

**Conference Program**  
**21st Annual Applied Power Electronics**  
**Conference And Exposition**

**March 19-23, 2006**  
**Hyatt Regency Hotel**  
**Dallas, Texas**

**[www.apec-conf.org](http://www.apec-conf.org)**  
**[apec@apec-conf.org](mailto:apec@apec-conf.org)**

**APEC**  
**The Premier Global Event**

**In Power Electronics™**

**2006**

**Co-Sponsored By**  
**IEEE Power Electronics Society**  
**IEEE Industry Applications Society**  
**Power Sources Manufacturer's**  
**Association (PSMA)**

# APEC 2006

March 19–23, 2006  
Hyatt Regency Hotel  
Dallas, Texas

The Premier Global Event In Power Electronics™

## Welcome To APEC 2006!

I would like to welcome you personally to my home, Dallas, Texas, for the 21st annual Applied Power Electronics Conference. As you know, we were looking forward to an exciting time in New Orleans, but Hurricane Katrina forced us to change our plans at the last minute. We were lucky to find the Hyatt Regency Hotel available, and their recent expansion added some very nice meeting space—even more than we need! Not only do we have an attractive conference facility, but also there are many things to do within easy walking distance in the West End District, and the DART light rail system provides convenient access to even more attractions! I am confident that you and your guests will find APEC 2006 in Dallas both enjoyable and informative.

As the premier power electronics event in the Americas, APEC focuses on the practical and applied aspects of the power electronics business. This is not just a designer's conference; APEC has something of interest for everyone involved in power electronics, including spouses & guests. This year the conference continues with its winning formula: a strong technical program, one of the largest power electronics expositions in the world, and an extensive social program.

The technical program consists of a Plenary Session with six industry leaders addressing the future of power electronics, followed by approximately 200 oral presentations over three days and 80 dialogue presentations covering the latest developments in power electronics—all commercial-free. Industry experts cover topics of particular interest to power-electronics users in four Special Presentation Sessions, and eighteen 3-hour Professional Education Seminars provide continuing education at levels from introductory to advanced.

The Exposition features more than 100 of the leading power-electronics companies showing their latest products and ready to discuss your needs. This three-day event opens with an Exhibitor's Reception for all conference attendees, and includes a greatly expanded program of approximately 30 half-hour Exhibitor Seminars. All this is free with an "Exhibits Only" registration, which also grants access to the Plenary Session, Rap Sessions and MicroMouse Contest!

The social events provide plenty of opportunities to network with old friends and make new ones. The Main Social Event is an evening of good food, drink, and some of Texas' best musical entertainment. Following the Exhibitor's Reception is an impressive display of robotics in the MicroMouse Contest, with much larger prizes this year to celebrate its 20th anniversary. Finally, three Rap Sessions allow you to challenge industry leaders on controversial topics in power electronics.

For spouses and guests, Dallas is a fabulous city with numerous opportunities for dining, shopping, and enjoying the arts. APEC 2006 will offer guests a continental welcoming breakfast, tours of local attractions (for a fee), coffee each morning in the guest hospitality room, and free admission to the Exposition, Exhibitor's Reception, Plenary Session, Rap Sessions and MicroMouse Contest.

Finally I must thank the 23 volunteers on the APEC 2006 Conference Committee who have contributed endless hours over the past year to create the high-quality, vibrant event you have come to expect from APEC. My thanks go also to the three conference sponsors, and the staff of Courtesy Associates who take care of countless details to make things run smoothly.

Thank you for your participation, and we look forward to seeing you at APEC 2006!

Van Niemela  
General Chair

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## FOR MORE INFORMATION

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For the latest information on APEC, please consult the APEC Web site at [www.apec-conf.org](http://www.apec-conf.org). The Web site has the latest news and information, access to on-line conference and hotel registration and downloadable registration forms.

If the information you need is not in this program or on the APEC Web site, inquiries can also be directed to:

APEC 2006  
2025 M Street, NW, Suite 800  
Washington DC 20046 USA  
Telephone: +1-202-973-8664  
Facsimile: +1-202-331-0111  
Email: [apec@apec-conf.org](mailto:apec@apec-conf.org)



The Dallas Skyline, Viewed Here From  
Across The Trinity River

## CONFERENCE HIGHLIGHTS

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### DALLAS—THE “BIG D”!

While strong images of the western cowboy culture, ranching, and the oil business remain, there exists a complex and sophisticated side to Texas, particularly in ultra-modern Dallas. The city of Dallas and the surrounding area have a tremendous technology base of companies that are deeply involved with leading edge power electronics in systems, business and technology. This includes a large contingent of organizations involved in semiconductors, contract design, contract manufacturing, electronic components, telecommunications, logistics, electronics distribution as well as world class universities. Dallas as the 9th largest city in the United States features both a large indigenous base of power electronics component suppliers as well as a large number of OEM users and power electronics customers in proximity to the conference.

Consider the extensive galleries and permanent exhibits the Dallas Museum of Art, one of only two museums in the United States that hosted the "Splendors of Chinas Forbidden City" exhibit earlier this year. The city features the impressive Nasher Sculpture Center, the newest jewel in an extensive urban arts district. Designed by architect Renzo Piano, the center showcases one of the world's foremost, privately owned collections of modern and contemporary art. The

new Latino Cultural Center serves as a vocal point for the cities 800,000 strong Hispanic community and a catalyst for the preservation, development and promotion of Latino and Hispanic art underscoring this cities diverse population from all over the world. Dallas has major arts, music, ethnic and culinary festivals on their extensive list of year round activities. City Arts includes concerts, artist demonstrations, multicultural performances, food, and museum exhibits. Savor Dallas, a celebration of food, wine and spirits, brings together world famous chefs and vintners with the cultural institutions in the arts districts. Dallas redefines and underscores the concept that everything in Texas is measured on a large scale.

For more information on Dallas please visit the Web sites of the [Dallas Convention & Visitors Bureau](#), the [Dallas-Fort Worth Metroplex Visitors Bureau](#) and the superb and recently totally refurbished, expanded and redecorated [Hyatt Regency Dallas](#).

The weather should be quite pleasant with an average daily high temperature of 21 °C (70°F) and an average daily low of 10 °C (50 °F).

## A PLENARY SESSION NOT TO BE MISSED

A superstar cast has been assembled for this year's plenary. Starting with **Larry Kazmerski**, the plenary will grab your attention with the timeliness and breadth of topics. Larry, a member of the National Academy of Engineering, will provide a comprehensive look at the state of photovoltaics and the key contributions required to tip them into widespread use. **Bill Ott**, IBM's Vice President of eServer xSeries and IntelliStation Development, will then present the challenges of digital power management from an end user's perspective. If after Bill's presentation your mind starts to drift to your pocketbook and the price of gasoline, **Ray Ridley** (yes the creator of the magazine Switching Power) will bring you back into focus with his vision of the future of electric vehicles. After viewing the opportunities in vehicular applications, **Milan Jovanovic** will describe what he sees as the technology drivers for power supplies in the computer/telecommunications field.

The technical opportunities posed by Milan, Ray, Bill, and Larry may whet your appetite to start your own business. We thought that might happen and so we invited **Marty Schlecht**, who left a very successful career as a Professor of Electrical Engineering at MIT to start SynQor Inc., to describe his experience in building a business in the power electronics industry. Whether you start your own business or continue in your existing company, **Bob White's** report on the **PSMA 2006 Power Technology Roadmap Workshop** (held just days before APEC) will ensure you have a clear vision of the future of our field.

Remember – at APEC the plenary session is FREE with conference registration or an exhibitor's badge.

## THE TECHNICAL PROGRAM

Are you tired of paying good money to go to a conference just to see an endless supply of sales pitches posing as technical presentations? Industry professionals just like you participated in a rigorous peer review process and have carefully picked the papers in APEC's Technical Sessions. This process eliminates the commercial content from the technical sessions, and provides the highest quality possible. No other power electronics conference offers you so much quality content - and at a price that makes the APEC 2006 Technical Sessions the best value you will find this year!

We have two hundred papers of broad appeal scheduled for oral presentation from Tuesday morning to Thursday afternoon. Eighty-five papers with a more specialized focus are available for discussion with authors at the dialogue session on Thursday at 11:30 AM. In all, the 285 papers 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.

## SPECIAL PRESENTATION SESSIONS

The APEC Special Presentation Sessions were created to get you the latest information on the hot topics of today from industry experts in short, to the point presentations. This year's Special

Presentation Sessions promises to continue that path.

APEC 2006 has expanded the number of Special Presentation sessions to four and added some new twists—panel discussions to bring you even more information and points of view. On Tuesday morning, the Special Presentation session will explore market trends and the business of power electronics. The session ends with a panel discussion on the role of e-commerce in the power electronics industry.

Wednesday morning's Special Presentations address system design issues important to both system OEMs and their power suppliers, concluding with a panel discussion on the use of design tools for power electronics. Wednesday afternoon continues the very popular Current Topics In Power Electronics Research series. In this session, leading research institutions from around the world give you a glimpse of their research. This is certainly something that you won't see in your local conference room!

The last Special Presentation session is on Thursday morning and the topic is Power Electronics For A Greener World. With RoHS and WEEE on us right now, and with power electronics offering us the opportunity to make the best use of every bit of energy we have, there has never been a more timely session than this one. Any in power electronics who lives on this planet should see this session.

## PROFESSIONAL EDUCATION SEMINARS

The APEC 2006 Professional Education Seminars program continues APEC's tradition of a strong program and great value. Unlike other conferences that charge you hundreds of dollars for each half day seminar, APEC gives you a choice of 18 three hour seminars by recognized industry experts for one low price. And we give you the presentations from all 18 seminars so you will have a handy reference when you return to your office.

Digital power is the buzz word of the day and APEC 2006 is offering seminars on various aspects of digital control and digital power system management. This is a great opportunity to catch up quick on this important and fast changing area.



## Crowds At The APEC 2005 Exposition For The Prize Giveaway Drawing

From there, the APEC 2006 seminars offer a wide variety of seminars for power electronics professionals of all interests and skill levels. There are introductory design seminars, advanced design seminars, seminars on magnetics and semiconductor devices and more than one focuses on high efficiency design - also an important topic. With all of these choices, you can't help learning important information that will help you on the job once the conference is over!

## EXPOSITION

The APEC 2006 Exposition is the absolute must-see event in power electronics in 2006. This is not just a roomful of booths, but a program designed to attract the highest quality of customer-exhibitor interactions. This is not a sideshow, but rather a prime ingredient of this premier conference. The hours of the exhibition are carefully arranged to NOT overlay the paper sessions. During these hours, conference attendees can spend quality time with key technical staff of the exhibiting companies. NEW this year is the High Voltage Zone, where the high-voltage component suppliers share an aisle to better serve design engineers in this specialty. The exhibition is simply the place to be during exhibit hours. Food and drink further reinforce this!

Exhibitors understand the needs of APEC attendees, and have the information and staff available to answer the tough questions. Many have live, hands-on demonstrations in their

booths, so the design engineers visiting them can really get below the surface and learn about new products to help them succeed. Sure, many of the major vendors make special in-house presentations to the engineers in their larger customer accounts. But, as a design engineer, you need to see the bigger picture. The APEC 2006 Exhibition is the place!

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

**Admission To The APEC 2006 Exposition  
Is Free!**

**Just Stop By The Registration Desk For Your  
Complimentary "Exhibits Only" Badge!**

## RAP SESSIONS

There is plenty of controversy in the power electronics industry today. Whether or not "digital power", (whatever that means) will ever really catch on, let alone make any money.

And what about the role of China in the power electronics industry in particular and the electronics industry in general? Whether Westerners like it or not, China is here as a major player. Will they continue to grow? Will they eventually dominate? What does this mean for the power electronics industry in the US and Europe? Will China's continued growth mean doom or prosperity?

And why doesn't power electronics get any respect anyway? With the cost of energy rising around the world, power electronics can play a significant role in reducing the use of fossil fuels as well as enabling the efficient production of new alternative energy sources. But say "power electronics" to a politician or the general public and you'll get a blank stare. Is it time for the power electronics industry to stand up and make people take notice? Is there a need for an industry association to set up a lobbyist in Washington, DC? Why hasn't that happened already?

These are the topics that will be debated at the APEC 2006 Rap Sessions. No matter your job title, there is something for you in any of these sessions. The hardest part about the APEC 2006 Rap Sessions could well be deciding which one to attend!



**The APEC 2005 MicroMouse Contest**

## MICROMOUSE CONTEST

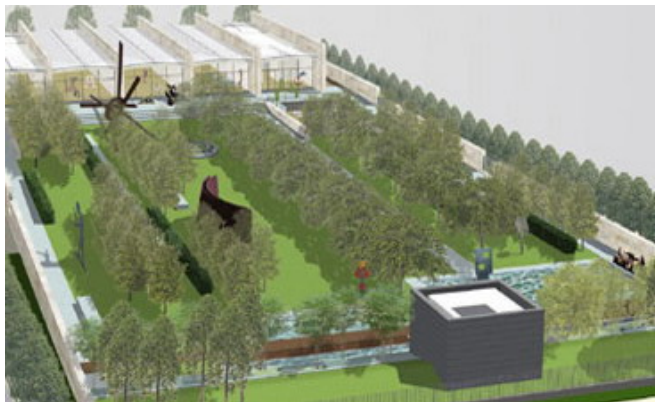
APEC 2006 will be hosting its Twentieth(!) annual MicroMouse contest at the Hyatt Regency Hotel in Dallas, Texas the evening of Monday, March 20 starting at approximately 8:00 PM in the Pegasus Ballroom. Come by to cheer your favorite mouse on to victory!

In honor of the twentieth anniversary, the cash prizes have been substantially increased this year. Two categories will be awarded, an open category and a student category. First, second, and third place prizes in both categories, based on the score of the mouse, will consist of US\$500, US\$250, and US\$125 respectively, as well as an attractive trophy. To encourage mice that may not be fast but are reliable, any registered team whose mouse reaches the center of the maze will receive an award of US\$500. Last but not least, the mouse that makes the fastest individual run of the day will receive a prize of US\$500 and a trophy.

If you are interested in entering a MicroMouse in the contest, please see the APEC Web site for information and instructions. Information is also available from the APEC 2006 offices.

## CONFERENCE SOCIAL EVENT

The APEC schedule is pretty busy. The sessions start early in the morning and go all day and even into the evening. The APEC Social Event provides a chance to wind down a bit, enjoy relaxed conversation with friends and colleagues new and old, have a nice dinner, and enjoy some good music. The APEC 2006 Social Event will be held



## **The Nasher Sculpture Center, One Of The Stops On Tuesday's Optional Tour, Includes An Indoor Gallery And Outdoor Sculpture Garden**

on the evening of Wednesday, March 22. The event will be a casual, buffet dinner followed by an evening of fine Texas music. The event is being held in the Union Station, just a short walk from the Hyatt Regency through a connecting passageway. So definitely reserve the evening of Wednesday, March 22 for an evening of conversation, food, drink and music.

## **SPOUSE AND GUEST PROGRAM**

APEC welcomes the spouses and guests of the APEC conference participants. A welcoming breakfast will be held on Monday, March 20th. The Spouse and Guest Hospitality room will be open each morning to provide a place to meet, have coffee and make plans for the day.

APEC 2006 has also arranged for two optional tours. The first tour, "Historic Homes Of Dallas", is on Monday right after the Welcoming Breakfast. This tour introduces you to fabulous homes, built in the early part of the 20<sup>th</sup> century, just minutes from downtown.

On Tuesday, March 21st, the "Crow Collection of Asian Art & The Nasher Sculpture Center" tour is available. This tour visits two outstanding collections of art. These are both unique and outstanding collections that will appeal to all.

Spouses and guests are also welcome at conference activities like the Exhibit Hall receptions and the MicroMouse Contest.

## **REGISTRATION**

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In order to participate in APEC 2006 activities, you must register with the conference. Attending the Professional Education Seminars, Presentation Sessions, and Dialogue Sessions requires payment of the appropriate registration fees. Even the APEC General Chair has to pay the registration fee!

## **ADMISSION TO THE EXHIBIT HALL IS FREE!**

Admission to the APEC 2006 Exposition, featuring more than 120 Exhibitors in 160 booths, is free to qualified members of the power electronics community. You must, however, register at the Conference Registration Center and receive a badge that allows entrance.

**Please note that Exposition Only registrations are only done at the conference and cannot be done in advance.**

The Exposition Only (aka Exhibits Only) registration includes admission to the Exhibit Hall, the Exhibitor Seminars, all social functions in the Exhibit Hall including the Welcoming Reception on Monday night, the Rap Sessions **and** the Plenary Session

## **MEMBER DISCOUNTS**

Members receive a substantial discount on the APEC registration fees. You may register at the Member Rate if either you are a member of the IEEE or your employer is a member of the [Power Sources Manufacturers Association \(PSMA\)](#).

IEEE members must supply their IEEE membership number on your registration form and will be asked to show your current IEEE membership card when you register at the conference.

Employees of PSMA member companies must list their employer's name on the registration form and will be asked for some verification of employment, such as a business card, when you register at the conference.

**Table 1. APEC 2006 Registration Rates**

Registration Type	Early Registration Price		Regular And On-Site Registration Price		IEEE Life Members & Students
	Member Rate	Non-Member Rate	Member Rate	Non-Member Rate	
Full Registration	\$750	\$925	\$925	\$1100	\$325
Technical Sessions	\$450	\$550	\$550	\$650	\$225
Seminars Only	\$375	\$450	\$450	\$525	\$175
Exhibits Only	FREE!				
Spouse And Guest Registration	FREE!				
Credentialed Press And Industry Analysts	FREE!				

## IEEE LIFE MEMBERS

IEEE Life Members are offered a reduced registration rate. Please have your IEEE membership card ready to show the registration clerk when you arrive at APEC 2006.

## STUDENT REGISTRATION

Full time undergraduate or graduate students at accredited institutions are offered a reduced registration rate. Please have your school identification card ready to show the registration clerk when you arrive at APEC 2006.

## SPOUSE AND GUEST REGISTRATION

Registration for spouses and guests of paid APEC registrants is free and is required to participate in APEC's Spouse and Guest Hospitality Program.

## PRESS & INDUSTRY ANALYSTS

Credentialed members of the press and industry analysts covering the power electronics industry are invited to APEC 2006 and are offered a complimentary registration. Please use the [Press & Analyst Online Registration](#) to secure your registration to APEC 2006.

## EARLY REGISTRATION

To be eligible for the Early Registration rates, registrations must be received at the APEC

registration offices or through the on-line registration system no later than the close of business on **Friday, February 17, 2006**.

## REGISTRATION FEES

Table 1 contains a summary of the APEC 2006 registration fees.

## WHAT'S INCLUDED

To help you choose the APEC registration type that is right for you, Table 2 describes what is, and is not, included with each type of registration

## HOW TO REGISTER

### *On-Line Registration*

To register on-line, visit the APEC Web site, [www.apec-conf.org](http://www.apec-conf.org). A Master Card, Visa or American Express credit card will be required.

The on-line registration will remain open until Friday, March 17. After March 17, all registrations must be at the conference.

### *Registering By Mail Or Fax*

A registration form is included in this Advance Program or one in Adobe® Acrobat® format can be downloaded from the APEC Web site, [www.apec-conf.org](http://www.apec-conf.org).

Complete this form and send it by mail or fax to the APEC Registration Center:

**APEC 2006/Badgeguys**  
**1959 Jester Circle**  
**Lawrenceville, GA 30043**  
**Facsimile: +1-678-407-3237**

For registrations that are sent by mail, payment must be included. You may make payment by credit card, check or money order. 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. If you wish to pay with a credit card, APEC accepts Master Card, Visa and American Express. Be sure to include your credit card number and expiration date where indicated on the registration form. Please do not send cash.

Registrations sent by fax must include payment by credit card. APEC accepts Master Card, Visa and American Express. Be sure to include your credit card number and expiration date where indicated on the registration form.

Registrations sent by mail or facsimile must reach the conference registration offices no later than Friday, March 17, 2006. After March 17, all registrations must be at the conference.

Checks and money orders returned unpaid or credit card payments for which payment was refused will be assessed an additional handling charge of \$50.00.

### ***Register At The Conference***

You may also register at the conference. For your convenience, the Conference Registration Center will be open each day, starting on Saturday afternoon.

For payments at the conference, APEC can accept credit cards (Master Card, Visa or American Express), or checks or money orders (payable in U.S dollars and drawn on an U.S. bank). Checks and money orders returned unpaid will be assessed an additional handling charge of \$50.00.

## **CONFERENCE REGISTRATION CENTER**

When you arrive at the conference, please go the Conference Registration Center, located in the foyer of Marsalis Hall on the lower level of the Hyatt Regency Hotel, to register and pick up your conference materials. The Conference Registration Center will be open:

Saturday, March 18 ..... 3:00 PM - 6:00 PM  
Sunday, March 19..... 8:00 AM - 5:00 PM  
Monday, March 20 ..... 8:00 AM - 5:00 PM  
Tuesday, March 21 ..... 8:00 AM - 5:00 PM  
Wednesday, March 22 ..... 8:00 AM - 3:00 PM  
Thursday, March 23 ..... 8:00 AM - Noon

## **CONFIRMATION OF REGISTRATION**

All Early Registrants will be sent an email confirming that their registration has been received. The email will include your name and address, events for which you registered, any extra items purchased and amounts paid. However, to protect your privacy, it will not contain any information about the method of payment.

Registrations received after the Early Registration deadline will not receive a confirmation email.

## **CANCELLATION & REFUND POLICY**

All requests for cancellation and refund of registration fees must be received in writing at the APEC offices no later than the close of business February 17, 2006. All refunds will be processed after the conclusion of the conference and will be subject to a \$50.00 processing fee.

For those who register and are unable to attend the conference, any Proceedings, Seminar Workbooks or other printed materials to which you are entitled will be shipped to you within 30 days of the conclusion of the conference.

## **PRIVACY POLICY**

To know how APEC may use the information you provide with registration, please see the APEC 2006 Privacy Policy on page 18.

**Table 2, What's Included With Your APEC 2006 Registration**

Included With Your Registration	Registration Type					
	Full Registration	Technical Sessions	Seminars Only	Exhibits Only	Spouse & Guest	Press & Analyst
Admission To All Presentation And Dialogue Sessions	✓	✓	✗	✗	✗	✓
Admission To The Plenary Session	✓	✓	✓	✓	✓	✓
Admission To All Professional Education Seminars	✓	✗	✓	✗	✗	✓
Admission To The Exhibit Hall	✓	✓	✓	✓	✓	✓
Admission To The Exhibitor Seminars	✓	✓	✓	✓	✗	✓
Admission To The Exhibit Hall Receptions	✓	✓	✓	✓	✓	✓
Lunch In The Exhibit Hall	Lunch Tickets Must Be Purchased Separately					
Admission To The Rap Sessions	✓	✓	✓	✓	✓	✓
Admission To The MicroMouse Contest	✓	✓	✓	✓	✓	✓
Admission To The Conference Social Event	✓	✓	With Separately Purchased Ticket			
Conference Proceedings (CD-ROM)	✓	✓	Must Be Purchased Separately			On Request
Conference Proceedings (Printed Copy)	Must Be Purchased Separately					
Seminar Workbook (Printed Copy)	✓	Purchased Separately	✓	Purchased Separately		
Admission To The Spouse And Guest Welcoming Breakfast	✗	✗	✗	✗	✓	✗



The Hyatt Regency Dallas, with the Reunion Tower, is an unmistakable landmark

## HOTEL AND RESERVATIONS

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### CONFERENCE HOTEL

The [Hyatt Regency Hotel in Dallas, Texas](#) will be the center of activity for APEC 2006. Your conference experience will be enhanced if you stay in the conference hotel. The Hyatt Regency Hotel is located at:

300 Reunion Boulevard  
Dallas, Texas, 75207  
Phone: 214-651-1234.

Please note that there are two Hyatt Regency Hotels in Dallas. One is at the DFW airport. This is NOT the conference hotel for APEC 2006. APEC 2006 is being held at the Hyatt Regency Dallas at Reunion, which is downtown next to the West End District.

### HOTEL ROOM RATES

A block of rooms has been reserved for the APEC 2006 participants at the Hyatt Regency Hotel at special conference rates. Be sure to mention that you are with the "IEEE Applied Power Electronics" when making a reservation to qualify for this rate:

Single .....\$179.00  
Double .....\$199.00  
Current city and state taxes are additional.

In order to receive the preferred conference rates listed above, **it is imperative that you make your reservations before February 17, 2006.** After February 17, 2006, reservations will be confirmed only on a space available basis.

### RESERVATIONS ONLINE—NEW FOR APEC 2006!

APEC 2006 and the Hyatt Regency are pleased to offer APEC attendees the ability to [make their APEC hotel reservations directly online](#). This is a great convenience and time saver!

### RESERVATIONS BY PHONE, MAIL OR FAX

To make a reservation by phone, please call the Hyatt Regency directly (214-651-1234 or 888-421-1442) and tell the reservation agent that you are with the "IEEE Applied Power Electronics".

You may also complete the [hotel reservation form](#) and mail or fax it with *one night's payment (check or major credit card)* to:

The Hyatt Regency  
Reservations  
300 Reunion Boulevard  
Dallas, Texas 75207-4498, USA

### CONTACTING THE HYATT REGENCY HOTEL

To reach the Hyatt Regency by phone or fax:

Hyatt Regency Reservations: .....800-233-1234  
Hyatt Regency Direct:.....214-651-1234  
Facsimile: .....214-712-7217

## TRAVEL INFORMATION

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### DALLAS-FORT WORTH AIRPORT (DFW)

[DFW](#) is a large airport (larger than the island of Manhattan!) that serves most of the air travel headed to Dallas and Fort Worth. DFW airport is located about 20 miles from downtown Dallas.

### Getting From DFW To The Hyatt Regency Dallas

The Hyatt Regency Hotel, in downtown Dallas, is served by all the cab and shuttle services operating at the Dallas-Fort Worth (DFW) airport.

## Taxi Service

Taxicab service is available at designated areas along upper-level curbside exits. Fares to the Hyatt Regency from the airport are approximately \$42.00 for one person. The charge for each additional person is \$2.00.

## Shared Ride Services

Shared ride (shuttle van) service between the DFW Airport and the Hyatt Regency is provided by several shared ride companies. Shared ride services at DFW Airport operate from the lower level of the terminal. After claiming your baggage, follow the signs for ground transportation to an escalator that will take you to the lower level. Reservations are not needed for transportation from the airport to the hotel.

Please see the [DFW Airport Web site](#) for a list of authorized shared ride service providers.

Typical shared ride fares are \$15-\$20 one way per person. Reservations are not needed for traveling from the airport to the hotel.

