, Qatar*

D12.5 Design of Energy Control Method for Three-Phase Buck-Type Rectifier with Very Demanding Load Steps
S. Zhao2, J. Molina[2], M. Silva[2], J. Oliver[2], P. Alou[2], J. Torres[1], F. Arévalo[1], O. Garcia[2], J. Cobos[2]; *[1]INDRA, Spain; [2]Universidad Politécnica de Madrid, Spain*

D12.7 Dynamic Model and Control of Wound-Rotor Machine in Single-Phase Grid System
K. Lee, Y. Han, J. Ha; *Seoul National University, Korea, South*

D12.8 A Building-Block Approach to Efficiency and Cost Models of Power Electronic Systems
A. Kulkarni, A. Bazzi; *University Of Connecticut, United States*

D12.9 One-Step Ahead Model Predictive Controller of Three-Phase Inverter for Uninterruptible Power Supply Applications
S. Kim[1], C. Park[2], Y. Lee[2]; *[1]Korea University, Korea, South; [2]Seoul National University of Science and Technology, Korea, South*

D12.10 Improved Modulation Techniques to Eliminate Leakage Ground Currents in Three-Phase Photovoltaic Systems
H. Huang, W. Chen, X. Song; *Xi'an Jiaotong University, China*

DIALOGUE SESSIONS

D12.11 Small-Signal Impedance Identification of Three-Phase Diode Rectifier with Multi-Tone Injection
B. Zhou[2], M. Jaksic[2], Z. Shen[2], B. Wen[2], P. Mattavelli[1], D. Boroyevich[2], R. Burgos[2]; *[1]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, United States; [2]Virginia Polytechnic Institute and State University, United States*

D12.12 A Time-Efficient Modeling and Simulation Strategy for Aggregated Multiple Microinverters in Large-Scale PV Systems
S. Park, A. Bazzi, S. Park, W. Chen; *University of Connecticut, United States*

D12.14 A Carrier Based PWM Technique for Capacitor Voltage Balancing of Single-Phase Three-Level Neutral-Point-Clamped Converters
I. Freitas[2], M. Bandeira[2], F. Salvadori[2], S. da Silva[2], L. Barros[2], C. Jacobina[3], E. dos Santos Jr.[1]; *[1]Purdue School of Engineering and Technology, United States; [2]Universidade Federal da Paraíba, Brazil; [3]Universidade Federal de Campina Grande, Brazil*

D12.15 Inverter Device Nonlinearity Characterization Technique for Use in a Motor Drive System
A. Babel[1], A. Muetze[2], R. Seebacher[2], K. Krischan[2], E. Strangas[1]; *[1]Michigan State University, United States; [2]Technische Universität Graz, Austria*

D12.16 Multi-Level Single-Phase Shunt Current Injection Converter Used in Small-Signal DQ Impedance Identification
M. Jaksic[2], Z. Shen[2], I. Cvetkovic[2], D. Boroyevich[2], R. Burgos[2], P. Mattavelli[1]; *[1]Università degli Studi di Padova / Virginia Polytechnic Institute and State University, Italy; [2]Virginia Polytechnic Institute and State University, United States*

SESSION D13: Modeling and Control II

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Ali Davoudi, *University of Texas at Arlington*

D13.1 Control Strategy for a Single-Input Dual-Output Converter with One Idling Output Port
M. Liang, T. Zheng, Y. Li, J. Miao; *Beijing Jiaotong University, China*

D13.2 Unified Control of a Buck Converter for Wide Load Range Applications
C. van der Broeck2, R. De Doncker[2], S. Richter[1], J. von Bloh[1]; *[1]AixControl GmbH, Germany; [2]Rheinisch-Westfaelische Technische Hochschule Aachen, Germany*

D13.4 On the Modeling of Switched Capacitor Converters with Multiple Outputs
J. Delos[2], T. Lopez[2], E. Alarcón[3], M. Hendrix[1]; *[1]Eindhoven University of Technology, Netherlands; [2]Philips Research, Netherlands; [3]Technical University of Catalonia, Spain*

D13.6 Time-Optimal Control in DC-DC Converters: a Maximum Principle Perspective
S. Dhople[2], K. Kim[1], A. Domínguez-García[1]; *[1]University of Illinois at Urbana-Champaign, United States; [2]University of Minnesota, United States*

D13.7 Small Signal Analysis and Design of Active Droop Control Using Current Mode Equivalent Circuit Model
Y. Yan, P. Liu, F. Lee; *Virginia Polytechnic Institute and State University, United States*

D13.8 Research on Stability of Buck Converter with Output-Current-Feedforward Control
B. Wang, P. Jia, T. Zheng, Y. Li; *Beijing Jiaotong University, China*

