

**Conference Program**  
**20th Annual Applied Power Electronics**  
**Conference And Exposition**

**March 6-10, 2005**

**Hilton Hotel**

**Austin, Texas**

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

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

**APEC<sup>®</sup>**

**2005**

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

**Applied Power Electronics Conference  
And Exposition  
March 6–10, 2005  
The Hilton Hotel, Austin Texas**

**Co-Sponsored By  
IEEE Industry Applications Society  
IEEE Power Electronics Society  
Power Sources Manufacturers Association**

APEC continues its growth with another record breaking digest submission. This year also marks the 20th birthday of APEC. The newly opened Hilton Hotel in downtown Austin, Texas provides excellent venues to bring together friends from all over the world. Austin is known not only for being the capital of Texas, but also the home of more than 1000 high tech companies including many well-known names familiar to most participants. Austin also offers top quality museums, galleries, professional ballet, symphony, opera, theaters, and live music. The APEC Conference Committee is excited about its debut in Austin.

APEC has been broadly regarded as the leading conference for practicing power electronics professionals not only through its excellent technical program, but also through all the enticing activities. This year is no exception. The Plenary Session has topnotch invited speakers to talk about past, present, and future technologies that promise to appeal to everyone. The daily Technical Sessions provide the opportunity for power electronics engineers to exchange their new ideas and research results. The Dialogue Session allows individuals to have lively face-to-face discussions. The Seminars on Sunday and Monday morning serve as the educational tool to bring us back to the fundamentals. The Monday night annual MicroMouse competition has been the most entertaining event that even appeals to non-power electronics engineers. The Rap Sessions are a chance to examine timely and controversial issues. The relatively new OEM Initiative program has all invited speakers from industries and universities to address the latest issues and share their research programs.

Be sure you do not miss the free-of-charge APEC Exposition. You can meet with leading power electronics companies and try their newly released products hands-on from Monday evening through Wednesday noon. You will also meet over 2000 attendees in the Exhibit Hall during the conference reception and the luncheons. On Wednesday evening, the Social Event at the Austin Music Hall brings you the famous Texas BBQ and Billy Joe Shaver's live band performance. The daily Spouse and Guest Program promises to show the best of Austin. So bring your family and friends and enjoy all the fun!

During the course of preparation, the APEC Committee members have volunteered countless hours and provided different perspectives to make APEC better than ever. We also received tremendous help from local companies and individuals to provide scouting services. I would like to express my sincere thanks to these volunteers. I also need to express my appreciation to the staff of Courtesy Associates, who have worked closely with the Committee to ensure a seamless conference.

Welcome to APEC 2005! May your week with us in Austin be both enjoyable and rewarding.

Jason Lai  
General Chair

## TABLE OF CONTENTS

---

New For APEC 2005 .....	2
Other APEC Highlights .....	3
Registration .....	5
Travel And Accommodations .....	8
Spouse & Guest Program .....	10
Technical Tour: Center For Electromechanics .....	11
Press Accommodations .....	12
Conference Social Event .....	12
Dining At APEC .....	13
Purchasing Additional Conference Proceedings And Seminar Workbooks .....	13
Additional Information .....	14
Important Notices .....	16
Visa Assistance .....	16
Professional Education Seminars .....	16
Exposition .....	25
Rap Sessions .....	28
Special Presentation Sessions .....	29
Presentation Sessions .....	30
Dialogue Sessions .....	45
APEC 2005 Conference Committee And Management .....	53

## FOR MORE INFORMATION

---

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 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 2005  
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)

## NEW FOR APEC 2005

---

### NEW ALL-IN-ONE REGISTRATION

For the first time APEC is offering a “one price for everything” registration. At previous APECs, you had to register separately for the Technical Sessions and the Professional Education Seminar. New for APEC 2005 is the Full Registration that offers admission to all of the Professional Education Seminars, all of the Technical Sessions, the Exposition, Rap Sessions, Exhibitor’s Reception, the Conference Social Event plus the APEC Proceedings on CD-ROM, the Seminar Workbooks with the presentations from all of the seminars and more – at a savings of \$50.

### AUSTIN!

APEC has long wanted to hold a conference in Austin, Texas – but we just could not find a suitable site until now. The brand new, just opened on December 27, 2003, Hilton Hotel in downtown Austin will be the site of APEC 2005.