## Rail Service

The Trinity River Railway Express, a service of the Dallas Area Regional Transit (DART) and the Fort Worth Transportation Authority, provides rail transportation between DFW airport and Union Station (right next to the Hyatt Regency ) from Monday through Saturday for as little as \$2.25. The [Trinity River Express Web pages](#) has details.

## DALLAS LOVE FIELD AIRPORT (DAL)

[Dallas Love Field](#) is a smaller airport located close to downtown Dallas. Service to Love Field is mostly short haul flights from neighboring states.

### ***Getting From Love Field To The Hyatt Regency Dallas***

#### **Taxi Service**

Taxi cab service is provided on the upper level across the street from the baggage claim wing of the main terminal building.

#### **Shared Ride Services**

Shared ride (shuttle van) service between Love Field and the Hyatt Regency is provided by several shared ride companies.

## Public Transportation

The Dallas Area Regional Transit (DART) provides low cost public transportation from Love Field to the Hyatt Regency. Please see the [DART Web pages](#) for more information.

## AIRLINE DISCOUNT PROGRAM

American Airlines is the official airline for APEC 2006. They are offering a number of discount fares for APEC attendees traveling to Dallas. These discounts are available starting March 15, 2006 and ending March 26, 2006.

To take advantage of these low fares, give the APEC 2006 conference identifier, Star #A5436AS. Provide this number to your travel agent or book online directly with [American Airlines](#).

## CAR RENTAL DISCOUNTS

AVIS will offer attendees a special conference rate from March 12-March 30, 2006. To take advantage of this special rate, call the AVIS Meeting Reservation and Information Desk at 1-800-331-1600 or [contact them online](#). Identify yourself as eligible for the APEC rate by the giving the AWD discount number, A606092.

## PARKING AT THE HYATT REGENCY HOTEL

### ***At The Hotel Itself***

Valet parking is available at hotel entrance. In and out privileges are for hotel guests only. The rates are:

Overnight Valet: \$18.00

Daily: 0-3 Hours \$10.00; 3-6 Hours \$14.00;  
6-24 Hours \$18.00

Self parking in the outdoor Radish Lot is conveniently located on the north end of the hotel at the intersection of Hotel Street and Reunion Boulevard West. The maximum rate is \$8.00 per day (no in and out privileges).

### ***Near The Hotel***

Self parking in the Reunion Arena parking lot is located at the intersection of Sports Street and Reunion Boulevard with a public plaza directly across from the Hotel's Motor Lobby. This parking lot is managed by Central Parking Systems and is not affiliated with the hotel. The rate on days

when there are no events at the Reunion Arena is \$3.00 and on event days, \$10.00 (no in and out privileges).

## VISA ASSISTANCE

APEC can only offer letters of invitation to support an application for a visa to enter the United States to presenting authors who have paid their registration fee. Please see the [Information For International Travelers](#) page on the [APEC 2006 Web site](#) for visa information APEC has available for international travelers.

## DALLAS WEATHER IN MARCH

The weather in Dallas for APEC 2006 is expected to be quite mild and pleasant. The average daily high temperature is around 70 °F (21 °C) and the average daily low temperature is about 50 °F (10 °C). March in Dallas averages just over 3 inches (75 cm) of rain so be prepared for a rain shower or two.

## SPOUSE & GUEST PROGRAM

Spouses and guests are encouraged and invited to attend the APEC 2006 Conference. Aside from the APEC activities, the Dallas area offers an enormous range of cultural, sightseeing and shopping activities.

In addition to the Spouse and Guest specific activities, spouses and guests are welcome at all APEC social and dining events. In particular, spouses and guests are welcome at the Exhibitor Receptions (badge required), Exhibit Hall Luncheons (ticket required), the Conference Social Event (ticket required), Rap Sessions (badge required), the MicroMouse Contest and the Technical Tour (free but reservation required). Please be sure to register for a badge in order to participate.

To make your visit rewarding and enjoyable, APEC has put together a Spouse and Guest Hospitality Program for registered spouses and guests including a Hospitality Room that will be open each morning, a complimentary, welcoming continental breakfast, and optional tours on Monday and Tuesday.

## HOSPITALITY ROOM

APEC 2006 has arranged for the use of the Parino's Oven restaurant, located on the Atrium level of the Hyatt Regency, as a daily meeting place for the spouses and guests of APEC attendees. The room will be open and coffee served Monday through Thursday from 8:30 AM to 10:00 AM.

## WELCOMING BREAKFAST

**Monday, March 20th, 8:00 – 9:00 AM**  
**Parino's Oven Restaurant, Atrium Level**

To help you start off what will be an exciting week, APEC is serving a continental breakfast for spouses and guests on Monday morning. This is a great time to meet old friends and make new ones. This event is complimentary to registered spouses and guests but you must have your name badge to be admitted.

## OPTIONAL TOURS

**Monday, March 20th**  
**Historic Homes Of Dallas**

Just two miles from downtown Dallas, Swiss Avenue is one of the finest early 20th-century neighborhoods in the southwest. This "dream drive" received its name when a group of Swiss, German and French immigrants first settled in the area. On this guided tour guests will view a variety of homes featuring a 1923 Italian Style Renaissance home.

First guests will experience the 7,000 square foot Aldredge Manor, where they will enjoy a full tour of the old mansion. The Aldredge home features a sweeping mahogany staircase, exquisite walnut paneling and a breath taking dining room. Invitees will surely feel at home in this matchless manor.

Also included on this tour is the Park Cities area, composed of the small but very affluent communities of Highland Park and University Park, it is 6 square miles completely surrounded by the city of Dallas. This pair has a small-town feeling in the shadows of downtown Dallas skyscrapers. On the way back toward Dallas, guests will stop at The Belo Mansion for a fine tour of this historical home built in the 1880s. Colonel Alfred Horatio Belo and his wife Nettie Ennis moved to Dallas from Galveston to open a

branch of the Galveston newspaper which many of us refer to today as The Dallas Morning News. Colonel Belo paved a historical path and name for he and his family right here in the middle of downtown Dallas.

Meet in Spouse Hospitality Room (Parino's Restaurant on the Atrium level) at 9:00 AM. The tour group will leave from there at 9:15 AM to start boarding the buses.

Cost of the tour: \$48.00

When you arrive, APEC suggests that you check with the Conference Registration Center for the latest information on the specific pick-up time and location.

### ***Tuesday, March 21st Crow Collection of Asian Art & The Nasher Sculpture Center***

The first stop will be [Dallas' Trammell Crow Collection of Asian Art](#). Nestled like a small jewel in the midst of Dallas' fast growing art district, it offers visitors a serene world of beauty and spirituality in the heart of the city. Sheltered by a shady veil of cypress trees, the entrance to the Crow Collection features a dramatic stepped fountain framing an Asian monumental sculpture.

This three level gallery houses some of the finest Japanese art in the world, from crafted jade, to a towering 18th century red sandstone façade. The Trammell Crow Collection of Asian Art is a classy and enlightening venue. Its wonderful ambiance, coupled with Asian history, makes for the perfect place to host a day of cultural enrichment.

Next, guests will travel across the street in the Dallas Arts District to one of Dallas' latest landmarks, the [Nasher Sculpture Center](#). This recent addition features a rotating display of one of the world's greatest collections of modern structure. Ranging from the late 19th century to the present, the collection includes works by Auguste Rodin, Pablo Picasso, Alberto Giacometti, Henry Moore, Alexander Calder and Richard Serra. The building itself is the work of a real artist among architects, Renzo Piano.

Dallas developer Raymond D. Nasher and his late wife, Patsy, collected sculptures over 40 years with stunning results. Only part of the collection,

which totals over 300 pieces, will be on display at any one time.

Situated in downtown Dallas at the base of the city's skyline, the Nasher Sculpture Center represents Ray Nasher's vision to create an outdoor "roof-less" museum that will serve as a peaceful retreat for reflection of art and nature and public home for his collection of 20th-century sculpture. The goal was to produce a structure of lasting significance that will sustain the legacy of the collection.

Meet in Spouse Hospitality Room (Parino's Restaurant on the Atrium level) at 9:00 AM. The tour group will leave from there at 9:15 AM to start boarding the buses.

Cost of the tour: \$40.00

When you arrive, APEC suggests that you check with the Conference Registration Center for the latest information on the specific pick-up time and location.

### **OTHER TOURS**

Dallas and nearby Fort Worth have such a variety of places of interest that we were unable to choose tours or attractions that would appeal to all. For example, Dallas is surrounded by world-class outlet malls such as the one in Hillsboro, south of Dallas on I-35. In Fort Worth, the [Stockyards National Historic](#) district with attractions like Billy Bobs (which bills itself as the world's largest honky-tonk) are a perennial favorite. The [Kimbell Art Museum](#) in Fort Worth is a real jewel and should not be missed if possible. The Fort Worth Zoo is also a very nice attraction with a large variety of animals kept in open, natural environment settings. APEC is sure that you will find far more that catches your interest than you will have time or energy to explore.

Please check with the Hyatt Regency concierge for information on available sightseeing tours, cultural events and shopping.

## PRESS ACCOMMODATIONS

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### PRESS WORKING ROOM

APEC 2006 will have Press Work Room reserved for the exclusive use of members of the press and financial analysts. This room will be equipped with tables and chairs, internet access, a computer, and a printer. Light refreshments will be available.

Copying and faxing, if needed, will be available from the Hyatt's Business Center.

An APEC 2006 Press Badge will be required for entrance to the Press Work Room. The Press Work Room will be open:

Tuesday, March 21 ..... 8:30 AM - 5:00 PM

Wednesday, March 22 ..... 8:30 AM - 5:00 PM

Thursday, March 23 ..... 8:30 AM - 2:00 PM

### PRESS CONFERENCE ROOM

APEC knows that the press and analysts often need a quiet place out of the main traffic for interviews and conferences. APEC 2006 will have a room reserved for this purpose.

An APEC 2006 Press Badge, APEC 2006 Conference Badge or APEC 2006 Exhibitor's Badge will be required for admission to the Press Conference Room. The room can be reserved on a first come, first served basis through the APEC Registration Desk. The APEC 2006 Press Conference Room will be available:

Tuesday, March 21 ..... 8:30 AM - 5:00 PM

Wednesday, March 22 ..... 8:30 AM - 2:00 PM

## CONFERENCE SOCIAL EVENT

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### Wednesday, March 22, 2006

APEC will be spending the evening at the historic Union Station for a dinner with entertainment that is pure Texas. We are still working on the details but this will be a wonderful evening of conversation, food, drink and entertainment. Check back later in the year for the details!

And a nice bonus comes with the Union Station—it is literally steps away from and connected to the Hyatt Regency. This year we are spared having to

queue for buses and then wait for the buses to give us a ride back to the hotel. You will be able to come and go from the Social Event as you please. But with all of the good company, food and entertainment, why would you want to leave until the clean-up crew is pushing you out the door!

## DINING AT APEC

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### RESTAURANTS IN AND NEAR THE HOTEL

#### *Dining In The Hyatt Regency*

The Centennial Cafe, located on the Atrium level, is a casual restaurant serving breakfast, lunch and dinner. Also available is Coffee's Post, a specialty coffee store, serving Starbucks coffee. It also offers juices, bottled water, sodas, sandwiches, salads, pastries, fruits and other quick snacks.

For dinner, Parino's Oven, also on the Atrium level, serves Northern Italian dishes, such as pastas and pizzas, in a casual bistro setting. And for that special lunch or dinner, the Antares restaurant, located at the top of the Reunion tower, offers New American cuisine with Southwestern influences as well as spectacular views of Dallas and the surrounding countryside.

The Hyatt Regency also offers room service from 6 AM to midnight, daily.

#### *Dining In Dallas Near The Hotel*

The West End of Dallas is a renovated warehouse district filled with restaurants, shopping and clubs. The West End is only a few blocks from the Hyatt Regency. The West End offers a range of restaurants from world class steak houses to casual and inexpensive barbeque. Here are some of the restaurants you will find in the West End:

- Sonny Bryan's (Unbeatable Texas barbeque! A big favorite of the APEC Webmaster!)
- Landry's (Seafood)
- Lombardi's (Wonderful Italian)
- El Fenix (Tex-Mex)
- The Palm (World class steak house)
- On The Border (Tex-Mex)
- The Butcher Block (Cook your own steaks)

## LUNCH WITH THE EXHIBITORS

Lunch will be served in the Exhibit Hall on Tuesday and Wednesday from Noon to 1:30 PM. Advance purchase of a ticket is required. Tickets are available for \$10.00 per person.

## DIALOGUE SESSION LUNCH

Box lunches will be distributed from 11:30 AM to 12:30 PM to those attending the Dialogue Session on Thursday.

## PURCHASING ADDITIONAL CONFERENCE PROCEEDINGS AND SEMINAR WORKBOOKS

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### PRINTED PROCEEDINGS

Only a CD-ROM copy of the APEC Proceedings is provided with the Full or Technical Sessions registration. Should you wish to have a printed copy, you may order one in advance for an additional charge of \$100.00. There is no guarantee that printed copies will be available for sale at the conference.

### PURCHASING THROUGH EARLY REGISTRATION

Conference registrants can purchase extra copies of the Conference Proceedings and Seminar Workbooks through Early Registration. Those wishing extra copies are strongly encouraged to purchase them through Early Registration.

APEC reserves the right to limit quantities of APEC Proceedings or Seminar Workbooks sold to any one person or institution.

Advance purchase prices with registration for the conference:

Conference Proceedings .....	\$100.00
(Hardcopy <b>or</b> CD-ROM)	
Seminar Workbook .....	\$100.00
(Hardcopy only)	

These prices are only available when your order is received with your paid conference registration by February 17, 2006. Publications purchased with Early Registration will be available for pick-up when you register for the conference.

## PURCHASING AT THE CONFERENCE

**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 22. If there are any extra copies available, the prices will be:

Conference Proceedings .....	\$175.00
(Includes Hardcopy <b>or</b> CD-ROM)	
Seminar Workbook .....	\$175.00
(Hardcopy only)	

For payments at the conference, APEC can accept credit cards (Master Card, Visa or American Express), or checks or money orders (payable in U.S dollars and drawn on an U.S. bank). Checks and money orders returned unpaid will be assessed an additional handling charge of \$50.00.

### PURCHASING THROUGH THE IEEE

After the conference, the APEC Proceedings may be purchased through the IEEE. Contact:

IEEE Single Copy Sales  
445 Hoes Lane  
Piscataway, New Jersey 08854 USA  
Telephone: +1-800-678-4333 (USA &  
Canada)  
+1-732-981-0060

Web site: <http://shop.ieee.org/ieeestore/>

### SPECIAL NOTE ON SEMINAR WORKBOOKS

The APEC Professional Seminar Education Workbook will not be available through the IEEE or any other source after the conference. If you want extra copies of the Seminar Workbook, you are strongly encouraged to buy them through Early Registration.

## ADDITIONAL INFORMATION

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### SPONSOR MEMBERSHIP DESKS

Each of the organizations sponsoring APEC will have membership desks. These desks will be located in the foyer of the Exhibit Hall (Marsalis Hall), in the vicinity of the Registration Desk.

Individuals can inquire about membership in the IEEE and the two societies that sponsor APEC, the [Power Electronics Society](#) and [Industry Applications Society](#). The [Power Sources Manufacturers Association \(PSMA\)](#) will also have a membership desk where organizations interested in joining can obtain information.

### MESSAGE CENTER

A bulletin board for messages will be placed near the main conference registration area, near the Marsalis Hall on the lower level. Messages can be received and posted whenever the Conference Registration Center is open. Please advise any callers who may wish to reach you to call the main number of the Dallas Hyatt Regency (+1-214-651-1234) and ask for the IEEE APEC 2006 Registration Desk. APEC participants are encouraged to regularly check the message board.

### INTERNET ACCESS

The Hyatt Regency Dallas offers wireless internet access in all guest rooms, the lobby and Atrium area. Some guest rooms, on the Skyline side of the hotel, also offered wired access.

The cost of access is \$9.95 per day. You will need a credit card for internet access service as this is billed through the provider, not the Hyatt Regency.

The best information APEC has is that if you sign up for wireless access in your room, you will have wireless access in any public space where it is available for no extra charge.

For those who do not bring a computer to APEC, the Hyatt Regency Business Center rents computer time. Please inquire at the Business Center for rental rate information.

### SHIPPING SERVICES

For those wishing to ship their APEC materials rather than carry them home, there are several options.

The first is the Business Center at the Hyatt Regency. They offer shipping services by Fedex and UPS. Please check with them regarding the availability of packing services, packing materials and rates.

In addition, there is a U.S. Post Office and two commercial shipping firms relatively near the Hyatt Regency. Again, please check with each of them regarding the availability of packing services, packing materials and rates.

#### [U.S. Post Office - Station C](#)

1100 Commerce St  
Dallas, TX 75242-9998

Phone: (214)752-5654  
Phone (Toll free): (800) ASK-USPS  
Fax: (214) 468-8149

Distance From Hyatt Regency: 0.56 Miles

#### [Fedex Kinko's](#)

1305 Ross Ave  
Dallas, TX 75202-1925

Phone: (214) 922-0403  
Fax: (214) 871-9521  
Email: [usa0213@fedexkinkos.com](mailto:usa0213@fedexkinkos.com)

Distance From Hotel: 1.16 miles

#### [The UPS Store #5022](#)

2633 McKinney Ave, Suite 130  
Dallas, TX 75204

Phone: (214)965-9226  
Fax: (214) 965-9261  
Email: [store5022@theupsstore.com](mailto:store5022@theupsstore.com)

Distance From Hotel: 1.56 miles

## **PRINTING PAPERS FROM THE APEC PROCEEDINGS CD-ROM**

For those wishing to print papers from the CD-ROM, there are several options.

The first is the Business Center at the Hyatt Regency. They offer the ability to print files from your computer. You can also rent computer time to print from the APEC Proceedings CD-ROM if you do not have a computer. The Business Center is located on the lower level, near the Exhibit Hall. Please check with the Business Center for the cost of printing and computer rental.

In addition, Fedex Kinko's and the UPS Store (contact information above) offer facilities for printing papers from the Proceedings CD-ROM. Again, please check with each of them regarding the availability of printing and computer time rental.

You may also want to check with Hyatt Regency Concierge about other options for printing papers from the Proceedings CD-ROM.

## **I WOULD LIKE TO HOLD A MEETING AT APEC. HOW DO I ARRANGE FOR A MEETING ROOM, AUDIO/VISUAL EQUIPMENT AND FOOD SERVICE?**

APEC 2006 controls all of the meeting space in the Hyatt Regency and works with the hotel to allocate that space. Meeting space will only be allocated for meetings directly affiliated with one of the sponsors or with an Exhibitor. Requests for meeting space from any other organization will be denied.

Also please note that no meetings will be scheduled during the Plenary Session and meetings while the Exhibit Hall is open will be limited based on the number of attendees and duration.

### ***Sponsor Related Meetings***

The first priority is given to meeting space for functions that are directly affiliation with one its sponsoring organizations: Power Sources Manufacturers Association (PSMA), IEEE Power Electronics Society (PELS) or the IEEE Industry Applications Society (IAS).

If your function is directly related to one of the sponsoring organizations, send your request to your Society's administrator or the PSMA executive offices. Include in your request the number of people expected, the duration of the meeting, the preferred time of the meeting, any audio/visual/phone service/data communications service/easel/projectors equipment that will be needed, any food service that will be needed and any other special requests. Each sponsor's administrator will combine the requests and serve as a single point of contact between the each of the sponsors and the APEC Conference Managers. The APEC Conference Managers will schedule the meetings and make all arrangements with the hotel.

### ***Exhibitor Related Meetings***

Exhibitors may request meeting space from APEC on a first-come, first-served basis. Please send your request to the Exposition Manager who will coordinate with the conference and the hotel to arrange your meeting space, if available.

Include in your request the number of people expected, the duration of the meeting, the preferred time of the meeting, any audio/visual/phone service/data communications service/easel/projectors equipment that will be needed, any food service that will be needed and any other special requests.

Billing for the meeting room, catering and A/V services and any other charges will be the direct responsibility of the organization booking the room. No charges will be allowed to APEC's accounts.

## IMPORTANT RULES AND NOTICES

### **DISTRIBUTING COMMERCIAL MATERIAL AT APEC**

#### ***Rules For Non-Exhibitors***

Distribution of commercial material in the APEC 2006 hotel space (including directly to the hotel rooms of APEC participants), meeting space and Exhibit Hall by people or organizations not participating in the Exposition is prohibited.

APEC reserves the right to remove without notice any materials not in compliance with this policy.

#### ***Rules For Exhibitors***

Exhibitors may only distribute commercial materials in their booth, at Exhibitor Seminars they are conducting and at press conferences they are holding.

APEC reserves the right to remove without notice any materials not in compliance with this policy.

### **NO RECRUITING! NO RECRUITERS!**

IEEE Policy #10.1.24 prohibits recruiting at IEEE sponsored conferences. Consequently, recruiters and recruiting advertisements will not be permitted in the APEC 2006 hotel space, meeting facilities or Exhibit Hall.

### **BADGES**

Badges are required for admission to all Professional Education Seminars, Presentation Sessions, Dialogue Sessions, Rap Sessions and the Exhibit Hall. Please wear your badge at all times so that you will not be delayed at the entrance to an event.

### **PRIVACY POLICY**

#### ***Information Provided During Registration***

Contact information, which may include your name, affiliation, mailing address, email address and phone number, will be provided upon request to any Exhibitor participating in the APEC 2006 Exposition.

In addition APEC may use the information you provide to contact you with information about APEC 2006 or any future APEC.

No other use will be made of the information you provide. Your information will not sold, distributed, leased or provided to any other person or organization except as described above.

#### ***Information Provided Other Than Through Registration***

APEC may use the information you provide, such as through the APEC Contact Web page, submitting a paper or seminar proposal, or signing up to review digests, to contact you with information about APEC 2006 or any future APEC.

No other use will be made of the information you provide. Your information will not sold, distributed, leased or provided to any other person or organization except as described above.

## PROFESSIONAL EDUCATION SEMINARS

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APEC 2006 features 18 professional education seminars with a broad range of topics. The conference committee has worked hard to make sure there is something of interest to all APEC attendees during each of the seminar time periods. As always, APEC seminars offer a practical mix of theory and application for the professional working in power electronics. Unlike other conferences that charge by the seminar, at APEC one low fee gains you access to any and all of the seminars, along with the notes for every seminar. Whether you want to review an important topic area, broaden your understanding of a neighboring discipline, or take advantage of the practical experience of experts in the field, the APEC 2006 seminars are a must for every conference attendee.

Please note that the room assignments are tentative and subject to change. Please check with the registration desk at the conference for the latest information.

### PROFESSIONAL EDUCATION SEMINARS SESSION ONE

**Sunday, March 19, 9:30 AM – 1:00 PM**

#### **S.1. Digital Power System Management**

**Robert V. White, Artesyn Technologies**

**Reunion Ballroom GH**

Digital control, today's hot topic, actually has two aspects. One is the real-time, cycle-by cycle control of the switching in a power converter. The other aspect is non-real-time system management – configuring, controlling, and monitoring a power system. Digital power system management has been around for many years. However, the recent widespread adoption of the intermediate bus architecture with its multiple dc-dc converters on each circuit board has also created the need for an efficient way to manage those converters. Digital power management is being rapidly adopted to answer that need. This seminar reviews the fundamentals of digital power system management for the entry-level to intermediate power system user or designer. The first part of

the seminar describes the various functions and features that are possible with digital power management. Along the way, seminar attendees are reminded that it is easy to become enamored of the “wow” factor. Instead, the attendee is reminded to ask “What does my system need?” and “How would this feature bring value to my customer?” The next section of the seminar discusses protocols and in some depth, data communications issues for power system management. Poor implementation of data communications buses is the single biggest source of problems when people implement digital power system management. Several of the most common problems are identified and suggestions for avoiding them given. The second half of the seminar delves more deeply into the actual features and functions that are possible in a digital power management system. Functions such as setting the output voltage, on/off control, fault detections, and reporting are treated in some details. Tradeoffs and limitations are pointed out and recommended implementations given.

#### **S.2. EMI Causes, Measurement, And Reduction Techniques For Switch-Mode Power Converters**

**Michael Schutten, GE Global Research  
Center**

**Landmark Ballroom D**

This seminar is intended as a comprehensive introduction for engineers wishing to obtain a fundamental understanding of EMI issues associated with switch-mode power converters, and experienced engineers desiring a detailed understanding of electromagnetic interference (EMI) causes and fixes for power converters. The seminar begins with an introduction to noise coupling mechanisms and their properties. The concept of impedance mismatch is presented as a basis for understanding filtering concepts. Differential-mode (DM) and common-mode (CM) separation and filtering approaches are derived, and measurement and separation techniques presented. DM & CM measurement and EMI reduction techniques are presented for an experimental flyback converter. Converter layout techniques and principles are derived, and experimentally verified. The seminar provides an emphasis on how DM and CM currents are

<b>SEMINARS AT A GLANCE</b>			
<b>TRACK</b>	<b>SESSION I Sunday, March 19 9:30 AM - 1:00 PM</b>	<b>SESSION II Sunday, March 19 2:30 – 6:00 PM</b>	<b>SESSION III Monday, March 20 8:30 AM – Noon</b>
<b>Digital Power</b>	<b>S.1 Digital Power System Management</b> Bob White, Artesyn Technologies Reunion Ballroom GH	<b>S.7 Digital Control Of Switched Mode Power Supplies</b> Dragan Maksimovic and Regan Zane, University of Colorado, Boulder Landmark Ballroom B	<b>S.13 Keeping An Eye On Digital Control</b> José Cobos, Oscar Garcia, Angel de Castro, and Andres Soto, Universidad Politécnica de Madrid Landmark Ballroom B
<b>Packaging And EMI</b>	<b>S.2 EMI Causes, Measurement, And Reduction Techniques For Switch-Mode Power Converters</b> Michael Schutten, GE Global Research Center Landmark Ballroom D	<b>S.8 Power Electronics System Thermal Design</b> Roger Stout, ON Semiconductor Landmark Ballroom D	<b>S. 14 Advanced Power Electronics Packaging Emphasizing High-Current High-Temperature Applications</b> Doug Hopkins, State University of New York Pegasus Ballroom
<b>The Business Of Power Electronics</b>	<b>S.3 Introduction To Power Electronics</b> James Kokernak, Advanced Energy Conversion Landmark Ballroom A	<b>S.9 Best Techniques For Procurement And Qualification Of Power Products</b> Randy Malik, IBM Landmark Ballroom A	<b>S.15 Using The Theories Of Innovation To Predict Technology Change In Power Electronics – An Introduction To Business</b> Dorin Neacsu Reunion Ballroom F
<b>High Efficiency Solutions</b>	<b>S.4 High Efficiency Power Supply Design</b> Ernie Wittenbreder, Technical Witts Landmark Ballroom B	<b>S.10 Battery Selection, Charging, And Extending Battery Run-time For Portable Power Applications</b> Dave Heacock, Yevgen Barsukov, and Jinrong Qian, Texas Instruments Reunion Ballroom GH	<b>S.16 On The Role Of Modern Power Semiconductor Devices As Pathfinder For Highest Efficiency Power Supply Solutions</b> Gerald Deboy, Lutz Gorgens, and Jon Hancock, Infineon Technologies Landmark Ballroom D
<b>Special Applications</b>	<b>S.5 Power Electronics of Piezoelectric Elements</b> Shmuel Ben-Yaakov, Ben-Gurion University of the Negev Reunion Ballroom F	<b>S.11 Electrical Ballasts For AC, DC, and Pulsed Loads</b> Grigoriy Trestman, OSRAM Sylvania Reunion Ballroom F	<b>S.17 Voltage Regulators For Microprocessors</b> Richard Redl, ELFI S.A. and Gabor Reizik, Analog Devices Landmark Ballroom A
<b>Motor Control And Magnetics</b>	<b>S.6 The Art of Implementing Digital Motor Control</b> Arefeen Mohammed, Texas Instruments Pegasus Ballroom	<b>S.12 Control Of The BLDC Machine With Improved Performance</b> Mark Ehsani, Texas A&M University Pegasus Ballroom	<b>S.18 Expert Shortcuts To More Effective Transformer Design</b> Victor Quinn, Tabtronics Landmark Ballroom A

created in power converters, and layout and construction techniques to minimize the need for costly filtering. Several practical EMI reduction techniques and construction methods are provided throughout the presentation.