D13.10 Stability Analysis and Control of Nonlinear Phenomena in Bidirectional Boost Converter Based on the Monodromy Matrix
H. Wu, V. Pickert; *Newcastle University, United Kingdom*

D13.11 Novel Small Signal Modeling and Control of an LLC Resonant Converter
B. Cheng[2], F. Musavi[1], W. Dunford[2]; *[1]CUI Inc., United States; [2]University of British Columbia, Canada*

D13.12 Damping Impact on Dynamic Analysis of LLC Resonant Converter
Z. Zahid[2], J. Lai[2], K. Huang[1], S. Madiwale[1], J. Hou[1]; *[1]Analog Devices Inc., United States; [2]Virginia Polytechnic Institute and State University, United States*

D13.13 Extended Averaging Method for Power Supply Systems with Multiple Switching Frequencies
P. Shamsi; *Missouri University of Science and Technology, United States*

D13.14 Small-Signal Modeling of Series-Series Compensated Induction Power Transfer System
Z. Zahid, Z. Dalala, J. Lai; *Virginia Polytechnic Institute and State University, United States*

DIALOGUE SESSIONS

SESSION D14: Modeling and Control III

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Jaber Abu Qahouq, *University of Alabama*

Brian Lynch, *Texas Instruments*

D14.2 On-Chip Coupled Power Inductor for Switching Power Converters
Z. Dang, J. Abu Qahouq; *University of Alabama, United States*

D14.3 Slew Rate Control Strategies for Smart Power ICs Based on Iterative Learning Control
M. Blank[2], T. Glück[2], A. Kugi[2], H. Kreuter[1]; *[1]Infineon Technology, Austria; [2]Technische Universität Wien, Austria*

D14.4 Toward Consensus-Based Balancing of Smart Batteries
S. Abhinav[1], G. Binetti[2], A. Davoudi[1], F. Lewis[1]; *[1]University of Texas at Arlignton, United States; [2]University of Texas at Arlington, United States*

D14.5 Pulsed Iv Characterization of GaN HEMTs for High Frequency, High Efficiency Integrated Power Converters
A. Pereira[1], A. Parker[1], M. Heimlich[1], N. Weste[1], L. Dunleavy[2]; *[1]Macquarie University, Australia; [2]Modelithics, Inc., United States*

D14.6 A New MPPT Control Strategy for Stand-Alone Solar PV Systems with Enhanced Battery Life
M. Das, V. Agarwal; *Indian Institute of Technology, Bombay, India*

D14.7 Comparison of the Behavior of Voltage Mode, V^2 and V^2Ic Control of a Buck Converter for a Very Fast and Robust Dynamic Response
J. Cortés, V. Svikovic, P. Alou, J. Oliver, J. Cobos; *Universidad Politécnica de Madrid, Spain*

D14.8 Comparison of Audible Noise Caused by Magnetic Components in Switch-Mode Power Supplies Operating in Burst Mode and Frequency-Foldback Mode
L. Huber, M. Jovanovic; *Delta Products Corporation, United States*

D14.9 Effects of Edge Termination Using Dielectric Field Plates with Different Dielectric Constants,Thicknesses and Bevel Angles
Y. Huang[2], K. Jayaprakash[1], C. Cheung[1]; *[1]Intersil Corporation, United States; [2]Rutgers University, United States*

D14.10 Distributed Cooperative Load Sharing in Parallel DC-DC Converters
S. Moayedi, A. Davoudi; *University of Texas at Arlignton, United States*

D14.11 Modeling and Analysis of Resonant Switched Capacitor Converters with Free-Wheeling ZCS
E. Hamo[1], M. Evzelman[2], M. Peretz[1]; *[1]Ben-Gurion University of the Negev, Israel; [2]Utah State University / Ben-Gurion University of the Negev, Israel*

D14.12 Ensuring Volt-Second Balance in High-Power-Density Phase-Shifted Full-Bridge Converter Design
A. Lemmon[3], M. Mazzola[1], J. Gafford[1], C. Parker[2]; *[1]Mississippi State University, United States; [2]Raytheon Company, United States; [3]University of Alabama, United States*

D14.13 Research on Soft-Switching and Peak Current of Dual Active Bridge Converters
J. Miao, X. You, Y. Li, M. Liang; *Beijing Jiaotong University, China*

SESSION D15: Quality & Business Issues

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

John Vigars, *Fairchild*

Chris Bridge, *Simplis Technologies*

D15.1 Mathematical Method of Scheduling Lead-Acid Battery for Cycling Use
B. Liu, F. Zhuo, Y. Zhu, S. Zhong; *Xi'an Jiaotong University, China*