The APEC Conference Committee is excited about Austin as it has so much to offer. Austin is known as the “live music capital of the world” with over 100 live music venues. And live music is only one of Austin’s many historic and cultural attractions. Austin is one of only a few U.S. cities with professional ballet, symphony, opera, and theater companies. The Austin cultural scene includes 20 museums, dozens of galleries and as many as 35 theater companies.

As a high tech center, it is the home of companies like Dell, the International SEMATECH consortium and home of too many semiconductor operations to name. In 2003, Forbes Magazine called Austin the “Best Place For Business” with more than 1000 tech companies. As the capital of the state of Texas, it is also an important political center.

Austin’s attractions are hardly limited to the indoors! Austin and the surrounding countryside are quite scenic with parks, nature preserves and lakes. Nearby is the renowned Texas Hill Country. In early March, the wildflowers should be providing a fabulous spectacle. The weather should be quite pleasant with an average daily

high temperature of 21-22 °C (70-72 °F) and an average daily low of 10 °C (50 °F). For more information on Austin and events in an around the Austin area, check the [Austin Convention & Visitor's Bureau Web site](#).

## **MORE PAPERS THAN EVER BEFORE!**

APEC 2005 had 645 digests submitted to the Program Committee – more than a hundred more than ever before. After a rigorous peer review process, the Program Committee accepted 329 for inclusion in the APEC 2005 Technical Program.

Two hundred of the papers with the broadest appeal have been assigned to the Presentation Sessions held from Tuesday morning to Thursday afternoon. One hundred twenty nine high quality papers with a more specialized focus have been assigned to the Dialogue Sessions held on Thursday at mid-day.

These papers cover every possible area of interest to the practicing power electronics professional, from low power dc-dc converters to high power converters for power quality applications, magnetic design, EMI/EMC, motor drives, lighting applications, automotive and transportation applications, power systems, power semiconductors and more. The APEC 2005 Technical Session papers are sure to give you many new ideas that you can take home and apply to your work right away.

## **TECHNICAL TOUR: CENTER FOR ELECTROMECHANICS**

The mission of the [Center for Electromechanics](#) at the University of Texas at Austin is to help industry produce products and processes that matter by combining university research with a growing core competence in the technologies needed to harness transient electrical and mechanical power. It is a large facility with 15 academic faculty, an 80 person research staff and an annual funding of US\$15 million. The Center has opened its doors to APEC attendees for a special tour on Thursday evening. This is a unique event that you won't find at any other power electronics conference this year.

## **OTHER APEC HIGHLIGHTS**

---

### **A PLENARY SESSION NOT TO BE MISSED**

We have assembled for your enjoyment a stellar cast for this year's Plenary Session. We have brought together for the Monday session four top executives in the electronics business and two top level U.S. government civil servants from organizations that directly impact the world of power electronics. This Plenary Session is a must-see for anyone interested in getting a look into the future of our business, presented by individuals who are at the helm of the flagship companies in the computer and power electronics industry.

Alex Lidow, CEO of International Rectifier, will lead off with a look at the development of key electrical systems that have improved our standard of living, and the impact as well as potential for power electronics to improve performance and efficiency. Kevin Kettler, the Chief Technology Officer of Dell, Inc., will then look at how advances in personal computing will drive innovation in power conditioning. We will then hear from John Zolper, Deputy Director of the Microsystems Technology Office Defense Advanced Research Projects Agency, who will give us a picture of the possibilities in a revolutionary device technology.

After an extended coffee break where we can catch up with old friends and colleagues, Andrew Fanara, from the Energy Star Program of the United States Environmental Protection Agency, will lead off the second half of the Plenary Session with the presentation of award winners from the 2004 Efficiency Challenge design competition. Izac Bencuya, Executive Vice President and Chief Strategy Officer of Fairchild Semiconductor, will look at the two major trends in the evolving power semiconductor industry. The first path is one of continuing innovation in silicon technology, while the other is the trend toward single package integration and increased functionality in one package. The Plenary Session will close with a presentation by Hans Stork, Chief Technology Officer of Texas Instruments. He will be giving a CTO's perspective on industry trends that will

significantly affect target markets and product planning in the power electronics business. As you can see, this star-studded Plenary is as big as Texas, and one that no power electronics engineer can afford to miss.

## **SPECIAL PRESENTATION SESSIONS**

There are three special presentation sessions to address issues of current interest. While these sessions are less technical in detail, they cover areas of great impact to the power electronics industry. Consequently these invited speakers come from both inside and outside of the industry.