### **S.3. Introduction To Power Electronics**

**James Kokernak, Advanced Energy Conversion**

**Landmark Ballroom A**

This seminar is intended for those who are relatively new to the field of power electronics or could use a refresher course. The seminar is presented in four parts: distinguishing features of power electronics, circuit analysis examples, control techniques, and practical issues. The attendee should leave with an understanding and an appreciation for the underlying principles of power electronics, thereby enabling either more effective project management or increased comprehension in more advanced seminars and technical sessions.

### **S.4. High Efficiency Power Supply Design**

**Ernie Wittenbreder, Technical Witts**

**Landmark Ballroom B**

With new mandates and standards for energy efficiency, the need for power supply designers to understand the new requirements, high efficiency design options, and the available trade offs is imperative. This seminar describes new and existing mandates and regulations for energy efficiency (no-load, maintenance, standby, and active-on). Loss mechanisms that contribute to poor efficiency in power supplies are described in detail. Most of the seminar is focused on providing practical in-depth information that the power supply designer can use to meet and exceed the new efficiency standards and mandates. Information is provided on topology selection and circuits and techniques that yield higher efficiencies. Soft switching circuits and the problems and practical solutions associated with these circuits are described, and the differences in the design optimization processes for hard switching and soft switching converters are described. Other topics are synchronous rectifiers, burst mode generation, and bridgeless PFC boost converters. This seminar is intended for intermediate and advanced level power supply

engineers who want a better understanding of the practical tradeoffs and design issues associated with high efficiency power conversion and practical ideas for accomplishing high efficiency power conversion.

### **S.5. Power Electronics Of Piezoelectric Elements**

**Shmuel Ben-Yaakov, Ben-Gurion University of the Negev**

**Reunion Ballroom F**

Although piezoelectricity was discovered about 100 years ago, piezoelectric elements (PE) only recently became a practical alternative in some power conversion applications. In a number of applications, the piezoelectric approach was shown to have a clear advantage over alternative solutions. In other applications, piezoelectric elements will clearly be a preferred choice if and when their price is lowered. Notwithstanding the relative simple structure of piezoelectric elements, the design of the power electronics circuitry associated with them is far from being simple or trivial. The objective of this seminar is to introduce the attendees to PE technology from the power electronics point of view. This will be accomplished by first reviewing the models of native PE devices, including when they are loaded by rectifiers and mechanical loads. This overview will then be used in the presentation of drivers and rectifiers. Finally, the seminar will address some specific problems that haunt designers, such as the issue of instability that may develop when a PE drives fluorescent lamps. The seminar is at the intermediate level intended for active workers in the field as well as for novices who wish to learn about PE and their applications.

### **S.6. The Art Of Implementing Digital Motor Control**

**Arefeen Mohammed, Texas Instruments**

**Pegasus Ballroom**

As motor drive systems evolve with advanced features (sensorless operation, vector control, etc.), motor drive designers are relying more and more on advanced digital controllers and the extensive suite of motor-control focused hardware and software solutions to help them get their designs to market faster with more customized features and better performance for virtually any

type of motor. A hurdle often faced by system developers working with a digital controller is determining how and where to get started, both from the software and hardware points of view. A good example system that illustrates the software and hardware configurations can be invaluable for any motor drive design engineer. The goal of this seminar is to go through every step necessary to build a digital controller based motor drive system. The seminar will provide general examples which can be applied to wide range digital controllers. The attendees of this seminar will gain in depth knowledge about the following topics:

1. The benefits of a digital controller in a motor drive system.
2. How to create modular software strategy for the ease of system implementation.
3. How to obtain maximum accuracy from a fixed point controller instead of using floating point device.
4. The tricks to obtain maximum benefit from “C” code without device cycle penalties
5. How to use incremental system build process to minimize system “bugs”.
6. Complete system example showing a BLDC drive written in “C”.

This seminar is targeted for system software and hardware engineers with intermediate to advanced experience.

## PROFESSIONAL EDUCATION SEMINARS SESSION TWO

**Sunday, March 19, 2:30 – 6:00 PM**

### **S.7. Digital Control Of Switched Mode Power Supplies**

**Dragan Maksimovic and Regan Zane;  
University of Colorado, Boulder  
Landmark Ballroom B**

The purpose of the seminar is to introduce practical digital controller design and implementation techniques for high-frequency switching power converters. Starting from standard analog controller architectures and design principles, sampling effects and the basics of discrete-time analysis and modeling in the time and frequency domains are introduced. Examples are used to illustrate simple digital compensator

design techniques, as well as characterization, selection, and implementation of A/D converters and digital modulators. Quantization effects and limit-cycling issues are also discussed. Details of an FPGA development platform for digital control will be discussed together with experimental results. Knowledge of basic converter operation and standard analog controller design will be assumed.

### **S.8. Power Electronics System Thermal Design**

**Roger Stout, ON Semiconductor  
Landmark Ballroom D**

This three-part, half-day seminar is designed for entry- to mid-level electronics system engineers who are reasonably comfortable with Microsoft® Excel. The first part will introduce the overall approach to semiconductor device thermal characterization. Pitfalls in the use and misuse of typically published semiconductor device thermal data will be discussed. The second part will focus on the principle of linear superposition as applied to thermal system design. The goal is to provide the attendee with sufficient understanding to construct and use relatively simple spreadsheet-based tools in real-life system thermal designs. In the process, the following points will be covered: how to correctly utilize published thermal data in a system level thermal model, how to predict actual operating temperatures of the significant power devices, how to predict the operating temperatures of low power but temperature sensitive devices, and how this approach may be used in conjunction with more sophisticated thermal analysis tools. The third section will be an in-depth presentation of a specific and highly non-linear thermal failure mechanism, thermal runaway, whence it arises and how it may be analyzed. The focus will be within the particular context of power semiconductor devices, but it should also become evident how the concept may be applied more generally.

### **S.9. Best Techniques For Procurement And Qualification Of Power Products**

**Randy Malik, IBM  
Landmark Ballroom A**

This seminar is designed for those who are involved in sales, marketing, design, and

manufacturing of power products. The presentation shall cover best techniques of procurement and qualification of products not necessarily limited to power products only. In the past, the role of a procurement organization was limited to buying OEM products, and therefore had no value add to the bottom line of a corporation. The popular joke in the hallways used to be, “an engineer with talent need not apply for this job.” The world of today is quite different, and the role of procurement has changed from a support organization to that of a core organization. In this new global world of outsourcing, a procurement organization is responsible for procuring, qualifying hardware and software from outside the company, managing quality, and negotiating contracts. Have you heard about the gate keeper! This organization comes close to such a gate keeper. This organization is responsible for awarding a business contract and qualifying a supplier’s product; it is very essential to understand how does it award the business? A supplier needs to understand the whole process to be successful in this environment. A unique feature of this seminar is that the speaker has a wide range of experience from research, design, advanced power technology, graphics memory, data processing and telecommunication to production procurement and qualification. The seminar is designed to review the basics of this emerging organization, and then step by step show how such an organization has transformed IBM in reducing cost and cycle times without sacrificing quality or proprietary technology. The techniques taught here are not necessarily applicable to one company or industry only, but could be applied to any industry. It is hoped that the attendee with the knowledge acquired during the session shall have a better appreciation of the changing world around them and could be a change agent for their company.

## **S.10. Battery Selection, Charging, And Extending Battery Run-time For Portable Power Applications**

**Dave Heacock, Yevgen Barsukov, and Jinrong Qian; Texas Instruments  
Reunion Ballroom GH**

Battery management continues to be a significant issue for a wide range of portable products. The

old questions of “which battery is best for my system,” and “how can I make the system run longer with the battery” have plagued designers and users alike. This seminar addresses the issues surrounding battery management, and provides an overview of rechargeable battery technologies, operating characteristics, healthy treatment, charging and termination methods, and practical suggestions to maximize the use of the battery capacity. The first part of the presentation provides the battery electrical behavior under DC and transient conditions and reviews the battery general operating characteristics. Then we are going to overview different battery technologies including battery construction, operating electro-chemical mechanism, charging method, healthy treatment, safety protection and their main applications for Lead acid, Nickel Cadmium (NiCd), Nickel Metal Hydride (NiMH), and Li-Ion batteries. The second part of the presentation is focused on the efficient charging algorithm, battery charging system architecture, interaction between system and charger for the Li-Ion battery. Power path management (PPM) technology is going to be presented to minimize the AC adapter power rating and size while charging the battery and supplying the system simultaneously for handheld and portable equipment. Several practical linear battery chargers, switching mode chargers, and their control integrated circuits (ICs) are going to be presented for cellular phones, MP3 players, DVD players, and laptop computers. The third part looks at understanding the changes in impedance over the service life of the battery. We are going to present the impedance track technology to accurately monitor the battery’s remaining capacity and measure the battery impedance. Combined with an adaptive end of discharge voltage termination scheme, it can reduce the loss of run-time for a system as a battery ages. Examples and system run-time data will be shown. The fourth part of the seminar presents new battery chemistry development trends for meeting the challenge in power hungry and cost sensitive portable power equipment applications. This seminar is structured to provide in-depth coverage of the topics of the battery power management, and is intended for the audience from entry level to intermediate experience level.



## **APEC Seminars Are Very Popular!**

### **S.11. Electrical Ballasts For AC, DC, And Pulsed Loads**

**Grigoriy Trestman, OSRAM Sylvania  
Reunion Ballroom F**

Broad classes of AC, DC, and pulsed loads such as fluorescent and HID lamps, gas and diode lasers, LEDs, pulsed lasers and lamps, and capacitor and battery chargers require power supplies with the output characteristics of a current or power source. Power supplies with such characteristics are called electrical ballasts. Despite a large number of publications, aspects of electrical ballast design are not reflected systematically in the technical literature. This seminar covers all aspects of electrical ballast design from basic definitions and passive current limiting to the design principles of multi-kilowatts voltage to current source converters. Seminar topics include:

- Electrical characteristics of ballasts and electrical loads requiring ballasting for operation.
- Passive and active methods of creating converters with the characteristics of current or power sources.
- Optimal configurations of the ballasts for AC, DC, and Pulsed loads.
- High-frequency switch mode ballast design including soft switching and non-dissipative snubbers.
- Low and high power ballast design and paralleling converter modules for power increase.
- Simple and precision control in electrical ballasts for AC, DC, and pulsed loads.

- Different methods of power factor correction.
- Methods of gas discharge ignition and igniter topologies.

The topics will be treated as a survey, and the level of the intended audience is entry to intermediate.

### **S.12. Control Of The BLDC Machine With Improved Performance**

**Mark Ehsani, Texas A&M University  
Pegasus Ballroom**

The Brushless DC (BLDC) motor drive system is one of the most popular advanced motor drives. High power density, very compact geometry, and high efficiency, along with simple control are among the main attractions for replacing many adjustable speed applications with this technology. The BLDC machine is now mature and increasingly used in automotive, military, traction, aerospace, industrial, and consumer products. In this short course, which is for practicing engineers as well as advanced researchers, we will address in detail the basics of the BLDC machine, comparing its features with those of other machines, its control strategies, and conventional sensorless control techniques. Moreover, advanced BLDC machine control topics including our novel sensorless position detection technique based on a new physical concept will be presented. Advanced controls are used for improving reliability in case of sensor failure and to maximize the power density, efficiency, and minimize the size and weight of the BLDC generator. The course will end with a discussion of BLDC machine drive application trends.

## **PROFESSIONAL EDUCATION SEMINARS SESSION THREE**

**Monday, March 20, 8:30 AM – Noon**

### **S.13 Keeping An Eye On Digital Control**

**José Cobos, Oscar Garcia, Angel de Castro  
and Andres Soto; Universidad Politécnica de  
Madrid**

**Landmark Ballroom B**

The seminar illustrates the use of digital control in four different applications: power factor pre-regulation, multi-phase dc-dc conversion for

automotive dual voltage (14/42 V) applications, power supplies for RF amplifiers, and integrated dc-dc converters with dynamic voltage scaling for low power microprocessors. The talk is structured in five sections. It begins with the motivation to keep an eye on digital control and its evolving possibilities. Then, hardware issues are pointed out to identify the actual possibilities, limitations, and basic parameters of the digital technologies and building blocks. Specific design issues are then analyzed in detail, pointing out different design alternatives and providing solutions for the critical points to meet the specifications in the design of the control loop, the digital PWM, ADCs...., etc. In the fourth section, the tools, procedures, and test setup to simulate and implement digital control are illustrated. Finally, an overall assessment of the results obtained in these four specific applications illustrates some of the reasons why digital control may be used or discarded in actual products. This seminar is intended for experienced power supply designers interested in being acquainted with the merits and limitations of digital control, derived from some specific examples.

#### **S.14. Advanced Power Electronics Packaging Emphasizing High-Current High-Temperature Applications**

**Doug Hopkins, State University of New York  
Pegasus Ballroom**

This seminar targets the experienced power electronics designer and provides a comprehensive description of leading and next-generation advanced packaging techniques for supplies, drives and derivatives, emphasizing high-current, high-temperature applications. Higher temperature (above 150 °C) is possible for a host of active and passive components provided a suitable packaging environment is used. Many high-current, high-density circuits can become much denser if advanced techniques are used to significantly improve thermal management. An update is given on lead-free soldering issues and how designs are impacted by component availability and compatibility. Recent results in electro- and thermo-migration testing will show the impact on reliability, and how new design rules are needed for electrically and thermally dense designs. Attributes, processes and design

rules for packaging techniques, such as multilayered heavy-copper pre-preg, copper-on-ceramic, and graphite and AlSiC composites, are presented. Devices, such as SiC diodes and transistors, and passives, are reviewed. Designers will gain necessary information to consider and select alternate packaging techniques that optimally meet their needs for inclusion of higher temperature components. This is an essential course for designers who must look at alternate packaging design approaches to further shrink their electronics. The material is co-presented from electrical, thermal and physical perspectives. The seminar is intended for the advanced electrical design engineer.

#### **S.15. Using The Theories Of Innovation To Predict Technology Change In Power Electronics – An Introduction To Business**

**Dorin Neacsu  
Reunion Ballroom F**

This seminar is directed to young power electronics specialists eager to embrace a career in the power electronics industry. All the information about markets, business language, theories of innovation, and technology trends is provided to arm the attendee with everything they need to know to be successful in a business endeavor in power electronics.

#### **S.16. On The Role Of Modern Power Semiconductor Devices As Pathfinder For Highest Efficiency Power Supply Solutions**

**Gerald Deboy, Lutz Gorgens and Jon Hancock; Infineon Technologies  
Landmark Ballroom D**

This seminar will deal with the role of modern power semiconductor devices as enabling technology for highest efficiency power supplies. Focusing on server and telecom AC/DC applications as a major market place for sophisticated system solutions, the seminar will discuss the required changes in system architecture and semiconductor usage to keep pace with ever more demanding power and form factor requirements. Typically the output power of a given server or telecom power supply has to increase by 20% per year at constant cost and

size. These requirements drive the efficiency needs continuously further up to meet thermal management demands. We will discuss in detail power factor correction including bridgeless boost approaches based on one-cycle control, one and two stage approaches for the main power conversion and synchronous rectification. The power devices used include boost diodes, high and low voltage MOSFETs plus the respective controllers. With the market entry of very low ohmic high and low voltage MOSFETs and practically zero reverse recovery diodes, the prerequisites for lean, no-fuss power architectures are available. Furthermore, semiconductor manufacturers endeavor to make devices fast switching and easy to drive. The energy stored in the output capacitance and reverse recovery charge is also kept at a minimum. We will show that hard switching applications can draw most benefit out of these devices. The seminar will furthermore discuss pros and cons of hard switching versus zero voltage or zero current switching power architectures. New ideas such as bridgeless boost power factor correction and current results are also addressed. The seminar targets design engineers of power supplies from the entry to experienced levels.

## **S.17. Voltage Regulators For Microprocessors**

**Richard Redl, ELFI S.A. and Gabor Reizik,  
Analog Devices**

**Landmark Ballroom A**

Powering a microprocessor is a challenging task. The power supply or VRM (voltage regulator module) must produce a high output current at a low output voltage with high efficiency and accuracy, and maintain the high efficiency over a wide range of output currents, especially in notebook applications. Additionally, the VRM must respond to a load transient without excessive under- or overshoots, have a prescribed output resistance (this feature is also called “adaptive voltage positioning”), be able to accept static and on-the-fly digital programming, and have small size and low cost. This seminar starts with a brief summary of the VRM specifications for modern microprocessors, then presents an overview of the most important power converter topologies (including the single-phase and multi-phase buck converter and their extensions, add-on circuits for

fast load transient response, and non-isolated and isolated multi-stage solutions), and continues with a discussion of the single-loop and multi-loop analog and digital voltage regulation techniques. The seminar concludes with the review of the various voltage positioning methods, feedback loop design considerations, and auxiliary control functions (controlling for high efficiency at light load, maintaining current/thermal balance, and overcurrent and overvoltage protection).

## **S.18. Expert Shortcuts To More Effective Transformer Design**

**Victor Quinn, Tabtronics**

**Reunion Ballroom GH**

Prediction of transformer loss and energy has been a frequent topic in literature. Nevertheless, there is continued widespread interest in more intuitive transformer design methods for high frequency power electronic applications. This seminar introduces normalized concepts of loss and energy density which yield powerful and intuitive transformer design shortcuts to determine optimal configurations for a specific application. Transformer fundamentals will be presented from the perspectives of circuit designer, transformer assembler, and transformer designer. Normalized functions will be discussed to introduce basic design optimization techniques. Empirical testing methods will be reviewed to establish objective measures of transformer function. High frequency effects will be considered using the concept of normalized loss and energy density functions. The concept of an equivalent winding thickness will be introduced with graphical depiction of optimization strategies. The equivalent winding thickness concept will be extended to power supply applications involving nonsinusoidal excitation. Normalized parameters will be used to rapidly estimate resultant loss and energy for selected transformers in a variety of high frequency power electronic applications. Empirical testing methods will be extended to address nonsinusoidal conditions. This detailed consideration of expert design shortcuts will benefit intermediate level designers who are looking for more intuitive transformer design methods.

## EXPOSITION

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Key words about the APEC 2006 Exposition: **BE THERE! DON'T MISS IT!**

There should be no problem finding time in your APEC schedule to see the exhibits because there are no papers being presented during the exhibit hours—that is how important the Exposition is at APEC.

During Exhibition hours, conference attendees can spend quality time with key technical staff of the exhibiting companies. NEW this year is the High Voltage Zone, where the high-voltage component suppliers share an aisle to better serve design engineers in this specialty.

The exhibition is simply the place to be during exhibit hours. Food and drink further reinforce this! Not only is this the place for getting product information, but also it's the place to renew acquaintances with colleagues and share your thoughts about the latest technical topics.

Exhibitors understand the needs of APEC attendees, and have the information and staff available to answer the tough questions. Many have live, hands-on demonstrations in their booths, so the design engineers visiting them can really get below the surface and learn about new products to help them succeed. Sure, many of the major vendors make special in-house presentations to the engineers in their larger customer accounts. But, as a design engineer, you need to see the bigger picture. The APEC 2006 Exposition is the place!

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

### EXPOSITION HOURS

The Exposition, located in the Marsalis Hall on the lower level of the Hyatt Regency, will open on Monday, March 20 when the Plenary Session concludes (expected to be about 5:30 PM). Additional hours are as follows:

Monday, March 20 ..... 5:30 PM - 8:00 PM

Tuesday, March 21 ..... Noon - 5:00 PM

Wednesday, March 22 ..... 10:15 AM - 2:00 PM

## APEC 2006 EXHIBITORS

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The Exhibitors confirmed at the time of publication of this Program are listed below. Please check the Exposition Directory at the conference for the final listing of companies participating in the APEC 2006 Exposition.

ACME Magnetics USA Inc.  
Actown Electrocoil, Inc.  
AMETHERM  
Amrel/American Reliance  
Analog Devices  
Anderson Power Products  
Ansoft Corporation  
AOS Thermal Compounds  
Applied Power Systems, Inc.  
Arnold Magnetics Limited  
Ault, Inc.  
Autotest  
AVX Corporation  
Bergquist Company (The)  
BI Technologies/Magnetics Components Div.  
Bobitrans  
C & D Technologies  
Cableco Technologies Corporation  
Central Semiconductor Corp.  
Ceramic Magnetics, Inc.  
Champs Technology  
Chang Sung Corporation  
Chroma Systems Solutions  
Coilcraft  
Collmer Components  
Cornell Dubilier  
Cree, Inc.  
Darnell Group  
Datatronic  
DAU Components / Thermal Solutions  
Delta Electronics  
Dexter Magnetic Technologies, Inc.  
EBG, LLC  
ECI (Electronic Coils)  
EFORE USA  
Eldre Corporation  
Electrocube, Inc.  
Electronic Concepts, Inc.  
Elna Magnetics  
Elytone Electronic Co., Ltd.  
EMA Design Automation

## EXPOSITION DIRECTORY

The Exposition Directory, which will be available at the conference, will give a complete listing of the Exhibitors, a map of the Exhibit Hall, details of the Exhibitor Seminars and other events in the Exhibit Hall.

## EXHIBIT HALL SOCIAL FUNCTIONS

### *Exhibitor's Reception*

A Welcoming Reception will be held in the Exhibit Hall on Monday, March 20, from 5:30 PM until 8:00 PM. Join us for hors d'oeuvres while visiting with the Exhibitors and other conference participants. Registered spouses and guests are welcome.

### *Tuesday Afternoon Coffee Break & Ice Cream Social*

Tuesday afternoon's coffee break will be held in the Exhibit Hall from 3:00 PM to 3:30 PM. As a special treat, ice cream will be served!

### *Wednesday Morning Coffee Break*

The Wednesday morning coffee break will be served in the Exhibit Hall from 10:15 AM to 10:45 AM.

### *Exhibit Hall Luncheons*

On Tuesday, March 21 and Wednesday, March 22, enjoy your lunch in the Exhibit Hall from Noon to 1:30 PM. Tickets are \$10.00 each and are available through Early Registration. Tickets may also be purchased at the Conference Registration Desk at least 24 hours in advance. The number of tickets is limited and may sell out. It is recommended that if you are interested in lunch in the Exhibit Hall that you buy them with your Early Registration. Tickets will not be available at the luncheons.

Registered spouses and guests are welcome at the Exhibit Hall luncheons - ticket required, of course.

## MORE APEC 2006 EXHIBITORS

EPA Energy Star  
EPCOS  
ERM (Eastern Rochester Manufacturing Corp.)  
Eupec, Inc.  
Evox Rifa  
Fairchild Semiconductor  
Fair-Rite Products Corporation  
Ferroxcube USA  
Filter Concepts Inc.  
Freescale Semiconductor  
Fuji Semiconductor, Inc.  
GMW Associates  
Great Wall Semiconductor  
High Voltage Components Associates (HV) And CKE  
HVR Advanced Power Components  
ICE Components, Inc.  
Illinois Capacitor  
Infineon Technologies NA Corporation  
Infolytica Corporation  
International Rectifier  
Intersil Corporation  
Isotek Corporation  
ITW Paktron  
Kaschke USA, Inc.  
Kemet  
Kester  
Lodestone Pacific  
Lytron, Inc.  
Magnetic Metals  
Magnetics  
Magsoft Corporation  
Maxim Integrated Products  
Methode - Network Bus Products  
MH&W International Corporation  
Micrel Semiconductor  
Micrometals, Inc.  
Microsemi Corporation  
MMG  
Mouser Electronics  
National Semiconductor Corporation  
Net Power Technologies  
New England Wire  
NH Research  
Nichicon  
NORWE, Inc  
NWL Transformers, Inc.

## EXPOSITION SURVEY & GIVEAWAY

To help the Exhibitors and us continually improve the APEC Exposition, a survey is taken each year. Those who complete the survey form and return it at the entrance to the Exhibit Hall by 4:00 PM Tuesday afternoon are entered in a drawing for one of four prizes. As a winning survey form is drawn, the winner will choose a prize from the remaining ones, until all four have been awarded. These are significant prizes—a couple of years ago, the first prize was a Dell laptop. The drawing will take place in the Exhibit Hall on Tuesday, March 21st at 4:45 PM and ***you must be present to win!*** Don't miss this opportunity!

## INTERESTED IN EXHIBITING AT APEC 2006?

For the details on exhibiting at APEC 2006, please see the APEC Web page [Exhibiting At APEC](#). This page has answers to just about any question you could ask about exhibiting at APEC 2006.