SESSION D16: Photovoltaics

Thursday, March 20, 11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Morgan Kiani, *Texas Christian University*
Zhong Nie, *Chrysler Group LLC*

D16.1 A Novel Five-Level Inverter for Solar System
F. Wang, L. Hang, Y. Wang; *Shanghai Jiao Tong University, China*

D16.3 Phase Skipping Control to Improve Light Load Efficiency of Three Phase Micro-Inverters
U. Somani, C. Jourdan, A. Amirahmadi, A. Grishina, H. Hu, I. Batarseh; *University of Central Florida, United States*

D16.4 A Maximum Power Point Tracking Technique for Single-Phase PV Systems with Reduced DC-Link Capacitor
S. Yarlagadda[1], W. Shireen[2]; *[1]Aim Electrical Consultants, United States; [2]University of Houston, United States*

D16.5 A Novel ZVS Resonant-Type Flyback Microinverter with Regenerative Snubber
A. Mukherjee[2], M. Pahlevaninezhad[1], G. Moschopoulos[2]; *[1]Queen's University, Canada; [2]University of Western Ontario, Canada*

D16.6 Forward Micro-Inverter with Primary-Parallel Secondary-Series Multicore Transformer
D. Meneses, O. García, P. Alou, J. Oliver, R. Prieto, J. Cobos; *Universidad Politécnica de Madrid, Spain*

D16.7 Enhanced Differential Power Processor for PV Systems: Resonant Switched-Capacitor Gyrator Converter with Local MPPT
A. Blumenfeld, A. Cervera, M. Peretz; *Ben-Gurion University of the Negev, Israel*

D16.8 Intelligent Slope-Based Maximum Power Point Searching Algorithm for Fixed-Pitch Horizontal-Axis Wind Energy Systems
J. Hui, A. Bakhshai, P. Jain; *Queen's University, Canada*

D16.9 Unified Maximum Power Tracking Among Distributed Power Sources
K. Siri[1], F. Chen[3], M. Batarseh[2]; *[1]Aerospace Corporation, United States; [2]Princess Sumaya University, Jordan; [3]University of Central Florida, United States*

D16.10 An Improved MPPT Technique for High Gain DC-DC Converter Using Model Predictive Control for Photovoltaic Applications
M. Shadmand[1], M. Mosa[2], R. Balog[1], H. Abu-Rub[2]; *[1]Texas A&M University, United States; [2]Texas A&M University at Qatar, Qatar*

D16.11 Modeling and Analysis of DC-Link Voltage for Three-Phase Four-Wire Two-Stage Micro-Inverter
F. Chen, Q. Zhang, A. Amirahmadi, I. Batarseh; *University of Central Florida, United States*

D16.12 Fuzzy Logic Based Control System for Cascaded H-Bridge Converter
G. Farivar, V. Agelidis, B. Hredzak; *University of New South Wales, Australia*

D16.13 Voltage Regulation in Single-Stage Boost Inverter for Stand-Alone Applications
A. Singh, A. Milani, B. Mirafzal; *Kansas State University, United States*

D16.14 Control and Configuration of Three-Level Dual-Active Bridge DC-DC Converter as a Front-End Interface for Photovoltaic System
M. Moonem, H. Krishnaswami; *University of Texas at San Antonio, United States*

D16.15 A Current Control MPPT Method in High Power Solar Energy Conversion System
B. Wu, K. Smedley; *University of California, Irvine, United States*

D16.16 Topology Variations and Design Improvements of a Single-Stage Flyback PV Microinverter
S. Chakraborty, S. Chattopadhyay; *Indian Institute of Technology Kharagpur, India*

D16.17 Non-Isolated Individual MPP Trackers for Series PV Strings Through Partial Current Processing Technique
M. Badawy, A. Elrayyah, F. Cingoz, Y. Sozer; *University of Akron, United States*

SESSION D17: Renewable Energy Sources & Systems

Thursday, March 20, 11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Alex Craig, *Fairchild Semiconductor*
Juan Carlos Balda, *University of Arkansas*

D17.1 Emulating Full-Converter Wind Turbine by a Single Converter in a Multiple Converter Based Emulation System
Y. Ma, L. Yang, J. Wang, F. Wang, L. Tolbert; *University of Tennessee, United States*

DIALOGUE SESSIONS

D17.2 Using Virtual Impedance Network to Improve the Control Performances of LCL-Type Grid-Connected Inverter Under the Weak Grid Condition
D. Yang, X. Ruan, H. Wu; *Nanjing Aeronautics and Astronautics University, China*

D17.3 Application of a Digital ANF-Based Power Processor for Micro-Grids Power Quality Enhancement
S. Rafiei2, A. Moallem[2], A. Bakhshai[2], D. Yazdani[1]; *[1]Fairchild Semiconductor, United States; [2]Queen's University, Canada*