The first session is a broad overview of energy efficiency and renewable energy perspectives to assist those who are working towards a greener world. Learn about the different implementation options to differentiate your products and your customers' products. Discover how different governments are promoting these worthy initiatives and explore ways to support them.

The second session continues last year's very successful "Current Topics In Power Electronics Research". We will hear from several academic and non-academic research centers from around the world on the latest in power electronics research.

In the third session, we will learn how the power electronics industry may change over the next three to five years. Four different representatives from different major industries will share their future needs, challenges and concerns in using power electronics. Two leading suppliers of power electronics will share how the power electronics industry is anticipating changes and outline various upcoming solutions. It will be most interesting to learn if there is a good match between the future needs of power electronics users and future power electronics solutions or if there is an opportunity to improve while there is still time.

## **EXPOSITION**

The Exposition is a key part of APEC 2005, and you will see, touch and learn about the newest products and services from the leading companies in the power electronics industry. APEC's Exhibitors are also offering a series of

seminars on Tuesday afternoon and Wednesday morning, where you can gain in-depth knowledge of the latest solutions to your power electronics challenges.

The Exhibit Hall is also the social center of APEC. Whether it is during one of the conference receptions or during the luncheons, the Exhibit Hall is the place to be. APEC's Exhibitors are also offering a series of seminars on Tuesday afternoon so that you can get an in-depth look at the latest solutions to your power electronics challenges.

And as always, admission to the APEC Exposition is free – although we do ask that you stop by the registration desk to pick up a badge that will allow you entrance.

## **MICROMOUSE CONTEST**

APEC will once again host the premier MicroMouse contest in North America, drawing contestants from all over the world. Come by the Governor's Ballroom Salon C, at 8:00 PM on Monday to cheer your favorite mouse to victory.

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 2005 offices.

## **CONFERENCE SOCIAL EVENT**

On Wednesday evening, APEC will mosey on over to the Austin Music Hall for an evening of pure Texas entertainment. Barbeque with all the fixings will be served with seating available for all. A true Texas music legend will take the stage at 8:30 PM to serenade us with the finest in Texas music. This is an evening not to be missed.

## **SPOUSE AND GUEST PROGRAM**

APEC welcomes the spouses and guests of the APEC conference participants. A welcoming breakfast will be held on Monday, March 7th. 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 2005 has also arranged for two optional tours. The first tour, "Texas Legends and Lore", is on Monday right after the Welcoming Breakfast. This tour introduces you to Texas with stops at

the Bob Bullock Texas State History Museum, the Texas Spirit Theatre and the Lyndon Baines Johnson Library and Museum. Along the way, a typically Texas lunch will be served.

On Tuesday, March 8th, the “Take A Walk On The Wild Side” tour is available. This tour starts off with a “duck’s eye” view tour of Austin in an amphibious duck boat. The tour moves on to the Lady Bird Johnson Wildflower Center, lunch at Guero’s Taco Bar and then to shopping on South Congress Avenue. This promises to be a very full and very fun day.

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

## REGISTRATION

---

In order to participate in APEC 2005 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, but you must register at the Conference Registration Center and receive a badge that allows entrance. Exhibits Only registrations are only done at the conference and cannot be done in advance.

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

### NEW FOR APEC 2005

In previous APECs, you had to register for the Professional Education Seminars and the Presentation/Technical Paper sessions separately. This year, APEC is offering a Full Registration package that offers admission to all Seminars, Presentations, the Exhibit Hall, and Conference Social Event - plus a CD-ROM of the Proceedings and a copy of the Seminar Workbook - at a savings of \$50 over the price if everything was purchased separately.

Can't stay for everything? That's OK, APEC is still offering separate registrations for Professional Education Seminars, Presentation and Dialogue Sessions and Exhibits (as always, admission to the Exhibit Hall is free). The details of the various registration options are listed below.

### 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.

### 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 2005.

### 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 2005.

### PRESS & INDUSTRY ANALYSTS

Credentialed members of the press and industry analysts covering the power electronics industry are invited to APEC 2005 and are offered a complimentary registration. Please contact the APEC offices as soon as possible to present your credentials so that you will not be delayed when you arrive at APEC.