Also please feel free to contact the APEC Exposition Manager:

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APEC Exposition Manager  
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Email: [exhibits@apec-conf.org](mailto:exhibits@apec-conf.org)

## MORE APEC 2006 EXHIBITORS

ON Semiconductor  
Payton America  
Pearson Electronics  
Philips  
Planar Quality Corporation  
Plexim  
Positronic Industries, Inc.  
Power Electronic Measurements Ltd.  
Power Electronics Technology  
Power Factor One, Inc.  
Power Integrations  
Power Systems Design Europe  
Powerex, Inc.  
Power-One, Inc.  
Powerstax plc.  
Precision Inc.  
RAF Technologies, Inc.  
Renco Electronics, Inc.  
Ridley Engineering, Inc.  
Roal Electronics  
ROHM  
Rubadue Wire Company Inc.  
SB Electronics  
SemiSouth Laboratories, Inc.  
Semtech  
Silicon Laboratories  
STMicroelectronics  
Tabtronics  
TDK  
Tektronix Inc.  
Texas Instruments  
Texas Spectrum Electronics, Inc.  
Tier Electronics  
Tocos America  
Transim Technology  
Tribotek, Inc.  
TSC Ferrite International Company  
Tyco Electronics / Power Connector Products  
United Chemi-Con  
VAC Magnetics  
Velox Semiconductor Corporation  
Venable Industries, Inc.  
Vishay Intertechnology, Inc.  
Voltage Multipliers  
Xitron Technologies Inc.  
Yokogawa Corporation Of America  
Zilker Labs, Inc.

## EXHIBITOR SEMINARS

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Several of the companies participating in the Exposition will be offering Exhibitor Seminars. These 30 minute seminars generally offer an in-depth look at solving one or more problems common to the industry using the products or services of the presenting Exhibitor. Although we all have suppliers knocking on our doors, this is a chance to see suppliers, both old favorites and those that are new to you, in a relaxed setting free from the day-to-day pressures of the office and learn about their latest and greatest offerings.

### EXHIBITOR SEMINAR SESSION 1

**Tuesday, March 21, 1:30 PM - 2:00 PM**

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**Exhibitor Seminar 1.1: Integrated Power Line EMI Filter For DC-Fed Electronic Equipment**  
Anderson Power Products  
Landmark Ballroom D

**Exhibitor Seminar 1.2: Small Signal Modeling And Measurement Of Switching Power Supplies**  
Ridley Engineering  
Landmark Ballroom B

**Exhibitor Seminar 1.3: Designing EM Components With Virtual Prototyping - Combine Parameters, Drives/Controls, Motion And J.C. Maxwell**  
Magsoft Corp.  
Reunion Ballroom F

**Exhibitor Seminar 1.4: Digital Phosphor Oscilloscopes: The Tool Of Choice For Advanced SMPS Design And Analysis**  
Tektronix, Inc.  
Landmark Ballroom C

**Exhibitor Seminar 1.5: Tailoring Power Supply Burn-In For Optimized Quality**  
C&D Technologies  
Landmark Ballroom A

### EXHIBITOR SEMINAR SESSION 2

**Tuesday, March 21, 2:15 PM - 2:45 PM**

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**Exhibitor Seminar 2.1: IPOSIM—A Program For Loss And Thermal Calculation Of eupec IGBT Modules**  
eupec  
Landmark Ballroom C

**Exhibitor Seminar 2.2: Designing By The Milliwatt—A Green Mode Power Design Example**  
Texas Instruments  
Landmark Ballroom B

**Exhibitor Seminar 2.3: New Kool M $\mu$  Configurations For Very Large Chokes**  
Magnetics  
Landmark Ballroom A

**Exhibitor Seminar 2.4: Multi-Domain Systems Modeling Software For Power Electronics**  
Ansoft  
Reunion Ballroom F

**Exhibitor Seminar 2.5: Advanced Techniques In Digital Loop Analysis And Impedance Measurement**  
Venable Industries  
Landmark Ballroom D

### EXHIBITOR SEMINAR SESSION 3

**Tuesday, March 21, 3:15 PM - 3:45 PM**

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**Exhibitor Seminar 3.1: The Smart Rectifier™: Simple, High Efficiency Synchronous Rectification For Flyback Converters**  
International Rectifier  
Landmark Ballroom B

**Exhibitor Seminar 3.2: New Transfer Molded Converter-Inverter-Brake (CIB) Modules Provide Lowest Cost And Simplified Assembly For Motor Drives**  
Powerex  
Landmark Ballroom D

**Exhibitor Seminar 3.3: Planar Magnetics For SMPS**  
Payton Planar Magnetics  
Landmark Ballroom A

**Exhibitor Seminar 3.4: Vishay Foil Resistors Presentation On Power Coefficient Of Resistance**  
Vishay  
Landmark Ballroom C

**Exhibitor Seminar 3.5: Considerations To The Derating Of  $V_{(BR)DSS}$  Of Power MOSFETs In SMPS**  
Infineon  
Reunion Ballroom F

## EXHIBITOR SEMINAR SESSION 4

Tuesday, March 21, 4:00 PM - 4:30 PM

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### Exhibitor Seminar 4.1: Point-Of-Load Power Conversion

Fairchild Semiconductor  
Landmark Ballroom B

### Exhibitor Seminar 4.2: Design Of High Current Density Interconnects Through Locally Compliant Surface Structures

Tribotek, Inc.  
Landmark Ballroom D

### Exhibitor Seminar 4.3: Simulating Power Electronic Systems Using Ideal Instantaneous Switches

Plexim  
Reunion Ballroom F

### Exhibitor Seminar 4.4: SIMatrix/SIMPLIS 5.2 – All-In-One Design Environment For Power Electronics – Components, ICs, Circuits And Systems

Transim Technology  
Landmark Ballroom A

### Exhibitor Seminar 4.5: Power Capacitors For Compact Converter Designs From EPCOS

EPCOS  
Landmark Ballroom C

## EXHIBITOR SEMINAR SESSION 5

Wednesday, March 22, 10:30 AM - 11:00 AM

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### Exhibitor Seminar 5.1: How To Calculate Failure Rate And MTBF Of Aluminum Electrolytic Capacitors And Capacitor Arrays

Cornell Dubilier  
Landmark Ballroom C

### Exhibitor Seminar 5.2: TDK Announces New Power Ferrite Material PC95 And PC90

MH&W  
Landmark Ballroom D

### Exhibitor Seminar 5.3: 600 V GaN Schottky Diodes Delivering SiC Performance At Si Prices

Velox Semiconductor  
Reunion Ballroom F

### Exhibitor Seminar 5.4: Hidden Value: Technology Innovations In Magnetic Devices

Tabtronics  
Landmark Ballroom A

### Exhibitor Seminar 5.5: PMBus™ Device To Controlling and Monitoring Power Supplies

Maxim  
Landmark Ballroom B

## EXHIBITOR SEMINAR SESSION 6

Wednesday, March 22, 11:15 AM - 11:45 AM

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### Exhibitor Seminar 6.1: Solutions For Energy-Efficient Power Supplies

ON Semiconductor  
Landmark Ballroom B

### Exhibitor Seminar 6.2: Digital Power Manager Controls Both Z-One Digital POLs And Industry Common Peripherals

Power-One  
Landmark Ballroom C

### Exhibitor Seminar 6.3: DQ Diodes: Combining Fast Recovery, Softness, And Reliability

Microsemi  
Landmark Ballroom A

### Exhibitor Seminar 6.4: Chang Sung Corp. Offers Improved Materials And New Powder Core Shapes

Chang Sung Corp.  
Landmark Ballroom D

### Exhibitor Seminar 6.5: Improved Precision Current Sensors With Magnetic Probe

Vacuumschmelze  
Reunion Ballroom F

## RAP SESSIONS

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All Rap Sessions will be held Tuesday, March 21 from 5:00 PM, right after the close of the Exhibit Hall, and carry on until 6:30 PM.

### **Rap Session #1 Is There Money In Digital Power?**

Moderator: Ami Joseph, Thomas Weisel Partners  
Landmark Ballroom A

Digital power has become the new buzzword in the industry. CEO's who embrace it believe their stocks will go up instantaneously, and analysts who follow it use it as an investment theme for buying stocks. As a result, any company with a mixed-signal engineer is claiming they will have a digital power product. But who is really making money in digital power and who is just talking?

### **Rap Session #2 China—Promise Or Peril?**

Moderator: Alix Paultre, Electronic Products  
Landmark Ballroom B

Is China just another place for low-cost manufacturing, or does its size and growth represent something new? Will China be more valuable as a market, or more costly as a competitor? Is the issue of IP theft strong enough to bring about change in China, or will there always be piracy on such a great scale? What about China's emergence as a design center? Come and participate in a freewheeling panel discussion on the ramifications of doing business with this great nation.

### **Rap Session #3 Got Power? Is The Power Electronics Industry Ripe For Self Promotion?**

Moderator: Arnold Alderman, Anagenesis, Inc  
Landmark Ballroom C

Do events like the recent US Energy Bill, and government agencies globally pushing for better efficiency give us a window of opportunity to put power electronics on everybody's dashboard? Today there is a chasm between the value of power electronics as a business enabler and our industry's image. Is it possible to make the power electronics industry sizzle, or are we doomed to be the unknown of the unknowns? Come join us and share your opinion and ideas!

**Admission To The Rap Sessions  
Is Free With An  
Exhibits Only Registration!  
Discussion-Stimulating  
Refreshments Will Be Served**

## PLENARY SESSION

Monday, March 20, 1:30 – 5:30 PM  
Landmark Ballroom AB

### Admission Is Free With Exhibits Only Badge!

This year's plenary is a feast for those hungry for a view into the future of the power electronics industry. We've assembled a stellar lineup that includes top technology and business leaders, and a PSMA presentation only days removed from the Power Technology Roadmap Workshop.



The plenary will open with Dr. **Larry Kazmerski**, director of the National Center for Photovoltaics and perhaps the world's leading authority on solar photovoltaics. 'Kaz' has been a leader in photovoltaic research for over thirty years and was recently elected to the National Academy of Engineering. His presentation will take a (fun) look back over the past half century of solar history and where we may expect to be in 2050.



From photovoltaics, the focus will switch from power sources to the power supply customer, where **Bill Ott** will provide a vision of the future of digital power management. IBM's Vice President of eServer xSeries and IntelliStation Development, Bill brings a wealth of knowledge based upon his experience leading the development of IBM's entire range of industry standard architecture Servers and Workstations, including BladeCenter.



**Ray Ridley** will close the first half of the plenary with his view on the future of electric vehicles (EVs). Undoubtedly, many attendees will be familiar with Ray's power supply design software, courses, and magazine *Switching Power (SP)*. The excellence of his presentations, publications, and designs is recognized worldwide. In a recent article in *SP*, Ray provides a candid assessment of existing EV technology and the technical and policy hurdles that are

barriers for their widespread use. Here he will expand upon his views, which represents a terrific opportunity for those developing their short- and long-term research and market strategies.

Following an extended coffee break to digest the first three presentations and catch up with colleagues, the second half of the plenary will open with Dr. **Milan Jovanovic's** views of technology drivers for power supplies in the computer and telecommunications industries.



As CTO of the Power Supply Group for Delta Power, Milan brings 29 years of experience to help project the future of power conversion and management issues for portable data-processing equipment, low-voltage power supplies, and distributed power systems for server and telecom applications.

After gaining insight into the technology drivers in power supply designs, Dr. **Marty Schlecht** will provide a look at the opportunities and challenges of starting a business in the power electronics industry. Arguably there are few more qualified to speak on such a topic, as Marty left a highly successful career as a Professor of Electrical Engineering at MIT to form SynQor, a world-class supplier of DC/DC conversion equipment.



The final presentation will be a **report on the PSMA 2006 Power Technology Roadmap Workshop**, which will be held the day before APEC. Talk about HOT OFF THE PRESS—it's hard to conceive that a more valuable and timely presentation could be arranged. Moreover, the report will be presented by **Bob White**, staff engineer in the Technology Group at Artesyn Technologies and a champion of PSMA, APEC, and the power electronics field in general. From Bob's technical experience, knowledge of markets, and dedication to APEC, one can guarantee that his report will be a dessert to the plenary that should not be skipped!



## SPECIAL PRESENTATION SESSIONS

The Special Presentation Sessions were introduced at APEC 2004. These presentations have been solicited from the leaders in the power electronics industry especially to address topics of current interest. Like the Professional Education Seminars, they were chosen for their specific topics and were not selected through the peer review process.

These special presentations do not have papers in the APEC Proceedings. The presentations will be available starting Saturday, March 18, 2006, in Adobe Acrobat format through the [APEC 2006 Web pages](#). They will be available only for a limited time after the conference concludes.

**Session SP1: Market Trends & Business** **Tuesday, March 21**  
**Landmark Ballroom A**  
**8:30 AM– Noon**

**Session Chairs: Kevin Parmenter, Fairchild Semiconductor and Ada Cheng, International Rectifier**

**SP1.1 Three Levels Of Power Management**  
S. Ohr, Gartner Dataquest, San Jose, CA

**SP1.2 Power Supplies' Emerging Business/Revenue Models**  
M. Mankikar, Micro-Tech Consultants (MTC), Santa Rosa CA

**SP1.3 Bricks Evolve As Form Factors, Architectures And Digital Control Technologies Shift**  
J. Bryant, Darnell Group Inc., Corona CA

**SP1.4 The Role Of Power Electronics In The Distributed And Cogeneration (DCG) Industry, A Critical Look At North America And Europe**  
R. Ruiz, Darnell Group Inc., Corona CA

**SP1.5 Winning In China Through Understanding Its Power Needs & Cultural Dynamics**  
L. Merriman, Fairchild Semiconductor, South Portland, ME

**SP1.6 E-Business Panel Discussion**  
B. Rayner<sup>1</sup>, S. Siddiqui<sup>2</sup>, S. Roller<sup>3</sup>, S. Bednar<sup>4</sup>, S. Diethelm<sup>5</sup>; <sup>1</sup>Electronics Supply & Manufacturing Magazine, Manhasset, NY, <sup>2</sup>Dell Computer Corporation, Austin, TX, <sup>3</sup>Texas Instruments Inc., Dallas, TX, <sup>4</sup>Freescale Semiconductor, Phoenix, AZ, <sup>5</sup>International Rectifier, El Segundo, CA

Special notice! The E-Commerce Panel Discussion will start after the fifth paper of the session and continue without a break until the end of the session (Noon). This allows a total of 45-50 minutes of discussion from both the panelists and questions from the audience.



**Session SP2: System Design**

**Wednesday, March 22**  
**Landmark Ballroom A**  
**8:30 – 10:15 AM**

**Session Chair: Scott Deuty, HP**

**SP2.1 Power System Efficiency In Wireless Communication**  
P. Gildert, Ericsson, Mölndal, SWEDEN

**SP2.2 Power Delivery Challenges in Computer Platforms**  
E. Stanford, Intel Corp., Dupont, WA

**SP2.3 Design Tools Panel Discussion**  
C. Ambarian<sup>1</sup>, J. Perry<sup>2</sup>, N. Gabbert<sup>3</sup>, A. Ball<sup>4</sup>, S. Diethelm<sup>5</sup>; <sup>1</sup>iSuppli Corp., El Segundo, CA, <sup>2</sup>National Semiconductor Corporation, Santa Clara, CA, <sup>3</sup>Transim Technology Corporation, Portland, OR, <sup>4</sup>ON Semiconductor, Phoenix, AZ, <sup>5</sup>International Rectifier, El Segundo, CA

Special notice! The Design Tools Panel Discussion will start after the second paper of the session and continue without a break until the end of the session (10:15 AM). This allows a total of 45-50 minutes of discussion from both the panelists and questions from the audience.



**Session SP3: Current Topics In Power Electronics Research**

**Wednesday, March 22**  
**Landmark Ballroom A**  
**2:00 – 5:30 PM**

**Session Chairs: Chuck Mullett, ON Semiconductor and Mike Briere, International Rectifier**

**SP3.1 Aachen University of Technology**  
R. DeDonker, Aachen University Of Technology, Aachen, GERMANY

**SP3.2 Research Status Of The National Key Laboratory Of Power Electronics**  
D. Xu, Zhejiang University, Hangzhou, P.R. CHINA

**SP3.3 University Of British Columbia**  
W. Dunford, University of British Columbia, Vancouver, BC, CANADA

## **SP3.4 Space Power Architecture And Power Electronics Research At Sandia National Laboratories**

J. B. Witcher, J. S. Bowers; Sandia National Laboratories, Albuquerque, NM

## **SP3.5 Georgia Institute Of Technology**

D. Divan, Georgia Institute of Technology, Atlanta, GA

## **SP3.6 University Of Central Florida**

I. Batarseh, University of Central Florida, Orlando, FL

## **SP3.7 University Of Illinois At Champaign-Urbana**

P. Krein, P. Chapman; University of Illinois at Champaign-Urbana, Urbana, IL



**Session SP4: Power Electronics For A Greener World**

**Thursday, March 23  
Landmark Ballroom A  
8:30 – 11:30 AM**

**Session Chairs: Alex Levran, Magnetek and Tim Cassidy, Ault Inc**

## **SP4.1 A High Efficiency, Low Cost, Utility Interactive Inverter - Australia's Winning Entry For The 2005 Future Energy Challenge Competition**

C. Beckett, J. Luo, and N. Sachchithananthan, Monash University, Melbourne, AUSTRALIA

## **SP4.2 The Efficiency Of Internal Power Supplies: Test Procedure And Policy Developments**

B. Fortenbery, EPRI Solutions, Inc., Knoxville, TN

## **SP4.3 Present Status And Future Direction Of Photovoltaic Solar Power**

C. Gay, SunPower Corp., Sunnyvale, CA

## **SP4.4 Reductions In The Cost Of Wind Generated Electricity: The Role Of Power Conversion Systems**

W. Erdman, BEW Engineering Inc., San Ramon, CA

## **SP4.5 Distribution Perspective On RoHS And WEEE Directives**

P. Howard, Arrow Electronics, Inc., Plano, TX

## **SP4.6 Artesyn's Approach To RoHS (& WEEE) Compliance**

K. Teuber, Artesyn Technologies, Westminster, CO



## **PRESENTATION SESSIONS**

The following are the APEC 2006 oral presentations. These papers were selected through a rigorous peer review process and are represented by papers in the APEC Proceedings. They were placed in an oral presentation because they generally have a broad appeal. 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. Then, 25 members of the Program Committee met last September to consider digests individually and construct the conference program. Only 50% of the 570 submitted digests were selected for presentation in either the oral or dialogue sessions.

## **Session 1: Plenary**

**Monday, March 20  
Landmark Ballroom AB  
1:30 – 5:30 PM**

## **Session Chair: Russ Spyker, Air Force Research Laboratory**

- 1.1 Solar Photovoltaics: At the Tipping Point**  
L. Kamerski, National Center for Photovoltaics (NCPV), Golden, CO
- 1.2 Challenges In Digital Power Management**  
W. Ott, IBM, Raleigh, NC
- 1.3 The Electric Car: What Does The Future Hold?**  
R. Ridley, Ridley Engineering, Inc, Roswell, GA
- 1.4 Technology Drivers And Trends In Power Supplies For Computer/Telecom Applications**  
M. Jovanovic, Power Supply Business Group, Delta Products Group, Raleigh, NC
- 1.5 Building a Business in the Power Electronics Industry**  
M. Schlecht, SynQor Inc., Boxborough, MA
- 1.6 Report On The PSMA 2006 Power Technology Roadmap Workshop**  
R. White<sup>1</sup>, C. Mullett<sup>2</sup>, <sup>1</sup>Artesyn Technologies, Westminster, CO, <sup>2</sup>ON Semiconductor, Santa Paula, CA



**Session 2: Voltage  
Regulator Modules I**

**Tuesday, March 21  
Landmark Ballroom B  
8:30 AM– Noon**

**Session Chairs: Laura M. Steffek , Texas  
Instruments and Greg Miller, Intersil Corporation**

- 2.1 Design And Experimentation Of A Novel Variable Frequency 48 V Voltage Regulator Module With Self-Sustained Oscillation Controller**  
M.Z Youssef, P.K Jain; Queen's University, Kingston, CANADA
- 2.2 High-Bandwidth Designs For Voltage Regulators With Peak-Current Control**  
Y. Qiu, J. Sun, M. Xu, K. Lee, F.C. Lee; Virginia Tech, Blacksburg, VA
- 2.3 Dynamic Current Sharing Analyses For Multiphase Buck VRs**  
J. Sun, Y. Qiu, M. Xu, F.C. Lee; Virginia Tech, Blacksburg, VA
- 2.4 Multi-Phase Buck Converters With Extended Duty Cycle**  
Y. Jang, M. Jovanovic, Y. Panov; Delta Products Corporation, Durham, NC
- 2.5 Driver Deadtime Control And Its Impact On System Stability Of Synchronous Buck Voltage Regulator**  
W. Qiu<sup>1</sup>, S. Mercer<sup>1</sup>, Z. Liang<sup>2</sup>, G. Miller<sup>3</sup>;  
<sup>1</sup>Intersil Corporation, Milpitas, CA, <sup>2</sup>Intersil Corporation, Portland, OR, <sup>3</sup>Intersil Corporation, Durham, NC
- 2.6 A New Resonant Gate Drive Circuit For Synchronous Buck Converter**  
Z. Yang, S. Ye, Y.F. Liu; Queen's University, Kingston, CANADA
- 2.7 Active Transient Voltage Compensator Design For VR Load Line Improvement**  
X. Wang<sup>1</sup>, S.A. Chickamenahalli<sup>2</sup>, E. Stanford<sup>3</sup>, H. Zhou<sup>1</sup>, M. Batarseh<sup>1</sup>, I. Batarseh<sup>1</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>Intel Corporation, Chandler, AZ, <sup>3</sup>Intel Corporation, DuPont, WA



**Session 3: DC-DC  
Converters: High Voltage  
And High Power**

**Tuesday, March 21  
Landmark Ballroom C  
8:30 AM– Noon**

**Session Chairs: Jim Walker, Walker Power Design,  
Inc and Hongwei Gao, Montanta State University**

- 3.1 Achieving A Wide Input Voltage And Output Power Load Range Step-Down DC-DC Conversion With Good Full Range Efficiency At 4 kW**  
A. Isurin, A. Cook; Vanner Inc., Hilliard, OH
- 3.2 Interleaved Zero Current Transition Three-Level Buck Converter**  
M. Ilic<sup>1</sup>, B. Hesterman<sup>1</sup>, D. Maksimovic<sup>2</sup>;  
<sup>1</sup>Advanced Energy Industries, Fort Collins, CO,  
<sup>2</sup>CoPEC, University of Colorado, Boulder, CO
- 3.3 A New Interleaved Isolated Boost Converter For High Power Applications**  
J. Wen, T. Jin, K. Smedley; Univ. of California, Irvine, CA
- 3.4 A Passive Reduced Rating Output Rectifier Snubber For Plasma Cutting Power Supply**  
G.R. Kamath, Hypertherm, Inc., Hanover, NH
- 3.5 A New Design Method For High Efficiency DC-DC Converters With Flying Capacitor Technology**  
F. Zhang<sup>1</sup>, L. Du<sup>1</sup>, F.Z. Peng<sup>1,2</sup>, Z.M. Qian<sup>1</sup>;  
<sup>1</sup>College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA, <sup>2</sup>Department of Electrical and Computer Engineering, Michigan State University, East Lansing, MI
- 3.6 Optimal Design And Control Of 5 kW PWM Plus Phase-Shift (PPS) Control Bidirectional DC-DC Converter**  
L. Shi, L. Sun, D. Xu, M. Chen; The Institute of Power Electronics, Department of Electrical Engineering, Zhejiang University, Yuquan, Hangzhou, CHINA
- 3.7 Comparison Of ZVS Operation Modes With And Without Phase Shift For Three-Level Resonant Converters**  
H.G. Sheng, D.B. Fu, X. Yang, F. Wang, F.C. Lee; CPES, Virginia Tech, Blacksburg, VA



**Session 4: Inverter Applications I**

**Tuesday, March 21  
Reunion Ballroom F  
8:30 AM– Noon**

**Session Chairs: Babak Fahimi, University of Texas-Arlington and Steven Pekarek, Purdue University**

- 4.1 Three-Phase AC-AC Four-Leg Converter With Minimization Of The Capacitor Current**  
C.B. Jacobina, I.S. de Freitas, E.R.C da Silva, A.C. Oliveira; LEIAM - DEE - CEEI - UFCG, Campina Grande, BRAZIL
- 4.2 Matrix Converter Control Using Direct AC-AC Conversion Method For Reducing Output Voltage Harmonics**  
H. Shimada, T. Takeshita; Nagoya Institute of Technology, Nagoya, JAPAN
- 4.3 A New Three-Phase AC-AC Z-Source Converter**  
F. Zhang<sup>1</sup>, X.P. Fang<sup>1</sup>, F.Z. Peng<sup>1,2</sup>, Z.M. Qian<sup>1</sup>; <sup>1</sup>College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA, <sup>2</sup>Department of Electrical and Computer Engineering, Michigan State University, East Lansing, MI
- 4.4 Modulation Methods Based On A Novel Carrier-Based PWM Scheme For Matrix Converter Operation Under Unbalanced Input Voltages**  
T. Satish, K.K. Mohapatra, N. Mohan; University of Minnesota, Minneapolis, MN
- 4.5 Hybrid Indirect Matrix Converter Immune To Unbalanced Voltage Supply, With Reduced Switching Losses And Improved Voltage Transfer Ratio**  
C. Klumpner, University of Nottingham, Nottingham, UK
- 4.6 A Novel Dual Secondary Winding And Dual Power Bridge High Frequency Link Inverter Based On Bipolar Combined Phase-Shifted Modulation**  
C.J. Zhang, Z. Zhang, H.R. Gu, W.Y. Wu; Yanshan University, Qinhuangdao, CHINA
- 4.7 An Overall Optimization Strategy For Novel Hybrid Parallel Active Power Filters Based On Genetic Algorithm**  
X. Tang, Y. Wang, X. Zhang, W. Si, Y. Tao, Z. Wang; School of Electrical Engineering, Xi'an Jiaotong University, Shaanxi, CHINA



**Session 5:  
Semiconductors-Discrete  
And Integrated**

**Tuesday, March 21  
Reunion Ballroom GH  
8:30 AM– Noon**

**Session Chairs: Bill Dillard, Archangel Systems and Peter Friedrichs, SiCED GmbH**

- 5.1 A Single-Inductor Multiple-Output Converter With Peak Current State-Machine Control**  
E. Bayer, G. Thiele; Texas Instruments Deutschland GmbH, Freising, GERMANY
- 5.2 Application Specific 1200 V Planar And Trench IGBTs**  
P.M. Shenoy, S. Shekhawat, B. Brockway; Fairchild Semiconductor, Mountaintop, PA
- 5.3 Evaluation Of IGBT Modules And Their Suitability For ZVS, Quasi-ZCS Converter Topologies**  
M. Pavlovsky, S.W.H. de Haan, J.A. Ferreira; Delft University of Technology, Delft, NETHERLANDS
- 5.4 2nd Generation 600 V SiC Schottky Diodes Use Merged PN/Schottky Structure For Surge Overload Protection**  
F. Bjoerk<sup>1</sup>, J. Hancock<sup>2</sup>, M. Treu<sup>1</sup>, R. Rupp<sup>3</sup>, T. Reimann<sup>4</sup>; <sup>1</sup>Infineon Technologies Austria, Villach, AUSTRIA, <sup>2</sup>Infineon Technologies North America Corp, San Jose, CA, <sup>3</sup>Infineon Technologies Germany, Munich, GERMANY, <sup>4</sup>ISLE GmbH, Germany, Ilmenau, GERMANY
- 5.5 Operation Characteristics Of Emitter Turn-Off Thyristor (ETO) For Solid-State Circuit Breaker And Fault Current Limiter**  
B. Chen, A.Q. Huang, M. Baran, C. Han, W. Song; Semiconductor Power Electronics Center, Department of Electrical and Computer Engineering, North Carolina State University, Raleigh, NC
- 5.6 SiC JFET Gate Driver Design For Use In DC-DC Converters**  
R.L. Kelley, M.S. Mazzola; SemiSouth Laboratories, Inc., Starkville, MS
- 5.7 A Self-Powered Resonant Gate Driver For High Power MOSFET Modules**  
H. Wang, F. Wang; Virginia Polytechnic Institute and State University, Blacksburg, VA