D17.4 Second Order Harmonics Reduction Thechnique Using Model Predictive Control for Household Energy Storage Systems
J. Park, H. Jeong, K. Lee; *Ajou University, Korea, South*

D17.5 Three-Port ZVS Converter with PWM Plus Secondary-Side Phase-Shifted for Photovoltaic-Storage Hybrid Systems
Z. Chen; *University of Wisconsin-Madison, United States*

D17.6 A Novel Active Power Control Strategy Based on Droop Control Method for Parallel Inverters
Z. You, J. Liu, X. Zhang, T. Wu, X. Wang; *Xi'an Jiaotong University, China*

D17.7 Thermal Behavior of Doubly-Fed Induction Generator Wind Turbine System During Balanced Grid Fault
D. Zhou[1], F. Blaabjerg[1], M. Lau[2], M. Tonnes[2]; *[1]Aalborg University, Denmark; [2]Danfoss Silicon Power GmbH, Germany*

D17.8 Medium-Voltage (MV) Matrix Converter Topology for Wind Power Conversion Using Medium-Frequency Transformer (MFT) Isolation
C. Gu[2], H. Krishnamoorthy[1], P. Enjeti1, Y. Li[2]; *[1]Texas A&M University, United States; [2]Tsinghua University, China*

D17.9 A Distributed Architecture Based on Micro-Bank Modules with Self-Reconfiguration Control Regarding Battery Recovery Effect for DC Microgrids
Z. Zhang[1], Y. Cai[1], X. He[1], Y. Liu[2]; *[1]Nanjing Aeronautics and Astronautics University, China; [2]Queen's University, Canada*

D17.10 Doubly Fed Induction Generator Based Wind Turbine Systems Subject to Recurring Grid Faults
W. Chen2, F. Blaabjerg[1], N. Zhu[2], M. Chen[2], D. Xu[2]; *[1]Aalborg University, Denmark; [2]Zhejiang University, China*

D17.11 Biomechanical Energy Harvesting System with Optimal Cost-of-Harvesting Tracking Algorithm
Z. Rubinshtein, M. Peretz, R. Riemer; *Ben-Gurion University of the Negev, Israel*

D17.12 SSR Analysis of a DFIG – Based Wind Farm Interfaced with a Gate-Controlled Series Capacitor
H. Mohammadpour[1], Y. Shin[2], E. Santi[1]; *[1]University of South Carolina, United States; [2]Yonsei University, Korea, South*

D17.13 A Fully Decoupled Feed-Forward Control for Low-Voltage Ride-Through of DFIG Based Wind Turbines
L. Zhou, J. Liu, S. Zhou, H. She; *Xi'an Jiaotong University, China*

D17.14 A Tapped-Inductor Buck-Boost Converter for a Dielectric ElectroActive Polymer Generator
E. Dimopoulos, S. Munk-Nielsen; *Aalborg University, Denmark*

D17.15 PV System Modeling and a Global-Planning Design for its Controller Parameters
Y. Xie[1], J. Huang[1], X. Liu[1], F. Zhuo[1], B. Liu[1], H. Zhang[2]; *[1]Xi'an Jiaotong University, China; [2]Xuji Group, China*

D17.16 A Wireless, Decentralized and Nonlinear Energy Management Strategy Using PCC Frequency for Islanded AC Microgrids
Z. Guo, D. Sha, X. Liao; *Beijing Institute of Technology, China*

D17.17 Efficiency Control of Multi-String PV System Considering Switching Losses Analysis
K. Hyung[2], H. Shin[2], J. Ha[2], A. Yoo[1]; *[1]LSIS Co. Ltd., Korea, South; [2]Seoul National University, Korea, South*

D17.18 A Novel Low Cost Power Converter Topology for Active Power Injection in Low Voltage Monophasic Power Line from Fuel Cells
J. Monteiro, M. Aguiar, G. Paula, A. Oliveira Jr., L. Neto, R. Altafim; *Universidade de São Paulo, Brazil*

D17.19 Effects of DSSC Configuration on Power Conversion Efficiency
D. Newell[2], M. Duffy[1], R. Twohig[3]; *[1]National University of Ireland, Galway, Ireland; [2]National University of Ireland, Galway / SolarPrint, Ireland; [3]SolarPrint, Ireland*

DIALOGUE SESSIONS

D17.20 Micro Grid Based PMSG Feeding Isolated Loads
A. Hamadi[1], S. Rahmani[1], K. Al-Haddad[1], K. Addoweesh[2]; *[1]École de Technologie Supérieure, Canada; [2]King Saud University, Saudi Arabia*