### EARLY REGISTRATION

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

**Table 1. APEC 2005 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	\$350	\$425	\$425	\$500	\$150
Exhibits Only			FREE!		
Spouse And Guest Registration			FREE!		
Credentialed Press And Industry Analysts			FREE!		

registration offices or through the on-line registration system no later than the close of business on **Thursday, February 3, 2005**.

## REGISTRATION FEES

Table 1 contains a summary of the APEC 2005 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, February 25. After February 25, 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 2005/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, February 25, 2005. After February 25, 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.

**Table 2, What's Included With Your APEC 2005 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	✓	✓	✓	✓	✓	✓
Technical Tour: Center For Electromechanics	✓	✓	✓	✗	✓	On Request
Admission To The MicroMouse Contest	✓	✓	✓	✓	✓	✓
Admission To The Conference Social Event	✓	✓	With Separately Purchased Ticket			
Conference Proceedings (CD-ROM)	✓	✓	✗	✗	✗	On Request
Conference Proceedings (Printed Copy)	Must Be Purchased Separately					
Seminar Workbook (Printed Copy)	✓	✗	✓	✗	✗	Purchased Separately
Admission To The Spouse And Guest Welcoming Breakfast	✗	✗	✗	✗	✓	✗

### 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 the Austin Grand Ballroom on the fourth floor of the Hilton Hotel, to register and pick up your conference materials. The Conference Registration Center will be open:

Saturday, March 5 ..... 3:00 PM - 6:00 PM  
Sunday, March 6 ..... 8:00 AM - 5:00 PM  
Monday, March 7 ..... 8:00 AM - 5:00 PM  
Tuesday, March 8 ..... 8:00 AM - 5:00 PM  
Wednesday, March 9 ..... 8:00 AM - 3:00 PM  
Thursday, March 10 ..... 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 3, 2005. 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.

## TRAVEL AND ACCOMMODATIONS

### CONFERENCE HOTEL

The [Hilton Hotel in Austin, Texas](#) will be the center of activity for APEC 2005. Your conference experience will be enhanced if you stay in the conference hotel. The Hilton Hotel is located at:

500 East 4th Street  
Austin, Texas, 78701  
Phone: 512-482-8000.

### Hotel Room Rates

A block of rooms has been reserved for the APEC 2005 participants at the Hilton Hotel at special conference rates. Be sure to mention that you are with the "IEEE APEC" when making a reservation to qualify for this rate:

Single ..... \$170.00  
Double ..... \$170.00

Current city taxes 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 3, 2005.** After February 3, 2005, reservations will be confirmed only on a space available basis.

### Reservations

To make a reservation, please call the Austin Hilton directly (+1-512-482-8000) and tell the reservation agent that you are with the "IEEE APEC". 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 Hilton Hotel  
Reservations  
500 East 4th Street  
Austin, Texas 78701**

A hotel registration form is included in this Conference Program. To download one in one in Adobe® Acrobat® format, [click here](#).

## **Contacting The Austin Hilton Hotel**

To reach the Hilton Hotel by phone or fax:

Hilton Reservation: ..... 800-445-8667  
Austin Hilton Direct: ..... 512-482-8000  
Facsimile:..... 512-469-0078

## **AIRPORT**

Austin is served by the [Austin-Bergstrom airport](#). The airport is available non-stop from about 30 cities in the United States and is served by all major U.S. airlines.

## **AIRLINE DISCOUNT PROGRAM**

American Airlines will be the official airline for APEC 2005. From March 3 to March 15 they are offering a number of discount fares for APEC attendees traveling to APEC. The earlier you make your reservations, the better the discount. To take advantage of these low fares, give the IEEE Applied Power Electronics Conference Star number, S 5035AA, to your travel agent or call American Airlines at their special Meeting Services Desk Toll Free Number: 1-800-433-1790.

## **GROUND TRANSPORTATION**

For the latest information on transportation from the Austin-Bergstrom airport to the Hilton Hotel, please check the [Austin-Bergstrom airport ground transportation Web page](#).

### **Public Transit**

The Capital Metro system's Airport Flyer is an express bus service to and from the airport and selected downtown locations. Coming from the airport, it stops on Sixth Street just one block from the Austin Hilton. Going to the airport, it picks up just outside the hotel. The fare is \$0.50.

For more information, including schedules:

Phone (Austin Local): ..... 512-474-1200  
Phone (Toll-free): ..... 800-474-1201  
Web site: ..... <http://www.capmetro.org>

### **Shared-Ride Shuttle Van Service**

The Austin-Bergstrom airport is served by SuperShuttle. Upon arrival at the airport, please follow signs from baggage claim to the SuperShuttle ticket counter. No reservation is

necessary, and service is available 24 hours a day. SuperShuttle accepts cash and credit cards for payment.