**Session 6: AC Motor Drives**

**Tuesday, March 21  
Pegasus Ballroom  
8:30 AM– Noon**

**Session Chairs: Mahesh Krishnamurthy, Univ. of Texas-Arlington and Tim Lewis, United Defense LP**

- 6.1 Reduction Of High Frequency Leakage Current From PWM Inverter-Motor System At The “Integrated Grounding System”**  
M. Morimoto, Tokai University, Hiratsuka, JAPAN
- 6.2 Direct Torque Control Of Five-Phase Induction Motor Using Space Vector Modulation With Harmonics Elimination And Optimal Switching Sequence**  
S. Lu, K.A. Corzine; University of Missouri - Rolla, Rolla, MO
- 6.3 A High Reliability Trigger Circuit For Frequent And High Speed Startup Of Single Phase Induction Motor**  
Y. Zhang<sup>1</sup>, J. Bao<sup>2</sup>; <sup>1</sup>College of Information & Electronics, Zhejiang Sci-tech University, Hangzhou, Zhejiang, CHINA, <sup>2</sup>College of Electrical Engineering, Zhejiang University, Hangzhou, Zhejiang, CHINA
- 6.4 Analysis Of A New PWM Method For Conducted EMI Reduction In A Field Oriented Controlled Induction Motor**  
L.-H. Kim<sup>1</sup>, N.-K. Hahm<sup>2</sup>, W.-C. Lee<sup>1</sup>, J.-S. Yu<sup>1</sup>, Y.-C. Kim<sup>1</sup>, C.-Y. Won<sup>1</sup>, Y.-R. Kim<sup>3</sup>; <sup>1</sup>School of Information & Computer Engineering Sung-Kyun-Kwan University, swoon, KOREA, <sup>2</sup>IN-TECH FA Co., Ltd, swoon, KOREA
- 6.5 A Novel Implementation Of Low Speed Sensorless Vector Control Of Synchronous Reluctance Motors With A New Online Parameter Identification Approach**  
A. Ghaderi, T. Hanamoto, T. Tsuji; Kyushu Institute of Technology, Kitakyushu, JAPAN
- 6.6 Motor Side Active Filter For High Power Synchronous Drive**  
C. Attaianese, V. Nardi, G. Tomasso; University of Cassino, Cassino, ITALY
- 6.7 Troubleshooting And Fixing Of Inverter Driven Induction Motor Bearing Currents In Existing Plants Of Large Size - An Evaluation Of Possible Mitigation Techniques In Practical Applications**  
S. Guttowski<sup>1</sup>, S. Weber<sup>1</sup>, M. Schinkel<sup>1</sup>, W. John<sup>1</sup>, H. Reichl<sup>2</sup>; <sup>1</sup>Fraunhofer IZM, Berlin, GERMANY, <sup>2</sup>Technical University Berlin, Berlin, GERMANY

**Session 7: Single Phase Power Factor Correction**

**Tuesday, March 21  
Landmark Ballroom D  
8:30 AM– Noon**

**Session Chairs: Jim Spangler, ON Semiconductor and Aleksandar Prodic, University of Toronto**

- 7.1 Isolated Boost Converters**  
Y. Jang, M.M. Jovanovic; Delta Products Corporation, Research Triangle Park, NC
- 7.2 Evaluation Of Power Losses In A Boost PFC Unit By Temperature Measurements**  
K. Viswanathan, R. Oruganti; National University of Singapore, Singapore, SINGAPORE
- 7.3 Efficient Wide Range Converters (EWiRaC): A New Family Of High Efficient AC-DC Converters**  
L. Petersen<sup>1</sup>, M.A.E. Andersen<sup>2</sup>; <sup>1</sup>Bang-Olufsen ICEpower, Kgs Lyngby, DENMARK, <sup>2</sup>Oersted, Technical University of Denmark, Kgs Lyngby, DENMARK
- 7.4 Low-Cost Energy-Efficient Smps Delivers Up To 90 W Peak From An EE-25 Core Transformer**  
J. Jovalusky, Power Integrations, San Jose, CA
- 7.5 Current Phase Lead Compensation In Single-Phase PFC Boost Converters With A Reduced Switching Frequency To Line Frequency Ratio**  
K.P. Louganski, J.-S. Lai; Virginia Polytechnic Institute and State University, Future Energy Electronics Center, Blacksburg, VA
- 7.6 Non-Unity Active PFC Methods For Filter Size Optimization**  
Y. Chen, J.W. Kimball, P.T. Krein; Grainger Center for Electric Machinery and Electromechanics, University of Illinois, Urbana, IL
- 7.7 Reducing The Inductor Size And Current Stress By Interleaved Boost Full Bridge Rectifiers Used For Power Factor Correction**  
A.A. Bento, E.R. da Silva, E.C. Santos Jr.; Universidade Federal de Campina Grande, Campina Grande, BRAZIL



**Session 8: Motor Drive Applications**

**Wednesday, March 22  
Landmark Ballroom B  
8:30 – 10:15 AM**

**Session Chairs: James Nagashima, General Motors and Thomas Hopkins, STMicroelectronics**

**8.1 Power Electronics Interface For A 100 W, 500000 RPM Gas Turbine Portable Power Unit**

C. Zwyssig, S.D. Round, J.W. Kolar; Swiss Federal Institute of Technology Zurich (ETHZ), Zurich, SWITZERLAND

**8.2 Mathematical Model Of Ultrasonic Motors For Speed Control**

T. Senjyu<sup>1</sup>, M. Nakamura<sup>1</sup>, N. Urasaki<sup>1</sup>, T. Funabashi<sup>2</sup>, H. Sekine<sup>1</sup>; <sup>1</sup>University of the Ryukyus, Okinawa, JAPAN, <sup>2</sup>Meidensha Corporation, Tokyo, JAPAN

**8.3 An Inductance Profile Demodulator Based Observer For Sensorless Control Of Switched Reluctance Motors**

J. Zhang<sup>1</sup>, A.V. Radun<sup>2</sup>, C.A. Ferreira<sup>3</sup>; <sup>1</sup>Ansoft Corporation, Pittsburgh, PA, <sup>2</sup>University of Kentucky, Lexington, KY, <sup>3</sup>Parker Aerospace, Irvine, CA

**8.4 Performance Analysis And Comparison Of Reduced Common Mode Voltage PWM And Standard PWM Techniques For Three-Phase Voltage Source Inverters**

E. Ün, A.M. Hava; Middle East Technical University, Ankara, TURKEY



**Session 9: Soft-Switched DC-DC Converters**

**Wednesday, March 22  
Landmark Ballroom C  
8:30 – 10:15 AM**

**Session Chairs: Phil Krein, University of Illinois and Jose Cobos, UPM**

**9.1 A Novel Zero-Current-Transition Three-Level DC-DC Converter**

G. Wu, L. Miao, C. Qiu, J. Zhang, Z. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA

**9.2 A Comparative Study Of Zero-Current-Transition PWM Converters**

P. Das, G. Moschopoulos; University of Western Ontario, London, CANADA

**9.3 A Novel High Performance Resonant Gate Drive Circuit With Low Circulating Current**

W. Eberle, P.C. Sen, Y.F. Liu; Queen's University, Kingston, CANADA

**9.4 A New PWM ZVS Full-Bridge Converter**

Y. Jang, M.M. Jovanovic; Delta Products Corporation, Research Triangle Park, NC



**Session 10: Uninterruptible Power Systems**

**Wednesday, March 22  
Landmark Ballroom D  
8:30 – 10:15 AM**

**Session Chairs: Benoit Herve, Zilker Labs Inc. and Josep Guerrero, UPC**

**10.1 A Switch-Mode Converter To Fill Voltage Sags In Interactive Uninterruptible Power Supplies**

A. Fernandez, M. Arias, V. de Prado, M.M. Hernando, J. Sebastián; Universidad de Oviedo, Gijón, SPAIN

**10.2 A Transformerless Single Phase On-Line Ups With 110 V/220 V Input Output Voltage**

C.G.C. Branco, C.M.T. Cruz, R.P. Torrico-Bascope, F.L.M. Antunes, L.H.S.C. Barreto; Federal University of Ceará, Fortaleza - Ceará, BRAZIL

**10.3 Progressively Converging Deadbeat Control For Ups Inverter**

Y.D. Liu<sup>1</sup>, Y. Xing<sup>2</sup>, L.P. Huang<sup>1</sup>, M. Sakane<sup>3</sup>; <sup>1</sup>Dept. of Electrical Engineering, Tsinghua Univ., Beijing, CHINA, <sup>2</sup>College of Automation Engineering, Nanjing Univ. of Aeronautics and Astronautics, Jiangsu Nanjing, CHINA, <sup>3</sup>GS Yuasa Power Electronics Ltd, Osaka, JAPAN

**10.4 A High Frequency Transformer Isolation 110 V/220 V Input Voltage Ups System**

R.P. Torrico-Bascope, D.S. Oliveira, C.G.C. Branco, F.L.M. Antunes, C.M.T. Cruz; Federal University of Ceará, Fortaleza, BRAZIL



**Session 11: Lighting Applications**

**Wednesday, March 22  
Pegasus Ballroom B  
8:30 – 10:15 AM**

**Session Chairs: Chris Eckhoff, Zilker Labs Inc. and Bill Peterson, E&M Power**

**11.1 A Novel Low-Cost High-Reliability Igniter For Metal Halide Lamps**

R. Guo, Z.M. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA

## 11.2 Accurate Current Control To Drive High Power LED Strings

O. Ronat, P. Green, S. Ragona; International Rectifier, El Segundo, CA

## 11.3 LED Back-Light Driving System For LCD Panels

C.-C. Chen<sup>1</sup>, C.-Y. Wu<sup>2</sup>, T.-F. Wu<sup>2</sup>; <sup>1</sup>Department of Electrical Engineering Nan-Jeon Institute of Technology Yen-Shui, Tainan, Yen-Shui, TAIWAN, <sup>2</sup>Department of Electrical Engineering National Chung Cheng University Ming-Hsiung, Chia-Yi, Ming-Hsiung, TAIWAN

## 11.4 Phase Controlled Piezoelectric-Transformer Backlight Inverter With No Magnetic Device

W.C. Su, P.C. Lin, C.L. Chen; Graduate Institute of Electronics Engineering, National Taiwan University, Taipei, TAIWAN



## Session 12: Single-Stage Power Factor Correction

Wednesday, March 22  
Reunion Ballroom GH  
8:30 – 10:15 AM

Session Chair: Ernest H. Wittenbreder, Technical Witts, Inc

## 12.1 A Single-Stage Symmetrical-Output-Voltage Push-Pull Boost Converter With A Notch Filter For Input-Current-Shaping

F.A.B. Coelho, J.C. de Oliveira, V.J. Farias, E.A.A. Coelho, L.C. de Freitas, J.B., Jr. Vieira; Federal University of Uberlândia, Uberlândia, BRAZIL

## 12.2 Design Considerations For A New AC-DC Single-Stage Flyback Converter

Y. Zheng, G. Moschopoulos; University of Western Ontario, London, CANADA

## 12.3 A SEPIC-Type Single-Stage Electronic Ballast To Achieve High Power Factor And Reduce Voltage Stress

C.-L. Shen, C.-C. Chen; Nan-Jeon Institute of Technology, Tainan, TAIWAN

## 12.4 A Single Stage Three Level Resonant LLC AC-DC Converter Using A Variable-Frequency-Phase-Shift Controller And A Voltage Balancing Auxiliary Circuit

M.S. Agamy, P.K. Jain; Queen's University, Kingston, CANADA



## Session 13: Multilevel Converters

Wednesday, March 22  
Pegasus Ballroom A  
8:30 – 10:15 AM

Session Chairs: Keith Corzine, University of Missouri-Rolla and Bill Diong, Texas Christian University

## 13.1 A Novel Series Resonant ZCS Full Bridge Three-Level DC-AC Inverter

X. Sun, J. Liu, X. Jin, W. Wu; Electrical Engineering Institute, Yanshan University, Qinhuangdao, CHINA

## 13.2 A Cascade Multilevel Inverter Using A Single DC Power Source

Z. Du<sup>1</sup>, L.M. Tolbert<sup>2,3</sup>, J.N. Chiasson<sup>2</sup>, B. Ozpineci<sup>3</sup>; <sup>1</sup>North Carolina State University, Raleigh, NC, <sup>2</sup>The University of Tennessee, Knoxville, TN, <sup>3</sup>Oak Ridge National Laboratory, Oak Ridge, TN

## 13.3 Pulse-Width Modulated Z-Source Neutral-Point-Clamped Inverter

P.C. Loh<sup>1</sup>, F. Blaabjerg<sup>2</sup>, S.Y. Feng<sup>1</sup>, K.N. Soon<sup>1</sup>; <sup>1</sup>Nanyang Technological University, Singapore, SINGAPORE, <sup>2</sup>Aalborg University, Aalborg, DENMARK

## 13.4 Withdrawn



## Session 14: Silicon Carbide Device Applications

Wednesday, March 22  
Reunion Ballroom F  
8:30 – 10:15 AM

Session Chairs: Stephen Bayne, Army Research Laboratory and John S. Bowers, Sandia Nat. Labs

## 14.1 Characterization Of SiC Diodes In Extremely High Temperature Ambient

T. Funaki<sup>1</sup>, A.S. Kashyap<sup>2</sup>, H.A. Mantooth<sup>2</sup>, J.C. Balda<sup>2</sup>, F.D. Barlow<sup>2</sup>, T. Kimoto<sup>3</sup>, T. Hikihara<sup>1</sup>; <sup>1</sup>Kyoto University, Dept. of Electrical Eng., Kyoto, JAPAN, <sup>2</sup>University of Arkansas, Fayetteville, AR, <sup>3</sup>Kyoto University, Dept. of Electronic Science and Eng., Kyoto, JAPAN

## 14.2 A 55 kW Three-Phase Inverter With Si IGBTs And SiC Schottky Diodes

B. Ozpineci<sup>1</sup>, M.S. Chinthavali<sup>1</sup>, L.M. Tolbert<sup>1,2</sup>, A. Kashyap<sup>3</sup>, H.A. Mantooth<sup>3</sup>; <sup>1</sup>Oak Ridge National Laboratory, Knoxville, TN, <sup>2</sup>The University of Tennessee, Knoxville, TN, <sup>3</sup>The University of Arkansas, Fayetteville, AR

**14.3 A Study On Switching Frequency Limitation Of High Voltage Power Converters In Combination Of Si-IGBT And SiC-PiN Diode**  
K.-M. Sung<sup>1</sup>, K. Suzuki<sup>1</sup>, Y. Tanaka<sup>2</sup>, T. Ogura<sup>3</sup>, H. Ohashi<sup>2</sup>; <sup>1</sup>Tokyo Institute of Technology, Tokyo, JAPAN, <sup>2</sup>National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, JAPAN, <sup>3</sup>Toshiba Corp., Kawasaki, JAPAN

**14.4 A Scalable SiC Device For DC-DC Converters In Future Hybrid Electric Vehicles**  
R.L. Kelley<sup>1</sup>, M.S. Mazzola<sup>1</sup>, V. Bondarenko<sup>2</sup>; <sup>1</sup>SemiSouth Laboratories, Inc., Starkville, MS, <sup>2</sup>CAVS at Mississippi State University, Starkville, MS



**Session 15: Voltage Regulator Modules II**                      **Wednesday, March 22  
Landmark Ballroom C  
2:00 – 5:30 PM**

**Session Chairs: Siamak Abedinpour, Freescale Semiconductor, Inc. and Xin Zhang, Virginia Polytechnic Institute and State University**

- 15.1 Novel 3-Switch Dual Output Buck Voltage Regulator**  
P. Kumar<sup>1</sup>, M. Rojas-Gonzalez<sup>2</sup>; <sup>1</sup>Intel Corporation, Hillsboro, OR, <sup>2</sup>Texas A&M University, College Station, TX
- 15.2 A Novel Technique For Compensating POL Converters With Variable Output Capacitance**  
C.A. DeVries, Texas Instruments, Inc., Warrenton, IL
- 15.3 Analysis Of Limit Cycle Oscillations In Digital Current-Mode Control**  
S Chattopadhyay, Indian Institute of Technology Kharagpur, Kharagpur, INDIA
- 15.4 Multi-Phase Buck Converter Design With Two-Phase Coupled Inductors**  
W. Wu, N.-C. Lee, G. Schuellein; International Rectifier, North Kingstown, RI
- 15.5 Digital Auto-Tuning System For Inductor Current Sensing In VRM Applications**  
G. Garcea<sup>1</sup>, S. Saggini<sup>2</sup>, D. Zambotti<sup>2</sup>, M. Ghioni<sup>1</sup>; <sup>1</sup>Politecnico di Milano, Department of Electronics and information (DEI), Milan, ITALY, <sup>2</sup>ST Microelectronics, IP&C Division, Cornaredo (MI), ITALY

**15.6 Voltage Divider And Its Application In The Two-Stage Power Architecture**  
M. Xu, J. Sun, F.C. Lee; CPES, Virginia Tech, Blacksburg, VA

**15.7 High-Accuracy Hysteretic Current-Mode Regulator For Powering Microprocessors**  
C. Song, J.L. Nilles; National Semiconductor Corporation, Santa Clara, CA



**Session 16: Soft-Switched Isolated DC-DC Converters**                      **Wednesday, March 22  
Landmark Ballroom D  
2:00 – 5:30 PM**

**Session Chairs: David Strasser, Texas Instruments and Baoxing Chen, Analog Devices, Inc.**

- 16.1 A Family Of Zero-Voltage-Switching DC-DC Transformers**  
Z. Yao, L. Xiao, Y. Yan; Aero-Power Sci-tech Center, College of Automation Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing, CHINA
- 16.2 Accurately Regulated Multiple Output ZVS DC-DC Converter**  
Y. Zhang<sup>1</sup>, D. Xu<sup>1</sup>, F. Gao<sup>1</sup>, Y. Han<sup>2</sup>, Z. Du<sup>2</sup>; <sup>1</sup>Institute of Power Electronics, Zhejiang University, Hangzhou 310027, China, Hangzhou, CHINA, <sup>2</sup>Emerson Network Power Co., Ltd. Shenzhen 518129, China, Shenzhen, CHINA
- 16.3 A Flux Balancer For Phase Shift ZVS DC-DC Converters Under Transient Conditions**  
J.A. Claassens, I.W. Hofsaier; University of Johannesburg, Johannesburg, SOUTH AFRICA
- 16.4 Soft-Switched Asymmetric Half-Bridge Flyback-Forward Converter**  
H. Mao<sup>1</sup>, O. Abdel-Rahman<sup>2</sup>, B. Higgins<sup>1</sup>, G. Potter<sup>1</sup>; <sup>1</sup>Astec Power, Emerson Network Power, Andover, MA, <sup>2</sup>University of Central Florida, Orlando, FL
- 16.5 Optimal Design Methodology For LLC Resonant Converter**  
B. Lu, W. Liu, Y. Liang, F.C. Lee, J.D. Van Wyk; Virginia Polytechnic Institute and State University, Blacksburg, VA
- 16.6 Passive Component Integration In A ZVS Flyback Converter**  
J. Claassens, I.W. Hofsaier, K. de Jager; University of Johannesburg, Johannesburg, SOUTH AFRICA

**16.7 Zero-Voltage-Switching Buck-Flyback Isolated DC-DC Converter With Synchronous Rectification**

L. Yao<sup>1</sup>, H. Mao<sup>2</sup>, J. Liu<sup>1</sup>, I. Batarseh<sup>1</sup>;  
<sup>1</sup>University of Central Florida, Orlando, FL,  
<sup>2</sup>Astec Power, Emerson Network Power,  
Andover, MA



**Session 17: Magnetics And Current Sensing**

**Wednesday, March 22**  
**Pegasus Ballroom**  
**2:00 – 5:30 PM**

**Session Chairs: Victor Quinn, Tabtronics, Inc. and Matthew Wilkowski, Enpirion, Inc.**

**17.1 Loss Analysis And Optimization Of Round-Wire Planar Windings For Domestic Induction Heating Appliances**

J. Acero, R. Alonso, J.M. Burdío, L.A. Barragan, D. Navarro; University of Zaragoza, Zaragoza, SPAIN

**17.2 A Novel Isolated Current Sensor For High-Performance Power Electronics Applications**

L. Dalessandro, N. Karrer, J.W. Kolar; ETH Zurich, Zurich, SWITZERLAND

**17.3 Magnetics Design For Active Transient Voltage Compensator**

H. Zhou, X. Wang, T. Wu, I. Batarseh; University of Central Florida, Orlando, FL

**17.4 Verification Of Rogowski Current Transducer's Ability To Measure Fast Switching Transients**

C.R. Hewson, W.F. Ray, R.M. Davis; Power Electronic Measurements Ltd, Nottingham, UK

**17.5 Using The Dynamic Behavior Of Superimposed Fields For Point Field-Based Current Sensing**

E.R. Olson, R.D. Lorenz; University of Wisconsin - Madison, Madison, WI

**17.6 A New Approach To Obtain 1D Thermal Models For Magnetic Components Including The Effect Of Spacing Between Conductors**

L.M. Escribano, R. Prieto, J.A. Oliver, J.A. Cobos; Universidad Politecnica de Madrid, Madrid, SPAIN

**17.7 Low Profile Integratable Inductor Fabricated Based On Ltcc Technology For Microprocessor Power Delivery Applications**

M.H.F. Lim, Z. Liang, J.D. van Wyk; Virginia Polytechnic Institute and State University, Blacksburg, VA

**Session 18A: Battery Management**

**Wednesday, March 22**  
**Reunion Ballroom F**  
**2:00 – 3:45 PM**

**Session Chair: Phil McKenzie, Zilker Labs Inc.**

**18A.1 Soft Switching Bidirectional Converter For Battery Discharging-Charging**

E. Sanchis-Kilders<sup>1</sup>, A. Ferreres<sup>1</sup>, E. Maset<sup>1</sup>, J.B. Ejea<sup>1</sup>, V. Esteve-Gomez<sup>1</sup>, J. Jordan<sup>1</sup>, A. Garrigos<sup>2</sup>, J. Calvente<sup>3</sup>; <sup>1</sup>Universitat de Valencia, Valencia, SPAIN, <sup>2</sup>Universitat Miguel-Hernandez, Elche, SPAIN, <sup>3</sup>Universitat Rovira i Virgili, Tarragona, SPAIN

**18A.2 Fast Lead-Acid Battery Charge Strategy**

J. Marcos, J. Dios, A.M. Cao, J. Doval, C.M. Penalver, A. Nogueiras, A. Lago, F. Poza; University of Vigo, Vigo, SPAIN

**18A.3 An Ultra Low Current Low Cost Zinc-Air Battery Discharge Monitor Utilizing A Microcontroller Based Countdown Algorithm**

J.J. Nance<sup>1</sup>, H.L. Hess<sup>1</sup>, T.B. Atwater<sup>2</sup>; <sup>1</sup>University of Idaho, Moscow, ID, <sup>2</sup>US Army LABCOM, Fort Monmouth, NJ

**18A.4 Morphed Dual-Stage System With Varied Switching Frequency Of Power Converters During Battery Discharge Period**

L. Li<sup>1</sup>, R. Patel<sup>1,2</sup>; <sup>1</sup>Apple Computer, Cupertino, CA, <sup>2</sup>Intersil Corporation, Milpitas, CA



**Session 18B: Automotive And Transportation Applications**

**Wednesday, March 22**  
**Reunion Ballroom F**  
**4:15 – 5:30 PM**

**Session Chairs: Phil McKenzie, Zilker Labs Inc. and Gui-Jia Su, Oak Ridge National Laboratory**

**18B.1 A Low Power Topology Derived From Flyback With Active Clamp Based On A Very Simple Transformer**

P. Alou<sup>1</sup>, A. Bakkali<sup>1</sup>, I. Barbero<sup>1</sup>, J.A. Cobos<sup>1</sup>, M. Rascon<sup>2</sup>; <sup>1</sup>Universidad Politecnica de Madrid (UPM), Madrid, SPAIN, <sup>2</sup>Alcatel, Madrid, SPAIN

**18B.2 Low-Voltage Power Electronics Building Block For Automotive Applications**

L. Solero, V. Serrao, P. Taglioni, F. Crescimbin; University of Roma Tre - DIMI, Roma, ITALY

## 18B.3 Pulse-Width-Modulation Schemes For An Integrated Traction And Compressor Drive System

G. Su, Oak Ridge National Laboratory, Knoxville, TN



## 19.7 Robust Maximum Torque Per Amp (MTPA) Control Of PM Assisted Synchronous Reluctance Motor

P. Niazi<sup>1</sup>, H.A. Toliyat<sup>2</sup>; <sup>1</sup>Maxtor Corporation, Shrewsbury, MA, <sup>2</sup>Texas A&M University, College Station, TX



### Session 19: Permanent Magnet Motor Drives

Wednesday, March 22  
Reunion Ballroom GH  
2:00 – 5:30 PM

Session Chairs: Patrick Chapman, University of Illinois and Syed Hossain, Globe Motors

#### 19.1 Dual Field Oriented Permanent Magnet Synchronous Motor (PMSM) Drive Using A Single Dsp Controller

M. Arefeen<sup>1</sup>, K. Godbole<sup>1</sup>, M. Konghirun<sup>2</sup>; <sup>1</sup>Texas Instruments Inc., Stafford, TX, <sup>2</sup>King Mongkut's University of Technology Thonburi, Bangkok, THAILAND

#### 19.2 The Comparison Of Sensorless Estimation Techniques For PMSM Between Extended Kalman Filter And Flux-Linkage Observer