D17.21 Reliability and Cost Analysis of Solar Photovoltaic and Fuel Cell Based Microgrids
F. Cingoz, A. Elrayyah, M. Badawy, Y. Sozer; *University of Akron, United States*

D17.22 Control of Squirrel Cage Induction Generator in an Oscillating Point Absorber Based Wave Energy Conversion System
S. Hazra, S. Bhattacharya; *North Carolina State University, United States*

D17.23 Power Flow Analysis Algorithm for Islanded LV Microgrids Including Distributed Generator Units with Droop Control and Virtual Impedance Loop
C. Li, S. Chaudhary, J. Vasquez, J. Guerrero; *Aalborg University, Denmark*

D17.24 Online LCL Filter Compensation Using Embedded FRA
M. Bhardwaj1, S. Choudhury[1], V. Xue[1], B. Akin[2]; *[1]Texas Instruments, China; [2]University of Texas at Dallas, United States*

SESSION D18: Vehicular Electronics II

Thursday, March 20, 11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):

Bulent Sarlioglu, *University of Wisconsin – Madison*

Khurram Afridi, *University of Colorado Boulder*

D18.1 Optimal Design and Control of OBC-LDC Integrated Power Unit for Electric Vehicles
Y. Kim[2], C. Oh[2], W. Sung[2], B. Lee[2], G. Park[1]; *[1]Dongahelecomm Corporation, Korea, South; [2]Sungkyunkwan University, Korea, South*

D18.2 Asymmetric Control Algorithm for Non-Isolated Type on-Board Battery Charger with Single Controller
D. Kim, M. Kim, S. Ryu, Y. Kim, B. Lee; *Sungkyunkwan University, Korea, South*

D18.4 An Interleaving Scheme to Reduce DC-Link Current Harmonics of Dual Traction Inverters in Hybrid Electric Vehicles
H. Ye, A. Emadi; *McMaster University, Canada*

D18.5 Propulsion and Battery Charging Systems of an All-Electric Boat Fully Constructed with Interleaved Converters Employing Interphase Transformers and Gallium Nitride (GaN) Power FET Semiconductors
T. Soeiro[1], T. Jappe[2], W. dos Santos[2], D. Martins[2], M. Heldwein[2]; *[1]ABB Switzerland Ltd., Switzerland; [2]Universidade Federal de Santa Catarina, Brazil*

D18.6 Study of the Characteristics of Battery Packs in Electric Vehicles with Parallel-Connected Lithium-Ion Battery Cells
X. Gong, R. Xiong, C. Mi; *University of Michigan-Dearborn, United States*

D18.7 Genetic Algorithm Based Coil System Design for Wireless Power Charging
P. Ning, X. Wen; *Institute of Electrical Engineering, Chinese Academy of Sciences, China*

D18.8 Active Balancing System for Electric Vehicles with Incorporated Low Voltage Bus
D. Costinett[2], K. Hathaway[3], M. Rehman[3], M. Evzelman[4], R. Zane[3], Y. Levron[1], D. Maksimovic[1]; *[1]University of Colorado at Boulder, United States; [2]University of Tennessee, United States; [3]Utah State University, United States; [4]Utah State University / Ben-Gurion University of the Negev, United States*

D18.10 A Single-Stage Bridgeless High Efficiency ZVS Hybrid-Resonant Off-Road and Neighborhood EV Battery Charger
M. Alam[2], W. Eberle[2], F. Musavi[1]; *[1]Delta-Q Technologies Corp., Canada; [2]University of British Columbia, Canada*

D18.11 Effect of PWM Schemes on Integrated Battery Charger for Plug-in Hybrid Electric Vehicles: Performance, Power Factor, and Efficiency
D. Woo, Y. Kim, B. Lee*; Sungkyunkwan University, Korea, South*

DIALOGUE SESSIONS

SESSION D19: Power Electronics I

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Robert Pilawa, *University of Illinois at Urbana-Champaign*

Joao Andres, *General Electric*

D19.1 Analysis and Design of Voltage Maintaining Method for Series Resonant Capacitor Charging Power Supply
L. Lin, H. Zhong, Y. Deng, L. Gao, X. Luo, A. Li, Y. Liao; *Huazhong University of Science and Technology, China*

D19.5 Analysis and Design of High Frequency LCC Resonant Converter Applied in Corona Generator for Film Treatment
C. Zhang, T. Guo, S. Hao, X. Liu, Y. Dong, J. Liu, X. He; *Zhejiang University, China*

D19.7 Interleaved SWISS Rectifiers for Fast EV/PHEV Battery Chargers
M. Ahmed, J. Dasika, M. Saeedifard, O. Wasynczuk; *Purdue University, United States*