The approximate fare from the airport to the Hilton Hotel is \$10 per person, not including a gratuity for the driver.

Phone (Austin Local): ..... 512-258-3826  
Phone (Toll-free): ..... 800-258-3828  
Web site: ..... <http://www.supershuttle.com>

### **Taxi Service**

Taxi service from the Austin-Bergstrom airport to the Hilton Hotel is provided by several companies. The approximate fare from the airport to the Hilton Hotel is \$20-23, not including gratuity.

### **Car Rental**

Once again this year, AVIS will offer attendees a special conference rate from March 3 to March 15. To take advantage of this special rate, call the AVIS Meeting Reservation and Information Desk at 1-800-331-1600 or contact them online at [www.avis.com](http://www.avis.com). Identify yourself as eligible for the APEC rate by giving the Avis Worldwide Discount (AWD) number, A606092.

### **Parking At The Hilton Hotel**

Parking at the Hilton Hotel is \$11.00 per day for self-parking and \$16.00 per day for valet parking.

There is limited public parking in the area around the hotel. Parking lots and garages are scattered and typically cost \$7-10 per day.

There is a parking garage under construction right next to the Austin Hilton. It is on Red River Street between Third and Fourth Streets. It is scheduled to open in January 2005. Please check with the hotel for the latest information.

## **AUSTIN WEATHER IN MARCH**

The weather in the Austin area in March is quite mild. The average daily high temperature is 21-22 °C (70-71 °F) and the average daily low temperature is 9-10 °C (49-50 °F). The average rainfall in Austin for the month of March is of 54 mm (2.1 in) so be prepared for the occasional rain shower.

## **SPOUSE & GUEST PROGRAM**

---

Spouses and guests are encouraged and invited to attend the APEC 2005 Conference. Aside from the APEC activities, the Austin 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. Please be sure to register for a badge in order to participate.

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).

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 2005 has arranged Room 404 of the Hilton Hotel 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 7th, 8:00 – 9:00 AM  
Room 404***

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 7th  
Texas Legends and Lore***

This tour begins with the Story of Texas, the Bob Bullock Texas State History Museum. It is a most magnificent museum honoring the memory of one of Texas' legendary politicians, Bob Bullock, as well as paying tribute to the deep love he had for his home state!

The museum exemplifies the bigger than life persona of Texas and Texans. There are a variety of fun and whimsical displays that depict Texas valor, vision, pride, perseverance, swagger and showmanship! We will experience the Texas Spirit Theatre, which is a multimedia event entitled "The Star of Destiny" which focuses on Texas stories of perseverance. Historic events such as the Galveston Hurricane of 1900 come to life with amazing special effects. Seats shake as visitors witness a gusher exploding from an East Texas oil derrick and the takeoff of a Saturn V rocket as seen from Mission Control at the Lyndon B. Johnson Space Center in Houston.

What is a bigger Texas legend than the late President Lyndon Baines Johnson? The Lyndon Baines Johnson Library and Museum on the University of Texas Campus houses Johnson's desire to "show the facts, not just the joy and triumphs, but the sorrow and failures too". This incredible facility is one of eleven Presidential libraries administered by the National Archives and Records Administration. Displays include the landmark Civil Rights Programs, the war in Vietnam and many other historical events which took place during the Johnson administration.

Lunch, included in the cost of the tour, will be typically Texan!

The cost per person is \$64.00.

Please meet in the Spouse and Guest Hospitality Room (Room 404) at 9:00 AM. The bus will start loading at 9:30 AM and will depart as soon as possible. The buses are expected to return to the Austin Hilton about 4:00 PM.

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 8th**  
**Take A Walk on the Wild Side**

This tour shows us the Capital City from a Duck's Eye view! Riding in an amphibious vehicle from the Austin Duck Tours, we will begin with a tour of downtown Austin as our professional guide weaves the stories of Austin's past and present with clever anecdotes. We will see the State Capitol, the Governor's Mansion, the Bob Bullock Museum, the historic Congress Avenue and the ever-popular and music-rich 6th Street before "splashing" into nearby Lake Austin. From downtown, it's a straight drive and dive into Lake Austin for a Duck's Eye view of Austin's city skyline and a fun spin around the waters of this beautiful downtown lake which is surrounded by beautiful homes along the banks of the Colorado River! These off road amphibious cargo carrier vehicles reach a top speed of 40 miles an hour on land and about 6 knots in the water! Once used by the military to carry heavy equipment, these vehicles are now used for fun and entertainment.