M.C. Huang, A.J. Moses, F. Anayi; Cardiff University, CARDIFF, UK

#### 19.3 Matrix Converter BLDC Drive Using Reverse-Blocking IGBTs

S. Bala, G. Venkataramanan; University of Wisconsin - Madison, Madison, WI

#### 19.4 Low-Cost Direct Torque Control Of Permanent Magnet Synchronous Motor Using Hall-Effect Sensors

S.B. Ozturk<sup>1</sup>, B. Akin<sup>1</sup>, H.A. Toliyat<sup>1</sup>, F. Ashrafzadeh<sup>2</sup>; <sup>1</sup>Texas A&M University, College Station, TX, <sup>2</sup>Whirlpool Company, Benton Harbor, MI

#### 19.5 Fuzzy Back-Emf Observer For Improving Performance Of Sensorless Brushless DC Motor Drive

B.G. Park, T.S. Kim, J.S. Ryu, D.S. Hyun; Department of Electrical Engineering, Hanyang University, Seoul, KOREA

#### 19.6 Unknown Input Observer For A Novel Sensorless Drive Of Brushless DC Motors

T.S. Kim, J.S. Ryu, D.S. Hyun; Department of Electrical Engineering, Hanyang University, Seoul, KOREA

### Session 20: Digital Control of DC-DC Converters I

Wednesday, March 22  
Landmark Ballroom B  
2:00 – 5:30 PM

Session Chairs: Shamala Chickamenahalli, Intel Corporation and Phillip Cooke, International Rectifier

#### 20.1 Design And Implementation Of A DSP Based Digital Controller For A Dual Half Bridge Isolated Bi-Directional DC-DC Converter

D. Liu, H. Li; Department of Electrical and Computer Engineering, Florida State University, Tallahassee, FL

#### 20.2 A Low Power Mixed-Signal Current-Mode DC-DC Converter Using A One-Bit Delta Sigma DAC

O. Trescases, Z. Lukic, W.T. Ng, A. Prodic; University of Toronto, Toronto, CANADA

#### 20.3 A Novel Linear-Non-Linear Digital Control For DC-DC Converter With Fast Transient Response

G.M. Di Blasi<sup>1</sup>, V. Boscaino<sup>1</sup>, P. Livreri<sup>1</sup>, F. Marino<sup>2</sup>, M. Minieri<sup>2</sup>; <sup>1</sup>Università di Palermo - Dipartimento di Ingegneria Elettrica Elettronica e TLC, Palermo, ITALY, <sup>2</sup>STMicroelectronics - Industrial & Power Conversion, Catania, ITALY

#### 20.4 A Self-Compensating Adaptive Digital Regulator For Switching Converters Based On Linear Prediction

A.L. Kelly<sup>1</sup>, K. Rinne<sup>2</sup>; <sup>1</sup>Analog Devices, Limerick, IRELAND, <sup>2</sup>CSRC, University of Limerick, Limerick, IRELAND

#### 20.5 All-Digital DPWM/DPFM Controller For Low-Power DC-DC Converters

K. Wang, N. Rahman, Z. Lukic, A. Prodic; University of Toronto, Toronto, CANADA

#### 20.6 Non-Linear Digital Control Breaks Bandwidth Limitations

A. Soto, P. Alou, J.A. Cobos; Universidad Politécnica de Madrid, Madrid, SPAIN

## 20.7 Adaptive Nonlinear Compensation For Asymmetrical Half Bridge DC-DC Converters

Y. Wen<sup>1</sup>, S. Xiao<sup>1</sup>, Y. Jin<sup>2</sup>, I. Batarseh<sup>1</sup>;  
<sup>1</sup>University of Central Florida, Orlando, FL,  
<sup>2</sup>University of Texas at San Antonio, San Antonio, TX



**Session 21: DC-DC Output Rectifier Circuits**      **Thursday, March 23  
Landmark Ballroom B  
8:30 – 11:30 AM**

**Session Chair: Frank Cirolia, Artesyn Technologies**

### 21.1 A Novel Charge Retention Circuit For Synchronous Rectifiers

Y.L. Gu<sup>1</sup>, L.J. Hang<sup>1</sup>, G.S. Huang<sup>2</sup>, A.J. Zhang<sup>2</sup>,  
Z.Y. Lu<sup>1</sup>, X.G. Xie<sup>1</sup>; <sup>1</sup>Zhejiang University,  
Hangzhou, CHINA, <sup>2</sup>Delta Power Electronics  
Center, Shanghai, CHINA

### 21.2 Comparison Of Current Doubler Rectifier And Center Tapped Rectifier For Low Voltage Applications

P. Alou, J.A. Oliver, O. García, R. Prieto, J.A.  
Cobos; Universidad Politecnica de Madrid  
(UPM), Madrid, SPAIN

### 21.3 Construction Of Ideal Self-Driven Synchronous Rectification Circuits

X.G. Xie<sup>1</sup>, J.M. Zhang<sup>1</sup>, X.Y. Yang<sup>2</sup>, Z.M. Qian<sup>1</sup>;  
<sup>1</sup>Power Electronics Research Institute of  
Zhejiang University, Hang Zhou, CHINA,  
<sup>2</sup>Electrical Engineering College of Zhejiang  
University, Hang Zhou, CHINA

### 21.4 A New Dual Channel Resonant Gate Drive Circuit For Synchronous Rectifiers

Z. Yang, S. Ye, Y.F. Liu; Queen's University,  
Kingston, CANADA

### 21.5 Self-Driven Synchronous Rectification System For Converters With Symmetrically Driven Transformer Based On The Use Of The Output Inductor

A. Fernandez, J. Sebastián, M.M. Hernando,  
D.G. Lamar; Universidad de Oviedo, Gijón,  
SPAIN

### 21.6 Inductor Current Sharing Of Current Doubler Rectifier In Isolated DC-DC Converters

H. Mao<sup>1</sup>, L. Yao<sup>2</sup>, S. Deng<sup>2</sup>, O. Abdel-Rahman<sup>2</sup>,  
J. Liu<sup>2</sup>, I. Batarseh<sup>2</sup>; <sup>1</sup>Astec Power, Emerson  
Network Power, Andover, MA, <sup>2</sup>University of  
Central Florida, Orlando, FL



## Session 22: Inverter Applications II

**Thursday, March 23  
Pegasus Ballroom  
8:30 – 11:30 AM**

**Session Chairs: Bill Diong, Texas Christian University and Dorin Neacsu, Consultant**

### 22.1 A Novel Control Strategy For Grid-Interactive Inverter In Grid-Connected And Stand-Alone Modes

Z. Yao, Z. Wang, L. Xiao, Y. Yan; Aero-Power  
Sci-tech Center, College of Automation  
Engineering, Nanjing University of Aeronautics  
and Astronautics, Nanjing, CHINA

### 22.2 Evaluation Of Resonant Damping Techniques For Z-Source Current-Type Inverter

P.C. Loh<sup>1</sup>, C.J. Gajanayake<sup>1</sup>, D.M.  
Vilathgamuwa<sup>1</sup>, F. Blaabjerg<sup>2</sup>; <sup>1</sup>Nanyang  
Technological University, Singapore,  
SINGAPORE, <sup>2</sup>Aalborg University, analog,  
DENMARK

### 22.3 Three-Phase Boost-Type Grid-Connected Inverter

Y. Chen, K. Smedley; Univ. of California, Irvine,  
Irvine, CA

### 22.4 Performance Analysis And Improvement Of Digital Controlled Inverter

L. Peng, K. Zhang, Y. Kang, J. Chen; Huazhong  
University of Science and Technology, Wuhan,  
CHINA

### 22.5 A Flexible Loss-Minimizing And Stress-Sharing Switch Cell For Power Converters

G. Chen, Q. Liu, F. Wang, D. Boroyevich;  
Center for Power Electronics Systems, Virginia  
Polytechnic Institute and State University,  
Blacksburg, VA

### 22.6 A Synchronous Rectification Featured Soft-Switching Inverter Using CoolMOS

J. Zhang, J.-S. Lai; Virginia Polytechnic Institute  
and State University, Blacksburg, VA



**Session 23: Systems And Applications**      **Thursday, March 23**  
**Landmark Ballroom D**  
**8:30 – 11:30 AM**

**Session Chairs: Jim MacDonald, Zilker Labs Inc. and Oscar Garcia, Universidad Politecnica de Madrid**

- 23.1 Electrical Isolation Requirements In Power-Over-Ethernet (PoE) Power Sourcing Equipment (PSE)**  
R. White, Artesyn Technologies, Westminster, CO
- 23.2 Power Line Communication For Lighting Applications Using Binary Phase Shift Keying (BPSK) With A Single DSP Controller**  
M. Hagen, M. Heminger, M. Arefeen; Texas Instruments Inc., Stafford, TX
- 23.3 Understanding The Dominant Field Failure Mechanism For DC Power Supplies**  
D. Divan<sup>1</sup>, A. Bendre<sup>2</sup>, H. Johal<sup>1</sup>; <sup>1</sup>Georgia Institute of Technology, Atlanta, GA, <sup>2</sup>DRS Power and Control Technologies, Milwaukee, WI
- 23.4 Understanding And Using Pmbus™ Data Formats**  
R. White, D. Durant; Artesyn Technologies, Westminster, CO
- 23.5 Static Paralleling Of Power MOSFETs In Thermal Equilibrium**  
T. Lopez, R. Elferich; Philips Research Laboratories, Aachen, GERMANY
- 23.6 Using Redundant DC Power In High Availability Systems**  
R. White, Artesyn Technologies, Westminster, CO



**Session 24: Packaging, Integration And Thermal Management**      **Thursday, March 23**  
**Reunion Ballroom F**  
**8:30 – 11:30 AM**

**Session Chairs: Bruce Miller, Dell Inc. and Cian O Mathuna, Tyndall National Institute**

- 24.1 3D Integration With PCB Technology**  
E.C.W. de Jong, J.A. Ferreira, P. Bauer; Delft University of Technology, Delft, NETHERLANDS
- 24.2 Understanding Thermal Performance Of DC-DC Power Modules**  
B. Narveson, G. Jones; Texas Instruments, Warrenville, IL

- 24.3 High-Temperature, High-Density Packaging Of A 60 kW Converter For Greater Than 200 C Embedded Operation**  
D.C. Hopkins<sup>1</sup>, D.W. Kellerman<sup>2</sup>, R.A. Wunderlich<sup>3</sup>, C. Basaran<sup>1</sup>, J. Gomez<sup>1</sup>;  
<sup>1</sup>University at Buffalo, Buffalo, NY, <sup>2</sup>Material Solutions LLC, Venice, FL, <sup>3</sup>Innovative Ideas & Designs, Endicott, NY
- 24.4 Design Towards Higher Integration Levels In Power Electronics**  
E.C.W. de Jong, J. Popovic, J.A. Ferreira; Delft University of Technology, Delft, NETHERLANDS
- 24.5 Micro-Channel Thermal Management Of High Power Devices**  
S.A. Solovitz, L.D. Stevanovic, R.A. Beaupre; GE Global Research Center, Niskayuna, NY
- 24.6 Board Level Reliability Testing For Power Semiconductors In Extended Use Applications**  
D. Lang, Fairchild Semiconductor, San Jose, CA



**Session 25: Digital Control Techniques And Applications**      **Thursday, March 23**  
**Landmark Ballroom C**  
**8:30 – 11:30 AM**

**Session Chairs: Chuck Mullett, ON Semiconductor and Liping Guo, Auburn University**

- 25.1 Hardware-In-The-Loop Testing Of Digital Power Controllers**  
Z. Jiang<sup>1</sup>, R.A. Dougal<sup>2</sup>, R. Leonard<sup>2</sup>, H. Figueroa<sup>2</sup>, A. Monti<sup>2</sup>; <sup>1</sup>University of New Orleans, New Orleans, LA, <sup>2</sup>University of South Carolina, Columbia, SC
- 25.2 Online Grid Impedance Measurement Suitable For Multiple PV Inverters Running In Parallel**  
A.V. Timbus<sup>1</sup>, R. Teodorescu<sup>1</sup>, F. Blaabjerg<sup>1</sup>, U. Borup<sup>2</sup>; <sup>1</sup>Aalborg University, Institute of Energy Technology, Aalborg, DENMARK, <sup>2</sup>PowerLynx A/S, Sonderborg, DENMARK
- 25.3 Design And Comparison Of High Performance Stationary-Frame Controllers For DVR Implementation**  
Y.W. Li<sup>1</sup>, F. Blaabjerg<sup>2</sup>, D.M. Vilathgamuwa<sup>1</sup>, P.C. Loh<sup>1</sup>; <sup>1</sup>Centre for Advanced Power Electronics, EEE School, Nanyang Technological University, Singapore, SINGAPORE, <sup>2</sup>Institute of Energy Technology, Aalborg University, Aalborg, DENMARK

**25.4 Repetitive Control Algorithms For A Real-Time Dynamic Electronic Load Simulator**

R. Zhang, J. Chen; Huazhong University of Science and Technology, Wuhan, CHINA

**25.5 Dsp-Based Stable Control Loops Design For A Single Stage Inverter**

W.M. Al-Hoor, H. Al-Atrash, J. Abu-Qahouq, I. Batarseh; University of Central Florida, Orlando, FL

**25.6 Ultra Precise Position Estimation Of Servomotor Using Analog Quadrature Encoders**

J.C. Kim<sup>1</sup>, J.M. Kim<sup>1</sup>, C.U. Kim<sup>1</sup>, C. Choi<sup>2</sup>;  
<sup>1</sup>Pusan National University, Busan, KOREA,  
<sup>2</sup>OTIS-LG, Changwon, KOREA



**Session 26: Multiphase Power Factor Correction**

**Thursday, March 23**  
**Reunion Ballroom GH**  
**8:30 – 11:30 AM**

**Session Chairs: Kris Dehnel, Zilker Labs Inc. and Aaron Xu, Texas Instruments, Inc.**

**26.1 Comparative Study Of Three-Phase PWM Rectifiers For Wind Energy Conversion**

S Miller, J Sun; Rensselaer Polytechnic Institute, Troy, NY

**26.2 Space Vector Modulation Applied To Three-Phase Three-Switch Two-Level Unidirectional PWM Rectifier**

F.A.B. Batista, I. Barbi; Power Electronics Institute - Federal University of Santa Catarina, Florianopolis, BRAZIL

**26.3 A Novel ZVS Z-Source Rectifier**

X. Ding<sup>1</sup>, Z. Qian<sup>1</sup>, Y. Xie<sup>1</sup>, F.Z. Peng<sup>2</sup>; <sup>1</sup>Zhejiang University, Hangzhou, CHINA, <sup>2</sup>Michigan State University, East Lansing, MI

**26.4 Advanced Control Of A Boost AC-DC PWM Rectifier For Variable-Speed Induction Generator**

T. Ahmed<sup>1</sup>, K. Nishida<sup>2</sup>, M. Nakaoka<sup>1</sup>, T. Tanaka<sup>1</sup>; <sup>1</sup>Yamaguchi University, Yamaguchi, JAPAN, <sup>2</sup>Ube National College of Technology, Yamaguchi, JAPAN

**26.5 Soft Switching Condition Analysis For A Novel ZVS-SVM Controlled Three-Phase Boost PFC Converter**

R. Li<sup>1</sup>, D. Xu<sup>1</sup>, B. Feng<sup>1</sup>, K. Mino<sup>2</sup>, H. Umida<sup>2</sup>;  
<sup>1</sup>Institute of Power Electronics, Zhejiang University, Hangzhou, CHINA, <sup>2</sup>Fuji Electric Advanced Technology Co., Ltd., Tokyo, CHINA

**26.6 An Interleaved Active Power Filter With Reduced Size Of Passive Components**

L. Asiminoaei<sup>1</sup>, E. Aeloiza<sup>2</sup>, J.H. Kim<sup>3</sup>, P. Enjeti<sup>2</sup>, F. Blaabjerg<sup>1</sup>, L.T. Moran<sup>4</sup>, S.K. Sul<sup>3</sup>; <sup>1</sup>Aalborg University, Institute of Energy Technology, Aalborg, DENMARK, <sup>2</sup>Texas A&M University, Department of Electrical Engineering, College Station, TX, <sup>3</sup>Seoul National University, School of Electrical Engineering and Computer Science, Seoul, KOREA, <sup>4</sup>University of Concepcion, Department of Electrical Engineering, Concepcion, CHILE



**Session 27: DC-DC Conversion Topics**

**Thursday, March 23**  
**Landmark Ballroom B**  
**2:00 – 5:30 PM**

**Session Chairs: Jim Templeton, Zilker Labs and Wei Gu, National Semiconductor**

**27.1 Analysis And Evaluation Of A Series-Combined Connected Boost And Buck-Boost DC-DC Converter For Photovoltaic Application**

J.L. Duran-Gomez<sup>1</sup>, E. Garcia-Cervantes<sup>1</sup>, D.R. Lopez-Flores<sup>1</sup>, P.N. Enjeti<sup>2</sup>, L. Palma<sup>2</sup>; <sup>1</sup>Instituto Tecnológico de Chihuahua, Chihuahua, MEXICO, <sup>2</sup>Texas A&M University, College Station, TX

**27.2 Average And Small-Signal Model For Asymmetrically-Driven Double-Ended PWM DC-To-DC Converters**

W. Lim<sup>1</sup>, Y. Kang<sup>2</sup>, B. Choi<sup>1</sup>, J. Liu<sup>2</sup>; <sup>1</sup>School of Electrical Engineering and Computer Science, Kyungpook National University, Taegu, KOREA, <sup>2</sup>Artesyn Technologies Inc., Framingham, MA

**27.3 Envelope Tracking Power Supply With Fully Controlled 4th Order Output Filter**

M.C.W. Høyerby, M.A.E. Andersen; Technical University of Denmark, Lyngby, DENMARK

**27.4 Experimental Analysis Of A Flyback Converter With Excellent Efficiency**

U. Boeke<sup>1</sup>, D. Itzenga<sup>2</sup>, K. Rigbers<sup>2</sup>, R.W. De Doncker<sup>2</sup>; <sup>1</sup>Philips Research Laboratories, Aachen, GERMANY, <sup>2</sup>Institute ISEA, RWTH Aachen University, Aachen, GERMANY

**27.5 Withdrawn**

**27.6 Investigating Feedforward Mechanism In Current Mode Control**

J.Y. Guo, Fairchild Semiconductor, San Jose, CA

**27.7 A New DC-DC Converter For Fuel Cell Powered Distributed Residential Power Generation Systems**  
R. Sharma, H. Gao; Montana State University, Bozeman, MT



**Session 28: Electronic Ballasts For Lighting**      **Thursday, March 23  
Landmark Ballroom D  
2:00 – 5:30 PM**

**Session Chairs: Ron Vinsant, Zilker Labs Inc. and Francisco Azcondo, University of Cantabria**

- 28.1 Small-Signal Modeling Of Discharge Lamps Through Step Response And Its Application To Low-Frequency Square-Waveform Electronic Ballasts**  
J.M. Alonso, M.A. Dalla-Costa, J. Cardesin, J.A. Martin-Ramos, J. Garcia-Garcia; University of Oviedo, Gijon, SPAIN
- 28.2 New Control Strategy For A Two-Stage Low-Frequency Square-Wave Electronic Ballast For MHD Lamp**  
J.B. Xu, M. Chen, ZH.M Qian; Zhejiang University, Hangzhou, CHINA
- 28.3 Ignition Design Of Digital Ballast For Low Wattage Metal Halide Lamps**  
Z. Zuo, D. Xu; Harbin Institute of Technology, 150001, Harbin, CHINA
- 28.4 Phase-Controlled Quadruple LCp Resonant Inverter To Drive 600 W HPS Lamps**  
Ch. Brañas, F.J. Azcondo, R. Casanueva, S. Bracho; University of Cantabria, Santander, SPAIN
- 28.5 Low Frequency Square-Wave Electronic Ballast With Resonant Ignition Using Digital Mode And Power Control**  
F.J. Azcondo<sup>1</sup>, C.H. Brañas<sup>1</sup>, F.J. Díaz<sup>1</sup>, R. Casanueva<sup>1</sup>, R. Zane<sup>2</sup>; <sup>1</sup>University of Cantabria, Santander, SPAIN, <sup>2</sup>University of Colorado at Boulder, Boulder, CO
- 28.6 Designing A Wide Range High Performance T5HO Electronic Ballast Platform**  
Z. Huang, T. Ribarich; International Rectifier, El Segundo, CA
- 28.7 A Single-Stage Power Converter For A Large Screen LCD Back-Lighting**  
I.-H. Oh, Fairchild Semiconductor, San Jose, CA



**Session 29: Utility Interface And Power Quality**      **Thursday, March 23  
Landmark Ballroom A  
2:00 – 5:30 PM**

**Session Chair: Shiguo Luo, Dell Corporation**

- 29.1 An Improved Control Strategy For Grid-Connected Voltage Source Inverters With A LCL Filter**  
G. Shen<sup>1</sup>, D. Xu<sup>1</sup>, D. Xi<sup>1</sup>, X. Yuan<sup>2</sup>; <sup>1</sup>College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA, <sup>2</sup>General Electric Corporate R&D-Shanghai, Shanghai, CHINA
- 29.2 Investigation And Improvement Of Transient Response Of DVR At Medium Voltage Level**  
Y.W. Li<sup>1</sup>, P.C. Loh<sup>1</sup>, F. Blaabjerg<sup>2</sup>, D.M. Vilathgamuwa<sup>1</sup>; <sup>1</sup>Centre for Advanced Power Electronics, EEE School, Nanyang Technological University, Singapore, SINGAPORE, <sup>2</sup>Institute of Energy Technology, Aalborg University, Aalborg, DENMARK
- 29.3 Utility Grid Interfaced PV Power Conditioner Using Boost Chopper-Four Switch Three Phase Inverter With A Novel Quasi Resonant DC Link Snubber**  
T. Ahmed<sup>1</sup>, S. Nagai<sup>2</sup>, M. Nakaoka<sup>1</sup>; <sup>1</sup>Yamaguchi University, Yamaguchi, JAPAN, <sup>2</sup>Sanken Electric Co., Ltd., Saitama, JAPAN
- 29.4 Grid-Connected Hybrid PV/Wind Power Generation System With Improved DC Bus Voltage Regulation Strategy**  
Y.-M. Chen, C.-S. Cheng, H.-C. Wu; Dept. of Electrical Engineering, National Chung Cheng University, Chia-Yi, TAIWAN
- 29.5 Interface Control And Islanding Protection Of Grid-Connected Inverters Based On Unified Constant-Frequency Integration Control**  
H.R. Gu, W. Liu, C.J. Zhang, W.Y. Wu; Yanshan University, Qinhuangdao, CHINA
- 29.6 A DSP Based SVPWM Control For Utility Interactive Inverters Used In Alternate Energy Systems**  
W. Shireen, S. Vanapalli, H. Nene; University of Houston, Houston, TX
- 29.7 Modeling And Design Of A Transmission Ultracapacitor (TUCAP) Integrating Modular Voltage Source Converter With Ultracapacitor Energy Storage**  
C. Han<sup>1</sup>, A.Q. Huang<sup>1</sup>, D. Li<sup>1</sup>, H. Mamath<sup>2</sup>, M. Ingram<sup>3</sup>, S. Atcitty<sup>4</sup>; <sup>1</sup>SPEC, ECE Dept, North Carolina State University, Raleigh, NC, <sup>2</sup>EPRI solution, Knoxville, TN, <sup>3</sup>Tennessee Valley Authority, Chattanooga, TN, <sup>4</sup>Sandia National Laboratory, Albuquerque, NM



**Session 30: Digital Control Of DC-DC Converters II**

**Thursday, March 23  
Landmark Ballroom C  
2:00 – 5:30 PM**

**Session Chairs: Joseph Thottuvellil, Tyco Electronics Power Systems and Edward Stanford, Intel**

- 30.1 Closed Loop Implementation And Design Of A Novel Controller For 48 V Resonant Voltage Regulator Modules**  
M.Z Youssef, P.K Jain; Queen's University, Kingston, CANADA
- 30.2 High-Performance Synchronous-Asynchronous Digital Voltage-Mode Control For DC-DC Converters**  
D. Trevisan<sup>1</sup>, P. Mattavelli<sup>1</sup>, S. Saggini<sup>2</sup>, G. Garcea<sup>3</sup>, M. Ghioni<sup>3</sup>; <sup>1</sup>DIEGM, University of Udine, Udine, ITALY, <sup>2</sup>ST Microelectronics, I&PCD, Milano, ITALY, <sup>3</sup>Politecnico di Milano, Milano, ITALY
- 30.3 DPWM Time Resolution Requirements For Digitally Controlled DC-DC Converters**  
J. Chen<sup>1</sup>, M. Ribeiro<sup>1</sup>, R. Payseo<sup>1</sup>, D. Zhou<sup>1</sup>, J.R. Smith<sup>2</sup>, K. Kernahan<sup>1</sup>; <sup>1</sup>FyreStorm Inc., Sunnyvale, CA, <sup>2</sup>Estec Engineerings Inc., Bozeman, MT
- 30.4 An Estimative Current Mode Controller For DC-DC Converters Operating In Continuous Conduction Mode**  
M. Ferdowsi, University of Missouri-Rolla, Rolla, MO
- 30.5 A Counter-Based SR Forward Converter With Standby Power Reduction Considered**  
K.I. Hwu<sup>1</sup>, Y.T. Yau<sup>2</sup>; <sup>1</sup>National Taipei University of Technology, Taipei, TAIWAN, <sup>2</sup>Industrial Technology Research Institute, Hsinchu, TAIWAN
- 30.6 Limit-Cycle Based Auto-Tuning System For Digitally Controlled Low-Power SMPS**  
Z. Zhao, H. Li, A. Feizmohammadi, A. Prodic; University of Toronto, Toronto, CANADA
- 30.7 Energy-Based Approach For Predicting Limit Cycle Oscillations In Voltage-Mode Digitally-Controlled DC-DC Converters**  
W. Stefanutti<sup>1</sup>, P. Mattavelli<sup>2</sup>, S. Saggini<sup>3</sup>, G. Garcea<sup>4</sup>; <sup>1</sup>DIEGM, University of Udine, Udine, ITALY, <sup>2</sup>DTG, University of Padova, Udine, ITALY, <sup>3</sup>ST Microelectronics, I&PCD, Cornaredo (MI), ITALY, <sup>4</sup>DEI, Politecnico of Milano, Milano, ITALY