D19.8 Input-Series Output-Parallel Multiple Output Converter
X. Ren, Q. Zhang, Z. Pang, Q. Chen, X. Ruan; *Nanjing Aeronautics and Astronautics University, China*

D19.9 Cell Balancing Control of Single Switch Flyback Converter Using Generalized Filters
J. Kim, J. Ha; *Seoul National University, Korea, South*

D19.10 A High-Voltage Class D Audio Amplifier for Dielectric Elastomer Transducers
D. Nielsen, A. Knott, M. Andersen; *Technical University of Denmark, Denmark*

D19.11 State-of-the-Art Multiple Outputs High Brightness (HB) LED Driving Technology
C. Hu, Y. Zhang, X. Wu; *Zhejiang University, China*

D19.12 Simple Self Driven Post-Regulator for Space Applications
A. Fernández, H. Carbonnier, O. Mourra, F. Tonicello; *European Space Agency, Netherlands*

D19.13 Modular Design of Cascaded H-Bridge for Community Energy Storage Systems by Using Secondary Traction Batteries
S. Bai, S. Lukic; *North Carolina State University, United States*

D19.14 A Novel Magnetic Reset Zero-Voltage Soft-Switching Inverter with Improved Magnetic Coupling Method
B. Chen, B. Gu, L. Zhang, N. Kees, J. Lai; *Virginia Polytechnic Institute and State University, United States*

D19.15 Linear PFC Regulator for LED Lighting with the Multi-Level Structure and Low Voltage MOSFETs
Y. Noge, J. Itoh; *Nagaoka University of Technology, Japan*

D19.17 Power Electronics Integration on Battery Cells
Y. Li, Y. Han; *University of Wisconsin-Madison, United States*

D19.18 Single Stage Primary Side Controlled Offline Flyback LED Driver with Ripple Cancellation
P. Fang, Y. Liu; *Queen's University, Canada*

D19.19 Modulation, Control and Capacitor Voltage Balancing of Alternate Arm Modular Multilevel Converter with DC Fault Blocking Capability
E. Mathew, A. Shukla; *Indian Institute of Technology, Bombay, India*

D19.20 An AC-Powered, Flicker-Free, Multi-Channel LED Driver with Current-Balancing SIMO Buck Topology for Large Area Lighting Applications
H. Kim, C. Yoon, H. Ju, D. Jeong, J. Kim; *Seoul National University, Korea, South*

D19.21 Controlling Harmonics in Electrical Power Systems for Satisfying Total and Individual Harmonic Distortion Constraints
C. Gehrke, A. Lima, A. Oliveira; *Universidade Federal de Campina Grande, Brazil*

D19.22 A Robust Commutation Circuit for Reliable Single-Step Commutation of the Matrix Converter
A. Nabavi Niaki[2], R. Iravani[2], H. Kojori[1]; *[1]Honeywell Advanced Technology, Canada; [2]University of Toronto, Canada*

D19.23 High Efficiency Transformerless MOSFET Inverter for Grid-Tied Photovoltaic System
M. Islam, S. Mekhilef; *University of Malaya, Malaysia*

D19.24 Y-Source Impedance Network
Y. Siwakoti[2], P. Loh[1], F. Blaabjerg[1], G. Town[2]; *[1]Aalborg University, Denmark; [2]Macquarie University, Australia*

D19.25 Optimal Control of SVC-MERS and Application in SCIG Powered Micro-Grid
Y. Wei[2], L. Kang[2], R. Qi[2], M. Wen[2], M. Cheng[1]; *[1]Hunan University, China; [2]South China University of Technology, China*

D19.26 LLC Resonant Converter Using a Planar Transformer with New Core Shape
E. Kim[1], C. Kang[1], I. Hwang[1], Y. Lee[2], D. Huh[2]; [1]Jeonju University, Korea, South; [2]LG Innotek, Korea, South

D19.27 Dynamic Operation and Control of a Stand-Alone PEM Fuel Cell System
H. Esmaeilian[1], R. Fadaeinedjad[1], G. Moschopoulos[2]; *[1]Graduate University of Advanced Technology, Iran; [2]University of Western Ontario, Canada*

D19.28 Implementation of a 2-in-1 Transformer Combined with a PFC Inductor and an LLC Transformer for PSUs
C. Kang[1], Y. Noh[1], J. Kwon[1], E. Kim[1], J. Won[1], D. Kim[2], Y. Lee[2]; *[1]Jeonju University, Korea, South; [2]LG Innotek, Korea, South*

D19.29 Performance Improvement of CM/DM Noise Separator with Impedance Matching Approach
X. Chang, W. Chen, X. Yang; *Xi'an Jiaotong University, China*