Back on dry land, we'll be planting the seeds for fun! At the Lady Bird Johnson Wildflower Center a docent-guided tour offers a customized view of the many magnificent features of this national treasure of display gardens and stunning architecture where wildflowers are the focus. Surrounded by fields of blooming color we will be transported into a wildflower wonderland found only in Austin, Texas.

To fuel up for continued adventure, for lunch we'll stop at Guero's Taco Bar for fajitas and queso. The cost of this lunch is included in the cost of the tour.

Our final "only in Austin" stop will be shopping on South Congress Avenue. New York's SoHo has nothing on Austin's "SoCo". Whether you're window shopping or taking home that special souvenir, you'll go wild over the unique and eclectic shops along the Avenue. In this easy-to-walk, five block fantasia you'll find a sampling of antiques, vintage clothing, western outfitters, imaginative toys, restaurants and cafes and a bevy of other incredible wares! The view up the

Avenue towards the Capitol and downtown is Austin like you've never seen it!

The cost is \$80.00 per person.

Please meet in the Spouse and Guest Hospitality Room (Room 404) at 9:00 AM. The bus will start loading at 9:30 AM and will depart as soon as possible. The buses are expected to return to the Austin Hilton about 4:00 PM.

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

Austin, nearby San Antonio and the surrounding Hill Country have such a variety of places of interest that we were unable to choose tours or attractions that would appeal to all. For example, historic and scenic San Antonio is only about a 90 minute drive from Austin. Even closer, about 35 minutes from Austin and on the way to San Antonio, are the seemingly endless outlet malls (over 200 stores!) of San Marcos, Texas. 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 Hilton Hotel concierge for information on available sightseeing tours, cultural events and shopping.

## TECHNICAL TOUR: CENTER FOR ELECTROMECHANICS

---

The mission of the Center for Electromechanics at the University of Texas at Austin is to help industry produce products and processes that matter by combining university research with a growing core competence in the technologies needed to harness transient electrical and mechanical power. It is a large facility with 15 academic faculty members, an 80 person research staff and an annual funding of US\$15 million. The Center has opened its doors to APEC attendees for a special tour on Thursday evening. This is a unique event that you won't find at any other power electronics conference this year.

The Center for Electromechanics conducts research in many areas important in today's world. In the area of electric power the Center has research projects in advanced generators, electric grid control, energy storage and distributed generation technology. Research in transportation includes advanced trains, hybrid vehicles, active suspension for vehicles, wheel motors, all electric ships and intelligent highways. The Center's areas of research in space technology include space power, electromagnetic launch and satellite attitude control.

This tour is free to any APEC attendee with a paid registration and to their spouses and guests. There are no restrictions on who can take the tour based on nationality or security clearance.

The buses will begin loading from the hotel lobby at 6:00 PM on Thursday, March 10. The buses are expected to return to the hotel between 8:00 PM and 8:30 PM.

Space is limited. If you are interested in this tour be sure to sign up through Early and Pre-Registration. If any seats are available after the close of pre-registration, tickets will be available at the Conference Registration Desk on a first-come, first-served basis.

## **PRESS ACCOMMODATIONS**

---

### **PRESS WORKING ROOM**

APEC 2005 has reserved Room 401, located right around the corner from the where the seminars and sessions will held, as a Press Work Room. This room is equipped with tables and chairs for setting up your laptop or reviewing your notes, internet access, a computer, and a printer. Light refreshments will available.

Copying and faxing, if needed, are available from the Hilton's Business Center.

An APEC 2005 Press Badge will be required for entrance to the Press Work Room. The Press Work Room will be open:

Tuesday, March 8 ..... 8:30 AM - 5:00 PM  
Wednesday, March 9 ..... 8:30 AM - 5:00 PM  
Thursday, March 10 ..... 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 2005 has reserved Room 403, next to the Press Work Room and around the corner from the where the seminars and sessions will held, for this purpose.