**Session 31: EMI Modeling And Suppression**

**Thursday, March 23  
Pegasus Ballroom  
2:00 – 5:30 PM**

**Session Chairs: Cahit Gezgin, Tyco Electronics Power Systems and Michael Schutten, GE Global Research Center**

- 31.1 Predicting Parasitics And Inductive Coupling In EMI Filters**  
S. Weber<sup>1</sup>, E. Hoene<sup>1</sup>, S. Guttowski<sup>1</sup>, W. John<sup>1</sup>, H. Reichl<sup>2</sup>; <sup>1</sup>Fraunhofer IZM, Gustav-Meyer-Allee 25, Berlin, GERMANY, <sup>2</sup>Berlin Center of Advanced Packaging, TIB4/2-1, Berlin, GERMANY
- 31.2 Study On The Conducted EMI Due To Radiated Coupling In Smps**  
L. Feng, W. Chen, H. Chen, Z. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, Zhejiang Province, CHINA
- 31.3 Modeling And Measurement Of The Impedance Of Common Mode Noise Source Of Switching Converters**  
H. Chen, L. Feng, W. Chen, Z. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA
- 31.4 Analysis The Inductive Coupling Effects On The Differential Mode EMI In Power Converter**  
W. Chen, L. Feng, H. Chen, Z. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA
- 31.5 Passive And Active Hybrid Integrated EMI Filters**  
J. Biela<sup>1</sup>, A. Wirthmueller<sup>1</sup>, R. Woespe<sup>1</sup>, M.L. Heldwein<sup>1</sup>, E. Waffenschmidt<sup>2</sup>, J.W. Kolar<sup>1</sup>; <sup>1</sup>Power Electronic Systems (PES) Laboratory, ETH Zurich, Zurich, SWITZERLAND, <sup>2</sup>Philips Research Center, Aachen, GERMANY
- 31.6 Efficient HF Modeling And Model Parameterization Of Induction Machines For Time And Frequency Domain Simulations**  
M. Schinkel<sup>1</sup>, S. Weber<sup>1</sup>, S. Guttowski<sup>1</sup>, W. John<sup>1</sup>, H. Reichl<sup>2</sup>; <sup>1</sup>Fraunhofer IZM, Dept. ASE, Berlin, GERMANY, <sup>2</sup>TU Berlin, Berlin, GERMANY

## 31.7 EMI Suppression In Voltage Source Converters By Utilizing DC-Link Decoupling Capacitors

Q. Liu, S. Wang, C. Baisden, F. Wang, D. Boroyevich; Virginia Polytechnic Institute and State University, Blacksburg, VA



## Session 32A: Power Converter And System Modeling

Thursday, March 23  
Reunion Ballroom GH  
2:00 – 3:45 PM

Session Chairs: Tim Groat, Stored Energy Systems and Annabelle Pratt, Intel

### 32A.1 High-Frequency Modeling For The Nonlinearities In Buck Converters

Y. Qiu, M. Xu, J. Sun, F.C. Lee; Virginia Tech, Blacksburg, VA

### 32A.2 Behavioural Modelling Of DC-DC Converters For Large-Signal Simulation Of Distributed Power Systems

J.A. Oliver, R. Prieto, V. Romero, J.A. Cobos; Universidad Politecnica de Madrid, Madrid, SPAIN

### 32A.3 Unified Steady-State Computer Aided Model For Soft-Switching DC-DC Converters

W.M. Al-Hoor, J.A. Abu-Qahouq, I. Batarseh; University of Central Florida (UCF), Orlando, FL

### 32A.4 Study And Engineering Practice Of Modeling IC Controllers For Switch Mode Power Supplies In SIMPLIS Environment

R.X. Wang<sup>1</sup>, J.J. Liu<sup>1</sup>, G. Gan<sup>2</sup>, W. Lee<sup>2</sup>, L. McGarry<sup>2</sup>, R.C. Wong<sup>3</sup>, T.G. Wilson, Jr.<sup>3</sup>; <sup>1</sup>Xi'an Jiaotong University, Xi'an, CHINA, <sup>2</sup>Astec Custom Power (HK) Ltd., Hong Kong, CHINA, <sup>3</sup>Transim Technology Corporation, Portland, OR



## Session 32B: Active Filters

Thursday, March 23  
Reunion Ballroom GH  
4:15 – 5:30 PM

Session Chairs: Subhashish Bhattacharya, Siemens Power Transmission & Distribution Inc. and Annabelle Pratt, Intel

### 32B.1 Sliding DFT Control Algorithm For Three-Phase Active Power Filter

K.P. Sozanski, University of Zielona Gora, Zielona Gora, POLAND

### 32B.2 Implementation Of A Transformer-Less Common Mode Active Filter For Off-Line Converter Systems

M.L. Heldwein<sup>1</sup>, H. Ertl<sup>2</sup>, J. Biela<sup>1</sup>, J.W. Kolar<sup>1</sup>; <sup>1</sup>Swiss Federal Institute of Technology (ETH) Zurich, Zurich, SWITZERLAND, <sup>2</sup>Technical University Vienna, Vienna, AUSTRIA

### 32B.3 Flicker Compensation With Combined Active And Passive Filters

M. Routimo<sup>1</sup>, A. Mäkinen<sup>1</sup>, M. Salo<sup>1</sup>, R. Seesvuori<sup>2</sup>, J. Kiviranta<sup>3</sup>, H. Tuusa<sup>1</sup>; <sup>1</sup>Tampere University of Technology, Tampere, FINLAND, <sup>2</sup>Tampere Power Distribution, Tampere, FINLAND, <sup>3</sup>Nokian Capacitors, Tampere, FINLAND



## Session 33: Fuel Cell Applications

Thursday, March 23  
Reunion Ballroom F  
2:00 – 5:30 PM

Session Chair: Jinrong Qian, Texas Instruments

### 33.1 Load Sharing In A Hybrid Power System With A PV Panel And A PEM Fuel-Cell

D. Yu<sup>1</sup>, S. Yuvarajan<sup>2</sup>; <sup>1</sup>Engine Research - Advanced Power Sources, Caterpillar Inc., Mossville, IL, <sup>2</sup>Electrical and Computer Engineering Dept., North Dakota State University, Fargo, ND

### 33.2 A Hybrid Fuel Cell Power Supply With Rapid Dynamic Response And High Peak-Power Capacity

Z. Jiang<sup>1</sup>, R.A. Dougal<sup>2</sup>; <sup>1</sup>University of New Orleans, New Orleans, LA, <sup>2</sup>University of South Carolina, Columbia, SC

### 33.3 Triple-Half-Bridge Bidirectional Converter Controlled By Phase Shift And PWM

H. Tao, A. Kotsopoulos, J.L. Duarte, M.A.M. Hendrix; Eindhoven University of Technology, Eindhoven, NETHERLANDS

### 33.4 Design Considerations For A Fuel Cell Powered DC-DC Converter For Portable Applications

L. Palma, M. Harfman-Todorovic, P. Enjeti; Department of Electrical & Computer Engineering, Texas A&M University, College Station, TX

- 33.5 Control And Simulation For Hybrid Solid Oxide Fuel Cell Power Systems**  
M. Xu<sup>1</sup>, C. Wang<sup>1</sup>, Y. Qiu<sup>1</sup>, B. Lu<sup>1</sup>, F.C. Lee<sup>1</sup>, G. Kopasakis<sup>2</sup>; <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA, <sup>2</sup>NASA Glenn Research Center, Cleveland, OH
- 33.6 Fault Tree Analysis Of Prismatic Lithium Thionyl Chloride (Li/SOCI<sub>2</sub>) Battery Cells – Phase 1**  
J.S. Bowers, D.B. Hardy; Sandia National Laboratories, Albuquerque, NM
- 33.7 Low-Cost Quasi-Resonant DC-DC Converter For Fuel Cells With Enhanced Efficiency**  
S. Wang, M. Krishnamurthy, R. Jayabalan, B. Fahimi; University of Texas- Arlington, Arlington, TX



## DIALOGUE SESSIONS

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Thursday, March 23, 11:30 AM – 2:00 PM

### Marsalis Hall

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. These papers were selected for a dialogue presentation by the APEC Program Committee because while they are of the same high quality as the orally presented papers, they are generally narrower in scope or more specialized than papers in the oral presentation sessions. 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.

To make it as easy as possible for you to see as many of the dialogue papers as possible, box lunches will be distributed from 11:30 AM to 12:30 PM to those attending the Dialogue Sessions.

### Session D1: AC-DC Power Conversion

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- D1.1 Unity Power Factor Isolated Three-Phase Rectifier With Neutral Point Based On The Scott Transformer**  
A.A. Badin, I. Barbi; Institute of Power Electronics, Florianopolis, BRAZIL, <sup>2</sup>Federal University of Santa Catarina, Florianopolis, BRAZIL
- D1.2 Adaptive Frequency Control Strategy For Piezoelectric Transformer In AC-DC Adapter Applications Using Phase-Detector**  
S.J. Choi, M.H. Ryu, S.M. Lee, B.H. Cho; School of Electrical Engineering and Computer Science, Seoul National University, Seoul, KOREA
- D1.3 A New High Power Factor Bidirectional Hybrid Three-Phase Rectifier**  
C.H. Illa Font, I. Barbi; Power Electronics Institute - Federal University of Santa Catarina, Florianopolis, BRAZIL

**D1.4 Shunt Active Power Filters And PWM Rectifiers In Three-Phase Three Wire Systems: A Survey**

E. Barcenás<sup>1</sup>, V. Cardenas<sup>2</sup>, J. Arau<sup>1</sup>;  
<sup>1</sup>CENIDET, Cuernavaca, MEXICO, <sup>2</sup>Universidad Autonoma de San Luis Potosi, San Luis Potosi, MEXICO

**D1.5 A New Piezoelectric Transformer Driving Topology For Universal Input AC-DC Adapter Using A Constant Frequency PWM Control**

M.H. Ryu, S.J. Choi, S.M. Lee, B.H. Cho; School of Electrical Engineering and Computer Science, Seoul National University, Seoul, KOREA

**D1.6 A Constant Power Limit Feed-Forward Control Circuit For Flyback Converters**

J.H. Choi<sup>1,2</sup>, J. Liu<sup>2</sup>, H. Lee<sup>2</sup>; <sup>1</sup>Fairchild Semiconductor, Dallas, TX, <sup>2</sup>Univ. of Texas at Dallas, Dallas, TX

**D1.7 Evaluation Of Average Models For Nine-Phase Diode Rectifier With Improved AC And DC Dynamics**

H. Zhu, R.P. Burgos, F. Lacaux, A. Uan-Zo-li, D.K. Lindner, F. Wang, D. Boroyevich; Virginia Polytechnic Institute and State University, Blacksburg, VA



## Session D2: DC-DC Converters

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**D2.1 High Efficiency Phase-Shift Controlled Hybrid Full Bridge DC Bus Converter**

X. Wu, J. Zhang, G. Wu, Z. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA

**D2.2 Input Impedance Analysis Of PWM DC-To-DC Converters**

D. Kim, D. Son, B. Choi; School of Electrical Engineering and Computer Science, Kyungpook National University, Taegu, KOREA

**D2.3 A Novel Distributed Control And Its Tolerance Analysis For Microprocessor Power Management**

X. Zhang<sup>1</sup>, A.Q. Huang<sup>2</sup>; <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA, <sup>2</sup>North Carolina State University, Raleigh, NC

**D2.4 Narrow Pulsed Voltage Generator For Liquid Food Sterilization**

T.-F. Wu<sup>1</sup>, S.-Y. Tseng<sup>2</sup>, M.-W. Wu<sup>1</sup>, Y.-M. Chen<sup>1</sup>; <sup>1</sup>Department of Electrical Engineering, National Chung Cheng University, Ming-Hsiung, Chia-Yi, TAIWAN, <sup>2</sup>Department of Electrical Engineering, Chien Kuo Technology University, Changhua, Changhua City, TAIWAN

**D2.5 High Efficiency 3 kW Three-Stage Power Supply**

H. Wetzel<sup>1</sup>, N. Fröhleke<sup>1</sup>, J. Böcker<sup>1</sup>, P. Ide<sup>2</sup>; <sup>1</sup>Institute of Power Electronics and Electrical Drives, Paderborn University, Paderborn, GERMANY, <sup>2</sup>Delta Energy Systems GmbH (Germany), Soest, GERMANY

**D2.6 Design Considerations Of Time Constant Mismatch Problem For Inductor DCR Current Sensing Method**

L. Hua<sup>1</sup>, S. Luo<sup>2</sup>; <sup>1</sup>Semtech Corporation, Camarillo, CA, <sup>2</sup>Dell Computer Corporation, Austin, TX

**D2.7 Development Of A 90 kW Bi-Directional DC-DC Converter For Power Dense Applications**

D.P. Urciuoli, C.W. Tipton; U. S. Army Research Laboratory, Adelphi, MD

**D2.8 Boundary Controller For Dynamic Voltage Restorers To Achieve Fast Dynamic Response**

P.K.W. Chan, K.K.S. Leung, H.S.H. Chung, S.Y.R. Hui; City University of Hong Kong, Hong Kong SAR, HONG KONG

**D2.9 Neptune Power System: Startup Power Supply For 10 kV To 400 V DC-DC Converters**

S. Lu<sup>1</sup>, M.A. El-Sharkawi<sup>1</sup>, H. Kirkham<sup>2</sup>, B.M. Howe<sup>3</sup>; <sup>1</sup>Electrical Engineering Department, University of Washington, Seattle, WA, <sup>2</sup>Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, <sup>3</sup>Applied Physics Laboratory, University of Washington, Seattle, WA

**D2.10 Impact Of Gate Voltage Bias On Reverse Recovery Losses Of Power MOSFETs**

R. Elferich, T. Lopez; Philips Research Laboratories, 52066 Aachen, GERMANY

**D2.11 Applying A Counter-Based PWM Control Scheme To An FPGA-Based SR Forward Converter**

K.I. Hwu<sup>1</sup>, Y.T. Yau<sup>2</sup>; <sup>1</sup>National Taipei University of Technology, Taipei, TAIWAN, <sup>2</sup>Industrial Technology Research Institute, Hsinchu, TAIWAN

- D2.12 An Improved Three-Level LCC Converter With A Novel Control Strategy For High-Frequency High-Power-Density Capacitor-Charging Power Supplies**  
D. Fu, Y. Qiu, B. Lu, F. Wang, F.C. Lee; Virginia Polytechnic Institute and State University, Blacksburg, VA



## Session D3: Digital Control

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- D3.1 Digital Control For Power Supply Of A Transmitter With Variable Reference**  
O. Garcia<sup>1</sup>, A. de Castro<sup>1</sup>, A. Soto<sup>1</sup>, J.A. Oliver<sup>1</sup>, J.A. Cobos<sup>1</sup>, J. Cezon<sup>2</sup>; <sup>1</sup>Universidad Politecnica de Madrid, Madrid, SPAIN, <sup>2</sup>Indra, Aranjuez, SPAIN
- D3.2 Pulse-By-Pulse Predictive Current Limiter**  
B.S. Borowy, L.F. Casey; SatCon Technology Corporation, Boston, MA
- D3.3 Digital Implementation Of Sliding Mode Fuzzy Controllers For Boost Converters**  
L. Guo, J.Y. Hung, R.M. Nelms; Auburn University, Auburn, AL
- D3.4 A Digital Control Algorithm For DC-DC Converters Under Input Voltage Changes**  
G. Feng, W. Eberle, Y.F. Liu; Queen's University, Kingston, CANADA
- D3.5 Design And Implementation Of A Practical Digital PWM Controller**  
K. Leung, D. Alfano; Silicon Laboratories Inc., Austin, TX
- D3.6 FPGA Implementation Of Neural Network-Based Controllers For Power Electronics Applications**  
J.L. Bastos, H.P. Figueroa, A. Monti; University of South Carolina, Columbia, SC



## Session D4: Inverters

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- D4.1 A Single-Stage PV Array-Based High-Frequency Link Inverter Design With Grid Connection**  
F. Tian<sup>1</sup>, H. Al-Atrash<sup>1</sup>, R. Kersten<sup>1</sup>, C. Scholl<sup>2</sup>, K. Siri<sup>1</sup>, I. Batarseh<sup>1</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>Aerospace Corporation, El Segundo, CA

- D4.2 Control And Optimization Of Vcvs Static Var Generators For Voltage Unbalance Mitigation**  
K. Li, J. Liu, G. Zhao, Z. Wang; School of Electrical Engineering, Xi'an Jiaotong University, Shaanxi, CHINA

- D4.3 A Four Quadrants HF AC Chopper With No Deadtime**  
S. Ben-Yaakov<sup>1,2</sup>, Y. Hadad<sup>1</sup>, N. Diamantstein<sup>1</sup>; <sup>1</sup>Ben-Gurion University, Beer-Sheva, ISRAEL, <sup>2</sup>Compulite Systems (2000) Ltd., Hod Hasharon, ISRAEL

- D4.4 Two-Degree-Of-Freedom PID Digital Control Of A Bidirectional Quasi-Single-Stage Push-Pull Forward High Frequency Link Inverter**  
Q. Zhao, X. Guo, W. Wu; College of Electrical Engineering, Yanshan University, Qinhuangdao, Hebei, CHINA

- D4.5 Analysis And Design For Sliding Mode Controlled Buck Inverter Based On Reference Sliding Surface And State Variables Surface**  
H. Ma, T. Zhang; Zhejiang University, Hangzhou, CHINA

- D4.6 Implementation Of A Hybrid AC-AC Direct Power Converter With Unity Voltage Transfer Ratio**  
T. Wijekoon, C. Klumpner, P. Wheeler; School of Electrical and Electronic Engineering, University of Nottingham, Nottingham, UK

- D4.7 A Simple Configuration Reducing Noise Level Three-Phase Sinewave Inverter Employing Delta-Sigma Modulation Scheme**  
A.H. Hirota<sup>1,2</sup>, M.N. Nakaoka<sup>1,2</sup>, S. Nagai<sup>3</sup>; <sup>1</sup>Yamaguchi University, Ube, JAPAN, <sup>2</sup>Kyungham University, Masan, KOREA, <sup>3</sup>Tsuyama National College of Technology, Tsuyama, JAPAN

- D4.8 A Rule-Based Control Strategy For Matrix Converters**  
S.Y. Jia, K.J. Tseng; Nanyang Technological University, Singapore, SINGAPORE



## Session D5: Marketing and Business

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- D5.1 CCFL Inverters: Opportunity Or Threat**  
B. Anderson, L. Brush; Darnell Group, Corona, CA



## Session D6: Systems And Applications

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- D6.1 Induction Heating Inverter With Simultaneous Dual-Frequency Output**  
V. Esteve<sup>1</sup>, J. Jordan<sup>1</sup>, E.J. Dede<sup>1,2</sup>, E. Sanchis-Kilders<sup>1</sup>, E. Maset<sup>1</sup>; <sup>1</sup>University of Valencia, Burjassot, SPAIN, <sup>2</sup>GH Electrotermia S.A., S. A. Benageber, SPAIN
- D6.2 High-Efficiency Weinberg Converter For Battery Discharging In Aerospace Applications**  
E. Maset, J.B. Ejea, A. Ferreres, E. Sanchis-Kilders, J. Jordán, V. Esteve; University of Valencia, Dpto. Ingeniería Electrónica, Burjassot, SPAIN
- D6.3 Stability Of Cold Cathode Fluorescent Lamps Driven By Piezoelectric Transformers**  
S. Ben-Yaakov, M.M. Peretz, S. Lineykin; Ben-Gurion University, Beer-Sheva, ISRAEL
- D6.4 Soft-Switching Push-Pull Converter Associated With A Full-Bridge Inverter For Caprahircas Stunning Applications**  
T.-F. Wu<sup>1</sup>, S.-Y. Tseng<sup>2</sup>, S.-S. Chen<sup>1</sup>;  
<sup>1</sup>Department of Electrical Engineering, National Chung Cheng University, Ming-Hsiung, Chia-Yi, TAIWAN, <sup>2</sup>Department of Electrical Engineering, Chien Kuo Technology University, Changhua, Chang-hue, TAIWAN
- D6.5 Buck And Boost Derived Converter For Livestock/Poultry Stunning Applications**  
T.-F. Wu<sup>1</sup>, S.-Y. Tseng<sup>2</sup>, J.-S. Hu<sup>1</sup>, Y.-M. Chen<sup>1</sup>;  
<sup>1</sup>Department of Electrical Engineering, National Chung Cheng University, Ming-Hsiung, Chia-Yi, TAIWAN, <sup>2</sup>Department of Electrical Engineering, Chien Kuo Technology University, Changhua, Changhua City, TAIWAN
- D6.6 High Step-Up Converter With Partial Energy Processing For Livestock Stunning Applications**  
S.-Y. Tseng, S.H. Tseng, J.G. Huang;  
Department of Electrical Engineering, Lab. of Power Electronic System, Chienkuo Technology University, Changhua, TAIWAN
- D6.7 Constant Resistance Control Of Solar Array Regulator Using Average Current Mode Control**  
J.H. Lee, H.S. Bae, S.H. Park, B.H. Cho; School of Electrical Engineering & Computer Science, Seoul National University, Seoul, KOREA

- D6.8 A Multi-Cell Cascaded Power Amplifier**  
G. Gong<sup>1</sup>, H. Ertl<sup>2</sup>, J.W. Kolar<sup>1</sup>; <sup>1</sup>Swiss Federal Institute of Technology (ETH) Zurich, Zurich, SWITZERLAND, <sup>2</sup>Technical University Vienna, Vienna, AUSTRIA



## Session D7: Modeling and Analysis

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- D7.1 Control Design Of A Modular Current Source Power Conditioning System For High Temperature Smes**  
J. Li<sup>1</sup>, Y.P. Shi<sup>1</sup>, D.H. Xu<sup>1</sup>, Y.J. Tang<sup>2</sup>, X.T. Peng<sup>2</sup>, S.J. Cheng<sup>2</sup>; <sup>1</sup>Zhejiang University, Hangzhou 310027, CHINA, <sup>2</sup>Huazhong University of Science and Technology, Wuhan 430074, CHINA
- D7.2 Piezoelectric Transformers Model Parameters Extraction Based On Time Domain Measurements**  
S. Ozeri, D. Shmilovitz; Tel Aviv University, Tel Aviv, ISRAEL
- D7.3 A Comparative Study On Voltage-Source Control And Current-Source Control Of Series Active Power Filter**  
X.Y. Wang, J.J. Liu, C. Yuan, Z.A. Wang; Xi'an Jiaotong University, Xi'an, CHINA
- D7.4 Study On Inverter-Fed Three-Pole Active Magnetic Bearing**  
H. Yang, R.X. Zhao, Q.B. Tang; College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA
- D7.5 Detection Of Shorted-Turns In The Rotor Winding Of Cylindrical Synchronous Generators Using Discrete Wavelet Transform**  
Y.J. Kim<sup>1</sup>, J.M. Kim<sup>1</sup>, B.Y. Yoon<sup>1</sup>, S.H. Lee<sup>1</sup>, T.U. Jung<sup>2</sup>; <sup>1</sup>Pusan National University, Busan, KOREA, <sup>2</sup>LG Electronics Inc, Busan, KOREA
- D7.6 Failure Mode For AC Drives On High Resistance Grounded Systems**  
R.M. Tallam, D.W. Schlegel, F.L. Hoadley; Rockwell Automation, Mequon, WI



## Session D8: Modeling and Control

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### D8.1 Power Line Communication In DC-DC Converters Using Switching Frequency Modulation

S. Saggini<sup>1</sup>, W. Stefanutti<sup>2</sup>, P. Mattavelli<sup>3</sup>, G. Garcea<sup>4</sup>, M. Ghioni<sup>4</sup>; <sup>1</sup>ST Microelectronics, I&PCD, Cornaredo, ITALY, <sup>2</sup>DIEGM, University of Udine, Udine, ITALY, <sup>3</sup>DTG, University of Padova, Vicenza, ITALY, <sup>4</sup>DEI, Politecnico of Milano, Milano, ITALY

### D8.2 Adaptive Resonant Controller For Grid-Connected Converters In Distributed Power Generation Systems

A.V. Timbus, M. Ciobotaru, R. Teodorescu, F. Blaabjerg; Aalborg University, Institute of Energy Technology, Aalborg, DENMARK

### D8.3 Withdrawn

### D8.4 Study On The EMI Filters To EFT/B Tests In Power Converters

L. Feng, Y. Xie, W. Chen, Z. Qian; College of Electrical Engineering, Zhejiang University, Hangzhou, Zhejiang Province, CHINA

### D8.5 Frequency Domain Modeling Of Multi-Conductor Planar Integrated Passive Structures

G.S. McMullin, I.W. Hofsajer; University of Johannesburg, Auckland park, SOUTH AFRICA

### D8.6 Common Mode Emc Input Filter Design For A Three-Phase Buck-Type PWM Rectifier System

T. Nussbaumer, M.L. Heldwein, J.W. Kolar; Swiss Federal Institute of Technology (ETH) Zurich, Zurich, SWITZERLAND



## Session D9: Motor Drives & Controls

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### D9.1 Realize A Self-Recovering Function During Phase-Sequence Fault Of A Digital Servo System

Q. Hu, B. Qu, Z. Lu, F. Zhang; Electrical Engineering Department of Zhejiang University, Hangzhou, CHINA

### D9.2 Implementation Of Closed-Loop Vector Control System Of Inductive Motor Without Voltage Feedforward Decoupler

Y. Zhang<sup>1</sup>, J. Chen<sup>1</sup>, J. Bao<sup>2</sup>; <sup>1</sup>College of Information & Electronics, Zhejiang Sci-tech University, Hangzhou, CHINA, <sup>2</sup>College of Electrical Engineering, Zhejiang University, Hangzhou, CHINA

### D9.3 High Performance Adaptive Control For BLDC Motor With Real-Time Estimation Of Uncertainties

Y. Jin<sup>1</sup>, Z. Tang<sup>2</sup>, Y. Wen<sup>3</sup>, H. Zou<sup>1</sup>; <sup>1</sup>University of Texas at San Antonio, San Antonio, TX, <sup>2</sup>Ansoft Corporation, Pittsburgh, PA, <sup>3</sup>Silicon Labs, Austin, TX

### D9.4 Design And Control Characterization Of Switched Reluctance Generator For Maximum Output Power

P. Asadi<sup>1</sup>, M. Ehsani<sup>1</sup>, B. Fahimi<sup>2</sup>; <sup>1</sup>Texas A&M University, College Station, TX, <sup>2</sup>University of Texas at Arlington, Arlington, TX

### D9.5 Sensorless Digital Motor Controller For High Reliability Applications

J. Goetz, W. Hu, J. Milliken; International Rectifier, El Segundo, CA



## Session D10: Multi-Level Converter Topics

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### D10.1 A Comparison Of The Carrier-Based PWM Techniques For Voltage Balance Of Flying Capacitor In The Flying Capacitor Multilevel Inverter

W.K. Lee, S.Y. Kim, J.S. Yoon, D.H. Baek; Power System Laboratory, Korea Electric Power Research Institute, Deajeon, KOREA

### D10.2 Capacitor Voltage Balancing Control For A Modular Matrix Converter

S. Angkititrakul, R.W. Erickson; Colorado Power Electronics Center; University of Colorado, Boulder, CO

### D10.3 Progressive Natural Balance Of Neutral-Point Voltage Of Three-Level NPC Inverter With A Modified SVM Scheme

C. Liu<sup>1</sup>, B. Wu<sup>1</sup>, D. Xu<sup>1</sup>, N. Zargari<sup>2</sup>, S. Rizzo<sup>2</sup>; <sup>1</sup>Department of Electrical & Computer Engineering, Ryerson University, Toronto, CANADA, <sup>2</sup>Medium Voltage R&D, Rockwell Automation Canada, Cambridge, CANADA



## Session D11: No Session D11

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No Papers In Session D11.