SESSION D20: Power Electronics II

Thursday, March 20, 11:30 a.m. – 1:30 p.m.
BALLROOM B

CHAIR(S):
Seungdeog Choi, *University of Akron*
Daniel Chang, *ActiveSemi Inc.*

D20.1 Low Power and High Receiving Sensitivity Wireless Wake-Up Receiver with 2-Stage Power-Supply Control Scheme for Lithium-Ion Battery Systems
T. Terada, M. Kikuchi, A. Kudo, T. Yamazoe, T. Takeuchi; *Hitachi Ltd., Japan*

D20.2 Design and Control Strategy for a New Hybrid Energy Storage System
Y. Wang[1], C. Xiang[1], S. Hu[2]; *[1]Beijing Institute of Technology, China; [2]University of Michigan-Dearborn, United States*

D20.3 A Clamping Circuit Parameter Design Method for IGCT Used in High Power Applications
Y. Wang, N. Li, C. Zhang, W. Cong, W. Lei, Z. Wang; *Xi'an Jiaotong University, China*

D20.4 An LLC-Based Planar Wireless Power Transfer System for Multiple Devices
N. Liu, B. Wang; *Mitsubishi Electric Research Laboratories, United States*

D20.6 Thermal Design Optimization of a High-Efficiency Resonant Converter Based on Multi-MOSFET Cells Using the Pareto Analysis
O. Lucía, H. Sarnago, F. Betés, J. Burdío; *Universidad de Zaragoza, Spain*

D20.7 A Protection Scheme Against DC Faults VSC Based DC Systems with Bus Capacitors
C. Peng, A. Huang; *North Carolina State University, United States*

D20.8 Design and Desmonstration of a 3.6kV-120V/10KVA Solid State Transformer for Smart Grid Application
X. She, X. Yu, F. Wang, A. Huang; *North Carolina State University, United States*

D20.10 High Efficiency Data Center Power Supply Using Wide Band Gap Power Devices
Y. Cui[2], F. Xu[2], W. Zhang[2], B. Guo[2], L. Tolbert[2], F. Wang[2], B. Blalock[2], L. Jenkins[1], C. Wilson[1], J. Aggas[1], B. Rhea[1], J. Moses[1], R. Dean[1]; *[1]Auburn University, United States; [2]University of Tennessee, United States*

D20.11 Determining the Physical Size of Inductive Couplers for IPT EV Systems
G. Nagendra, G. Covic, J. Boys; *University of Auckland, New Zealand*

D20.12 Load-Voltage-Based Single-Sensor MPPT Controller for Multi-Channel PV Systems
J. Abu Qahouq, Y. Jiang, W. Huang; *University of Alabama, United States*

D20.14 An Enhanced Energy Harvesting Method Based on Resonant Current Transformer for High Voltage AC Cable Monitoring Equipment
Z. Wang[2], J. Du[2], R. Wang[2], W. Huang[1], W. Hu[1], J. Wu[2], Y. Dong[2], X. He[2]; *[1]Zhejiang Provincial Electric Power Company of State Grid, China; [2]Zhejiang University, China*

D20.15 Direct 400 V to 1 V Converter for Data Center Power Supplies Using GaN FETs
Y. Cui, W. Zhang, L. Tolbert, F. Wang, B. Blalock; *University of Tennessee, United States*

D20.16 A Novel Method for Modeling of DC Micro-Grid Based on Characteristic Parameter
M. Zhu[1], C. Li[1], J. Huang[1], F. Zhuo[1], L. Xiong[1], B. Liu[1], H. Zhang[2]; *[1]Xi'an Jiaotong University, China; [2]Xuji Group, China*

EXHIBITOR SEMINARS

D20.17 Overvoltage Protection Scheme for Three-Phase Current Source Converter Built with SiC MOSFETs
B. Guo, F. Xu, F. Wang, L. Tolbert, B. Blalock; *University of Tennessee, United States*

D20.18 Experimental Validation of the Steady State and Transient Behavior of a Transformerless Intelligent Power Substation
S. Madhusoodhanan[2], A. Tripathi[2], A. Kadavelugu[2], S. Hazra[2], D. Patel[2], K. Mainali[2], S. Bhattacharya[2], K. Hatua[1]; *[1]Indian Institute of Technology Madras, India; [2]North Carolina State University, United States*

D20.19 Medium Voltage Power Distribution Architecture with Medium Frequency Isolation Transformer for Data Centers
B. Hafez[2], H. Krishnamoorthy[2], P. Enjeti[2], S. Ahmed[3], I. Pitel[1]; *[1]Magna-Power Electronics, Inc., United States; [2]Texas A&M University, United States; [3]Texas A&M University at Qatar, Qatar*

D20.20 Minimization of Power Loss and Harmonic Distortion in Grid-Tied Cascaded Multilevel Inverters
F. Fateh, D. Gruenbacher; *Kansas State University, United States*

D20.22 A Solid State Variable Capacitor with Minimum DC Capacitance
S. Liang, X. Lu, R. Chen, Y. Liu, S. Zhang, F. Peng; *Michigan State University, United States*

SESSION D21: Critical Packaging Topics for Power

Thursday, March 20

11:30 a.m. – 1:30 p.m.