## Session D12: Semiconductor Topics

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### D12.1 SiGe Semiconductor Devices For Cryogenic Power Electronics – IV

R.R. Ward<sup>1</sup>, W.J. Dawson<sup>1</sup>, L. Zhu<sup>1</sup>, R.K. Kirschman<sup>1</sup>, G. Niu<sup>2</sup>, R.M. Nelms<sup>2</sup>, O. Mueller<sup>3</sup>, M.J. Hennessy<sup>4</sup>, E.K. Mueller<sup>4</sup>, R.L. Patterson<sup>5</sup>, J.E. Dickman<sup>5</sup>, A. Hammoud<sup>6</sup>; <sup>1</sup>GPD Optoelectronics Corp., Salem, NH, <sup>2</sup>Auburn University Dept. of Electrical and Computer Engineering, Auburn, AL, <sup>3</sup>LTE-- Low Temperature Electronics, Ballston Lake, NY, <sup>4</sup>MTECH Laboratories LLC, Ballston Lake, NY, <sup>5</sup>NASA Glenn Research Center, Cleveland, OH, <sup>6</sup>QSS Group Inc., Cleveland, Ohio

### D12.2 Behavior Of High Voltage SiC VJFETs Under Avalanche Conditions

P. Friedrichs<sup>1</sup>, T. Reimann<sup>2</sup>; <sup>1</sup>SiCED Electronics Development GmbH & Co. KG, Erlangen, GERMANY, <sup>2</sup>ISLE Steuerungstechnik und Leistungselektronik GmbH, Ilmenau, GERMANY

### D12.3 Speed Shifting Gate Drive For Intelligent Power Modules

E.R. Motto, J.F. Donlon; Powerex Incorporated, Youngwood, PA



## Session D13: Thermal Design and Packaging

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### D13.1 Practical Design Considerations For IPEM-Based PFC Converter Employing Coolmos And SiC Diode

Q.L. Chen, X. Yang, Z.A. Wang, J.J. Liu; School of Electrical Engineering, Xi'an Jiaotong University, Xi'an, CHINA

### D13.2 Exact Thermal Design Method For High Output Power Density Converter Under Real Circuit Operation Condition

Y. Hayashi<sup>1</sup>, K. Takao<sup>1</sup>, S. Iyasu<sup>2</sup>, T. Shimizu<sup>2</sup>, H. Ohashi<sup>1</sup>; <sup>1</sup>National Institute of Advanced Industrial Science and Technology, Tsukuba, JAPAN, <sup>2</sup>Tokyo Metropolitan University, Hachioji, JAPAN



## Session D14: Uninterruptible Power Systems Topics

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### D14.1 The Zero-Sequence Circulating Currents Between Parallel Three-Phase Inverters With Three-Pole Transformers And Reactors

Y. Zhang, Y. Kang, J. Chen; Electrical and Electronic College, Huazhong University of Science and Technology, Wuhan, CHINA

### D14.2 Droop Control Method For The Parallel Operation Of Online Uninterruptible Power Systems Using Resistive Output Impedance

J.M. Guerrero<sup>1,2</sup>, N. Berbel<sup>2</sup>, J. Matas<sup>2</sup>, J. Sosa<sup>2</sup>, L. Garcia de Vicuña<sup>2</sup>, M. Castilla<sup>2</sup>; <sup>1</sup>Consorci Escola Industrial de Barcelona, Barcelona, SPAIN, <sup>2</sup>Universitat Politècnica de Catalunya, Vilanova i la Geltru, SPAIN

### D14.3 A Voltage-Error-Sharing Scheme For Parallel-Inverter Systems To Improve Weighting Current Distribution And Dynamic Response

T.-F. Wu<sup>1</sup>, H.-M. Hsieh<sup>1</sup>, H.-S. Nien<sup>1</sup>, Y.-E. Wu<sup>3</sup>, Y.-K. Chen<sup>2</sup>; <sup>1</sup>Department of Electrical Engineering, National Chung Cheng University, Chia-Yi, TAIWAN, <sup>2</sup>Department of Aeronautical Engineering, National Formosa University, Yun-Lin, TAIWAN, <sup>3</sup>Department of Electrical Engineering, Wu-Feng Institute of Technology, Chia-Yi, TAIWAN



## Session D15: Utility Interface and Power Quality Topics

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### D15.1 Development Of A Parallel Hybrid Power Filter With Respective Harmonic Compensation Method

X. Zhai, F. Zhuo, R. Duan, W.J. Lei, P.B. Zhang, Z.A. Wang; Xi'an Jiaotong University, Xi'an, CHINA

### D15.2 Predicting Load Harmonics In Three Phase Systems Using Neural Networks

J. Mazumdar<sup>1</sup>, R.G. Harley<sup>1</sup>, F. Lambert<sup>1</sup>, G.K. Venayagamoorthy<sup>2</sup>; <sup>1</sup>Georgia Institute of Technology, Atlanta, GA, <sup>2</sup>University of Missouri-Rolla, Rolla, MO

### D15.3 Implementation Of Control And Detection Algorithms For Utility Interfaced Power Conversion Systems

T. Thacker, F. Wang, R. Burgos, D. Boroyevich; Virginia Tech - Center for Power Electronics Systems, Blacksburg, VA

**D15.4 Transient Event Detection For Nonintrusive Load Monitoring And Demand-Side Management Using Voltage Distortion**

R. Cox<sup>1</sup>, S.B. Leeb<sup>1</sup>, S.R. Shaw<sup>2</sup>, L.K. Norford<sup>1</sup>;

<sup>1</sup>Massachusetts Institute of Technology, Cambridge, MA, <sup>2</sup>Montana State University, Bozeman, MT

**D15.5 A Comprehensive Power Quality Controller For Substations In Power System**

X. Zhang, Y. Wang, W. Lei, J. Yang, X. Tang, W. Si, J. Hou; Electrical Engineering School of Xi'an Jiaotong University, Xi'an, Shaanxi, CHINA

**D15.6 Impacts Of High Power Induction Heater On Power System**

S.W. Chan, C.S. Lam, K.W. To, S.K. Ho; CLP Power Hong Kong, Hong Kong, CHINA



## APEC 2006 CONFERENCE COMMITTEE AND MANAGEMENT

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Time	Sunday March 19	Monday March 20	Tuesday March 21	Wednesday March 22	Thursday March 23	Time		
8:30 AM						8:30 AM		
9:00 AM						9:00 AM		
9:30 AM						9:30 AM		
10:00 AM	<b>Seminars 1-6</b>	<b>Seminars 13-18</b>	<b>Sessions P2-P7 SP1</b>	<b>Sessions P8-P14 SP2</b>	<b>Sessions P21-P26 SP4</b>	10:00 AM		
10:30 AM								
11:00 AM								
11:30 AM								
Noon								
12:30 PM				<b>Exhibit Hall Open</b>	<b>Dialogue Sessions D1-D13</b>	Noon		
1:00 PM								
1:30 PM			<b>Exhibit Hall Open</b>			1:30 PM		
2:00 PM		<b>Plenary Session</b>				2:00 PM		
2:30 PM					<b>Sessions P15-P20 SP3</b>	<b>Sessions P27-P33</b>	2:30 PM	
3:00 PM								3:00 PM
3:30 PM	<b>Seminars 7-12</b>							
4:00 PM						4:00 PM		
4:30 PM					4:30 PM			
5:00 PM					5:00 PM			
5:30 PM				<b>Rap Sessions</b>		5:30 PM		
6:00 PM		<b>Exhibitor's Reception</b>	<b>APEC 2006 Social Event</b>			6:00 PM		
6:30 PM						6:30 PM		
7:00 PM					7:00 PM			
7:30 PM					7:30 PM			
8:00 PM				<b>Exhibitor Hospitality Time</b>		8:00 PM		
8:30 PM		<b>Micro- Mouse Contest</b>			8:30 PM			
9:00 PM					9:00 PM			
9:30 PM					9:30 PM			

<b>Saturday, March 18</b>			
Registration Desk Open		3:00 PM – 6:00 PM	Marsalis Hall Foyer
<b>Sunday, March 19</b>			
Registration Desk Open		8:00 AM – 5:00 PM	Marsalis Hall Foyer
Seminar 1	Digital Power System Management	9:30 AM – 1:00 PM	Reunion Ballroom GH
Seminar 2	EMI Causes, Measurement, And Reduction Techniques For Switch-Mode Power Converters	9:30 AM – 1:00 PM	Landmark Ballroom D
Seminar 3	Introduction To Power Electronics	9:30 AM – 1:00 PM	Landmark Ballroom A
Seminar 4	High Efficiency Power Supply Design	9:30 AM – 1:00 PM	Landmark Ballroom B
Seminar 5	Power Electronics Of Piezoelectric Elements	9:30 AM – 1:00 PM	Reunion Ballroom F
Seminar 6	The Art Of Implementing Digital Motor Control	9:30 AM – 1:00 PM	Pegasus Ballroom
Seminar 7	Digital Control Of Switched Mode Power Supplies	2:30 PM – 6:00 PM	Landmark Ballroom B
Seminar 8	Power Electronics System Thermal Design	2:30 PM – 6:00 PM	Landmark Ballroom D
Seminar 9	Best Techniques For Procurement and Qualification Of Power Products	2:30 PM – 6:00 PM	Landmark Ballroom A
Seminar 10	Battery Selection, Charging, And Extending Battery Run-Time For Portable Power Applications	2:30 PM – 6:00 PM	Reunion Ballroom GH
Seminar 11	Electrical Ballasts For AC, DC, And Pulsed Loads	2:30 PM – 6:00 PM	Reunion Ballroom F
Seminar 12	Control Of The BLDC Machine With Improved Performance	2:30 PM – 6:00 PM	Pegasus Ballroom
<b>Monday, March 20</b>			
Registration Desk Open		8:00 AM – 5:00 PM	Marsalis Hall Foyer
Seminar 13	Keeping An Eye On Digital Control	8:30 AM – Noon	Landmark Ballroom B
Seminar 14	Advanced Power Electronics Packaging Emphasizing High-Current High-Temperature Applications	8:30 AM – Noon	Pegasus Ballroom
Seminar 15	Using The Theories Of Innovation To Predict Technology Change In Power Electronics – An Introduction To Business	8:30 AM – Noon	Reunion Ballroom F
Seminar 16	On The Role of Modern Power Semiconductor Devices As Pathfinder For Highest Efficiency Power Supply Solutions	8:30 AM – Noon	Landmark Ballroom D
Seminar 17	Voltage Regulators For Microprocessors	8:30 AM – Noon	Landmark Ballroom A
Seminar 18	Expert Shortcuts To More Effective Transformer Design	8:30 AM – Noon	Reunion Ballroom GH
Session 1	Plenary Session	1:30 PM – 5:30 PM	Landmark Ballroom AB
Spouse & Guest Welcoming Breakfast		8:00 AM – 9:00 AM	Parino's Oven (Atrium Level)
Spouse & Guest Tour 1 – Historic Homes Of Dallas		9:00 AM – 4:00 PM	Meet At Parino's Oven
Welcoming Reception – (Exhibit Hall Opens When The Plenary Session Concludes)		5:30 PM – 8:00 PM	Marsalis Hall
Micro Mouse Contest		8:00 PM – 10:00 PM	Pegasus Ballroom

### Tuesday, March 21

Registration Desk Open	8:00 AM – 5:00 PM	Marsalis Hall Foyer
Speaker's Briefing And Breakfast (Tuesday Presenting Speakers Only)	7:00 AM – 8:00 AM	Lookout Room, Reunion Tower
Session 2 Voltage Regulator Modules I	8:30 AM – Noon	Landmark Ballroom B
Session 3 DC-DC Converters: High Voltage And High Power	8:30 AM – Noon	Landmark Ballroom C
Session 4 Inverter Applications I	8:30 AM – 10:15 AM	Reunion Ballroom F
Session 5 Semiconductors-Discrete And Integrated	8:30 AM – Noon	Reunion Ballroom H
Session 6 AC Motor Drives	8:30 AM – Noon	Pegasus Ballroom
Session 7 Single Phase Power Factor Correction	8:30 AM – Noon	Landmark Ballroom D
Special Presentation Session 1: Market Trends & Business	8:30 AM – Noon	Landmark Ballroom A
Spouse & Guest Tour 2 – Crow Collection of Asian Art & The Nasher Sculpture Center	9:00 AM – 4:00 PM	Meet At Parino's Oven
Exhibit Hall Open	Noon – 5:00 PM	Marsalis Hall
Lunch In The Exhibit Hall (Ticket Required)	Noon – 1:30 PM	Exhibit Hall
Exhibitor Seminars Session 1—See Exposition Directory For Seminar Descriptions	1:30 PM – 2:00 PM	See Exposition Directory
Exhibitor Seminars Session 2—See Exposition Directory For Seminar Descriptions	2:15 PM – 2:45 PM	See Exposition Directory
Tuesday Afternoon Coffee Break And Ice Cream Social	3:00 PM – 3:30 PM	Exhibit Hall
Exhibitor Seminars Session 3—See Exposition Directory For Seminar Descriptions	3:15 PM – 3:45 PM	See Exposition Directory
Exhibitor Seminars Session 4—See Exposition Directory For Seminar Descriptions	4:00 PM – 4:30 PM	See Exposition Directory
Deadline To Return Exposition Survey To Be Included In Giveaway Drawing	4:00 PM	Exhibit Hall
Exhibit Hall Giveaway Drawing	4:45 PM	Exhibit Hall
Rap Session I Rap Session 1: Is There Money In Digital Power?	5:00 PM – 6:30 PM	Landmark Ballroom A
Rap Session II Rap Session 2: China - Promise Or Peril?	5:00 PM – 6:30 PM	Landmark Ballroom B
Rap Session III Rap Session 3: Got Power? Is The Power Electronics Industry Ripe For Self Promotion?	5:00 PM – 6:30 PM	Landmark Ballroom C
Exhibitor Hospitality Time – See Individual Exhibitors For Their Offering	6:30 PM – 10:00 PM	

### Wednesday, March 22

Registration Desk Open	8:00 AM – 3:00 PM	Marsalis Hall Foyer
Speaker's Briefing And Breakfast (Wednesday Presenting Speakers Only)	7:00 AM – 8:00 AM	Lookout Room, Reunion Tower
Session 8 Motor Drive Applications	8:30 AM – 10:15 AM	Landmark Ballroom B
Session 9 Soft-Switched DC-DC Converters	8:30 AM – 10:15 AM	Landmark Ballroom C
Session 10 Uninterruptible Power Systems	8:30 AM – 10:15 AM	Landmark Ballroom D
Session 11 Lighting Applications	8:30 AM – 10:15 AM	Pegasus Ballroom B
Session 12 Single-Stage Power Factor Correction	8:30 AM – 10:15 AM	Reunion Ballroom GH
Session 13 Multilevel Converters	8:30 AM – 10:15 AM	Pegasus Ballroom A
Session 14 Silicon Carbide Device Applications	8:30 AM – 10:15 AM	Reunion Ballroom F
Special Presentation Session 2 – System Design	8:30 AM – 10:15 AM	Landmark Ballroom A

### Wednesday, March 22 (Continued)

Exhibit Hall Open	10:15 AM – 2:00 PM	Marsalis Hall
Wednesday Morning Coffee Break	10:15 AM – 10:45 AM	Exhibit Hall
Exhibitor Seminars Session 5—See Exposition Directory For Seminar Descriptions	10:30 AM – 11:00 AM	See Exposition Directory
Exhibitor Seminars Session 6—See Exposition Directory For Seminar Descriptions	11:15 AM – 11:45 AM	See Exposition Directory
Lunch In The Exhibit Hall (Ticket Required)	Noon – 1:30 PM	Exhibit Hall
Session 15 Voltage Regulator Modules II	2:00 PM – 5:30 PM	Landmark Ballroom C
Session 16 Soft-Switched Isolated DC-DC Converters	2:00 PM – 5:30 PM	Landmark Ballroom D
Session 17 Magnetics And Current Sensing	2:00 PM – 5:30 PM	Pegasus Ballroom
Session 18A Battery Management	2:00 PM – 3:45 PM	Reunion Ballroom F
Session 18B Automotive And Transportation Applications	4:15 PM – 5:30 PM	Reunion Ballroom F
Session 19 Permanent Magnet Motor Drives	2:00 PM – 5:30 PM	Reunion Ballroom GH
Session 20 Digital Control Of DC-DC Converters I	2:00 PM – 5:30 PM	Landmark Ballroom B
Special Presentation Session 3 – Current Topics In Power Electronics Research	2:00 PM – 5:30 PM	Landmark Ballroom A
Conference Social Event (See Conference Program For Details, Ticket Required)	6:45 PM – 10:00 PM	Grand Hall, Union Station

### Thursday, March 23

Registration Desk Open	8:00 AM – Noon	Marsalis Hall Foyer
Speaker's Briefing And Breakfast (All Thursday Presenters, Including Presentation, Special Presentation & Dialogue Sessions)	7:00 AM – 8:00 AM	Lookout Room, Reunion Tower
Session 21 DC-DC Output Rectifier Circuits	8:30 AM – 11:30 AM	Landmark Ballroom B
Session 22 Inverter Applications II	8:30 AM – 11:30 AM	Pegasus Ballroom
Session 23 Systems And Applications	8:30 AM – 11:30 AM	Landmark Ballroom D
Session 24 Packaging, Integration And Thermal Management	8:30 AM – 11:30 AM	Reunion Ballroom F
Session 25 Digital Control Techniques And Applications	8:30 AM – 11:30 AM	Landmark Ballroom C
Session 26 Multiphase Power Factor Correction	8:30 AM – 11:30 AM	Reunion Ballroom GH
Special Presentation Session 4 – Power Electronics For A Greener World	8:30 AM – 11:30 AM	Landmark Ballroom A
Dialogue Sessions See The APEC Advance Program For The Details	11:30 AM – 2:00 PM	Marsalis Hall
Dialogue Session Lunch Served	11:30 AM – 12:30 PM	Marsalis Hall
Session 27 DC-DC Conversion Topics	2:00 PM – 5:30 PM	Landmark Ballroom B
Session 28 Electronic Ballasts For Lighting	2:00 PM – 5:30 PM	Landmark Ballroom D
Session 29 Utility Interface And Power Quality	2:00 PM – 5:30 PM	Landmark Ballroom A
Session 30 Digital Control Of DC-DC Converters II	2:00 PM – 5:30 PM	Landmark Ballroom C
Session 31 EMI Modeling And Suppression	2:00 PM – 5:30 PM	Pegasus Ballroom
Session 32A Power Converter And System Modeling	2:00 PM – 3:45 PM	Reunion Ballroom GH
Session 32B Active Filters	4:15 PM – 5:30 PM	Reunion Ballroom GH
Session 33 Fuel Cell Applications	2:00 PM – 5:30 PM	Reunion Ballroom F

Last Revised: 14 January 2006

## EARLY REGISTRATION FORM

Mail or fax your registration to:

APEC 2006/Badgeguys  
1959 Jester Circle  
Lawrenceville, GA 30043 USA

Phone: +1-202-973-8664  
Fax: +1-678-407-3237  
Online: [www.apec-conf.org](http://www.apec-conf.org)

**Registration Must Be Received By Friday, February 17, 2006 To Qualify For Early Registration Rates!**

Family Name \_\_\_\_\_ Given Name \_\_\_\_\_

Affiliation \_\_\_\_\_

Department/Mail Stop \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_

Country \_\_\_\_\_ Email \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

IEEE Membership # \_\_\_\_\_ PSMA Member Company Name \_\_\_\_\_

If Author, Your Paper Numbers: \_\_\_\_\_ Spouse Or Guest Name For Badge: \_\_\_\_\_

Registering for APEC gives permission for your name, mailing address and e-mail address to be provided to the exhibitors and for the exhibitors to contact you during or after the conference. APEC will not otherwise distribute names or contact information received through the registration process.

### FULL REGISTRATION (INCLUDES TECHNICAL SESSIONS, CD-ROM PROCEEDINGS, SEMINARS, WORKBOOK AND SOCIAL EVENT)

Member – Received By February 17, 2006	\$750
Non-Member – Received By February 17, 2006	\$925
Students And IEEE Life Members	\$325

### TECHNICAL SESSIONS (INCLUDES CD-ROM PROCEEDINGS AND SOCIAL EVENT)

Member – Received By February 17, 2006	\$450
Non-Member – Received By February 17, 2006	\$550
Students And IEEE Life Members	\$225

### PROFESSIONAL EDUCATION SEMINARS (INCLUDES SEMINAR WORKBOOK)

Member – Received By February 17, 2006	\$375
Non-Member – Received By February 17, 2006	\$450
Students And IEEE Life Members	\$175

### EXTRAS AND TOURS

Tuesday Lunch In The Exhibit Hall	\$10
Wednesday Lunch In The Exhibit Hall	\$10
Additional Social Event Ticket	\$60
Monday Spouse & Guest Tour: Historic Homes of Dallas	\$48
Tuesday Spouse & Guest Tour: Crow Collection of Asian Art & Nasher Sculpture Center	\$40

### ADDITIONAL SEMINAR WORKBOOKS AND CONFERENCE PROCEEDINGS (WITH REGISTRATION)

Seminar Workbooks	\$100
Conference Proceedings (CD-ROM)	\$100
Conference Proceedings (Printed)	\$100

**TOTAL DUE:** \_\_\_\_\_

### PAYMENT

Registrations on this form received after Friday, February 17, 2006 will be charged the Regular Registration rates.

Payment can be by check or credit card. Checks should be made payable to **APEC 2006** and must be in U.S. dollars drawn on an U.S. bank.

Credit Card  American Express  Visa  Master Card Expiration Date \_\_\_\_\_

Credit Card Number \_\_\_\_\_

Signature \_\_\_\_\_

### CANCELLATION AND REFUND POLICY

Registration cancellations and requests for refunds must be received in writing at the APEC 2006 offices by Friday, February 17, 2006. All refund requests will be charged a \$50 handling fee and will be processed after the conference.

## REGISTRATION FORM

Mail or fax your registration to:

APEC 2006/Badgeguys  
1959 Jester Circle  
Lawrenceville, GA 30043 USA

Phone: +1-202-973-8664  
Fax: +1-678-407-3237  
Online: [www.apec-conf.org](http://www.apec-conf.org)

**Use This Form To Register After Friday, February 17, 2006**  
**Pre-Conference Registrations Must Be Received By Friday, March 10, 2006**  
**Save Time! [Register On-Line!](#)**

Family Name \_\_\_\_\_ Given Name \_\_\_\_\_

Affiliation \_\_\_\_\_

Department/Mail Stop \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_

Country \_\_\_\_\_ Email \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

IEEE Membership # \_\_\_\_\_ PSMA Member Company Name \_\_\_\_\_

If Author, Your Paper Numbers: \_\_\_\_\_ Spouse Or Guest Name For Badge: \_\_\_\_\_

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**FULL REGISTRATION (INCLUDES TECHNICAL SESSIONS, CD-ROM PROCEEDINGS, SEMINARS, WORKBOOK AND SOCIAL EVENT)**

Member – After February 17, 2006	\$925
Non-Member – After February 17, 2006	\$1100
Students And IEEE Life Members	\$325

**TECHNICAL SESSIONS (INCLUDES CD-ROM PROCEEDINGS AND SOCIAL EVENT)**

Member – After February 17, 2006	\$550
Non-Member – After February 17, 2006	\$650
Students And IEEE Life Members	\$225

**PROFESSIONAL EDUCATION SEMINARS (INCLUDES SEMINAR WORKBOOK)**

Member – After February 17, 2006	\$450
Non-Member – After February 17, 2006	\$525
Students And IEEE Life Members	\$175

**EXTRAS AND TOURS**

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Wednesday Lunch In The Exhibit Hall	\$10
Additional Social Event Ticket	\$60
Monday Spouse & Guest Tour: Historic Homes of Dallas	\$48
Tuesday Spouse & Guest Tour: Crow Collection of Asian Art & Nasher Sculpture Center	\$40

**TOTAL DUE:** \_\_\_\_\_

**PAYMENT**

Payment can be by check or credit card. Checks should be made payable to **APEC 2006** and must be in U.S. dollars drawn on an U.S. bank.

Credit Card  American Express  Visa  Master Card Expiration Date \_\_\_\_\_

Credit Card Number \_\_\_\_\_

Signature \_\_\_\_\_

**CANCELLATION AND REFUND POLICY**

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# APEC 2006

March 19–23, 2006  
Hyatt Regency Dallas  
Dallas, Texas

## IEEE APEC HOTEL RESERVATION FORM

Mail or fax with one night's reservation payment to:

The Hyatt Regency Dallas – Reservations  
300 Reunion Boulevard  
Dallas, Texas 75207-4498, USA

Phone: 214-651-1234  
Phone: 888-421-1442  
Fax: 214-712-7217

**All Hotel Reservations Must Be Received By February 17, 2006!**  
**Save Time! [Register Online!](#)**

Name \_\_\_\_\_  
Family Name Given Name

Affiliation \_\_\_\_\_

Department/Mail Stop \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

Email Address (To Send Confirmation) \_\_\_\_\_

### RESERVATION PARTICULARS

ARRIVAL DATE \_\_\_\_\_ DEPARTURE DATE \_\_\_\_\_

ROOM TYPE  Single Room (\$179.00 + taxes)  Double Room (\$199.00 + taxes)

HYATT REGENCY PROGRAM MEMBERSHIP NUMBER: \_\_\_\_\_

SMOKING PREFERENCE  Non-Smoking Room  Smoking Room

### ROOM SHARING

Name of guest(s) in room \_\_\_\_\_

### DEPOSIT

A deposit of one night's room charge is required to hold your reservation. Payment can be by check or credit card. Checks should be made payable to **Hyatt Regency Hotel**. All major credit cards are accepted.

Credit Card Type \_\_\_\_\_ Expiration Date \_\_\_\_\_

Credit Card Number \_\_\_\_\_

Signature \_\_\_\_\_

### CANCELLATION POLICY

Deposits are refundable if the reservation is cancelled at least 72 hours in advance of the arrival date. Call the hotel at 214-651-1234 to cancel. Be sure to record your cancellation number.