BALLROOM B

CHAIR(S):

Ernie Parker, *Crane*

John Vigars, *Fairchild*

D21.1 Operating Parameter Based Wirebond Model for a Power Module
L. Gopireddy[2], L. Tolbert[2], B. Ozpineci[1]; *[1]Oak Ridge Natinal Laboratory, United States; [2]University of Tennessee, United States*

D21.2 Performace Comparison of Thermal Interface Materials for Power Electronics Applications
D. Gautam, D. Wager, M. Edington, F. Musavi; *Delta-Q Technologies Corp., Canada*

APEC 2013 Exhibitors

The Exposition will open on Monday, March 18th when the Plenary Session concludes.

Exhibit Hall Hours

Monday, March 18th	*5:00 pm – 8:00 pm **hall will open upon conclusion of the Plenary*
Tuesday, March 19th	12:00 pm – 5:00 pm
Wednesday, March 20th	10:00 am – 2:00 pm

Exhibit Hall Functions

Exhibitor's Reception

A Welcoming Reception will be held in the Exhibit Hall on Monday, March 18, from 5:00 pm until 8:00 pm. Registered spouses and guests are welcome.

Exhibit Hall Breaks

Tuesday and Wednesday light snacks will be offered in the exhibit hall from 12:00 pm – 2:00 pm free of charge to all who have access to the exhibit hall.

On Tuesday afternoon from 3:00 pm – 3:30 pm we will be having an ice cream social in the Exhibit hall.

The Wednesday morning coffee break will be served in the Exhibit Hall from 10:30 am to 11:00 am.

Exposition Survey & Giveaway

During all three days of the Exhibition we will be giving away over $5000 in prizes. At registration everyone (exhibits only registrants and exhibitors included) will be issued a raffle ticket that you will put in a drop box upon entering the Exhibit Hall. This will be good for all three days of raffles during the exhibition but you must be present to win.

Exhibitor Listing
As of 2/06/14

ACME Electronics Corporation
Acopian Power Supplies
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Adelser Inc.
Advanced Cooling Technologies, Inc.
Advanced Test Equipment Rentals
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Alpha Power Technologies
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Amphenol Interconnect Products
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Anofol
Anpec Electronics
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API Delevan
API Technologies/ EIS Products
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Bergquist Company The
Bomatec International Corp.
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Ceramic Magnetics, Inc./Kolektor Magma
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C-Motive Technologies
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Cornell Dubilier
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Iwatsu Test Instruments
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LOUNGE
LTEC Corporation
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NXP Semiconductors
Ohmite MFG
Okaya
ON Semiconductor
Opal-RT Technologies
Pacific Sowa Corporation; C/O Epson Atmix Corporat
PAL NOVA, div of PAL PILOT Intl.
Panasonic
Pancon Corporation
Parker Hannifin
Payton America
PCM Electronics Ltd.
Pearson Electronics, Inc.
PELS
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Plexim
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PowerELab Ltd.
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Rubadue Wire Company, Inc.
SanRex Corporation
Sapa Extrusions North America
Schaefer Inc.
Semikron, Inc.
Semtech
Shanghai Eagtop Electronic Technology Co. Ltd
ShengYe Electrical Co. ltd
Shenzhen Poco Magnetic Co., LTD
Shenzhen Zeasset Electronic Technology Co., Ltd
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STMicroelectronics, Inc.
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Teledyne LeCroy
Texas Instruments
Thermacore, Inc.
Thermik Corporation
Thermo Cool
Tian Chang Fu An Electronic Corp.
Toshiba America Electronic Components, Inc.
TowerJazz
Transim Technology
Transphorm
TT electronics
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University of Maryland at College Park
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Wiley IEEE
Wolverine Tube Inc. - MicroCool Division
Wurth Electronics Midcom Inc.
X-FAB Semiconductor Foundries
Xitron Technologies Inc.
Yokogawa Corporation of America
ZES Zimmer Inc
Zhejiang Guidu Power Electronic Co. Ltd
ZMDI (Zentrum Mikroelektronik Dresden)

APEC 2014 EXHIBITORS

Convention Center Floor Plan

Exhibit Hall

EXHIBIT HALL AND HYATT FLOOR PLAN

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Checks may be personal, business or certified. Checks and money orders must be payable in United States dollars and drawn on a United States bank.

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