An APEC 2005 Press Badge, APEC 2005 Conference Badge or APEC 2005 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 2005 Press Conference Room will be available:

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

Wednesday, March 9 ..... 8:30 AM - 2:00 PM

## **CONFERENCE SOCIAL EVENT**

---

### **Wednesday, March 9, 2005**

APEC will be spending the evening at the Austin Music Hall—for a dinner with entertainment that is pure Texas. Barbeque with all the fixings will be served, and there will be seating available for everyone! Not a meat eater? Don't worry, there will be vegetarian alternatives available.

Entertainment, beginning at 8:30 PM will be by the Texas legend, Billy Joe Shaver. A singer and songwriter whose talent is compared to Hank Williams and Willie Nelson, Shaver's performance will highlight this true Austin experience. No cameras, audio or video recording devices will be permitted in the facility.

The Social Event is only included in registration fee for the Full Conference and Technical Sessions. All others may purchase tickets through Early Registration for \$60.00. Tickets may or may not be available at the conference so if you need one for yourself or an extra for your spouse or guest, be sure to order it through Early Registration.

The buses will start to load in front of the Hilton Hotel at 6:45 PM. The doors of the Austin Music Hall will open at 7:00 PM. For those that wish to return early, the first bus to return to the hotel will start loading about 9:00 PM. It will depart when

full. The last bus to the hotel is expected to depart about 10:15 PM.

## DINING AT APEC

---

### RESTAURANTS IN AND NEAR THE HOTEL

#### *Dining In The Austin Hilton*

The Austin Hilton offers three restaurants on the premises. The Liberty Tavern is a casual restaurant serving breakfast, lunch and dinner. The menu includes a variety of fare including sandwiches, salads and pasta. For breakfast you can order from the menu or serve yourself from a buffet.

The Finn & Porter is an upscale restaurant serving steaks, seafood and sushi. It is open daily for dinner only.

The Java Cost is a coffee shop that also offers a selection of sandwiches and salads. It is open all day.

#### *Dining Outside The Hotel*

For lunch and dinner, there are dozens of restaurants within a few blocks of the Austin Hilton offering fare for any taste and any budget. Check with the hotel concierge for a recommendation or simply start walking. You will surely find something to fit your mood within a few minutes walk.

The choices for breakfast are bit more limited as the area around the Austin Hilton is known for its night life. The Las Manitas Avenue Café in the 200 block of Congress is a favorite with locals for breakfast and lunch. There is an IHOP restaurant about four blocks southeast of the hotel at the corner of Second Street and the I-35 Frontage Road. The nearest Starbucks is on the northwest corner of Sixth and Congress, about five blocks from the Austin Hilton.

### 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/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

---

#### 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 <u>or</u> 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 3, 2005. 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 9.

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

Conference Proceedings .....	\$150.00
(Includes Hardcopy <u>or</u> CD-ROM)	
Seminar Workbook .....	\$150.00
(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: [shop.ieee.org/ieeestore/](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

### SPONSOR MEMBERSHIP DESKS

Each of the organizations sponsoring APEC will have membership desks. 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. 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 Hilton Hotel 512-482-8000 and ask for the IEEE APEC 2005 Registration Desk. APEC participants are encouraged to regularly check the message board.

## INTERNET ACCESS

High speed wireless internet access is available throughout the Austin Hilton including all guest rooms and common areas. Guest rooms also offer wired internet access but you must choose between wired and wireless. Signing up for one does not give access to the other. If you want to use your computer throughout the hotel, choose the wireless option. The fee is \$9.95 per day (\$12.95 per day if you need a public IP address, as do many corporate VPNs).

For those who do not bring a computer to APEC, the Austin Hilton business center rents computer time at the rate of \$2.50 per 15 minutes. There are also several internet cafes within walking distance of the Austin Hilton. These can change frequently so please ask at the concierge's desk for the latest information on local internet cafes.

## SHIPPING SERVICES

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

The Hilton Austin Business Center has some limited capability for packing and shipping using several shipping services. They have a limited supply of boxes and packing materials.

The United States Post Office is a moderate walk from the hotel and probably offers the most economical shipping services. They also have a limited supply of packing materials. The Post Office can be found at:

510 Guadalupe St Phone: (512) 494-2201  
Austin, TX 78701  
Web site: ..... [www.usps.com/](http://www.usps.com/)  
(Approximately 8 blocks from the Austin Hilton  
Hotel)

There are also two commercial shipping services  
a short walk from the Hilton. They offer a wider  
range of services and packing materials than the  
Hilton Hotel Business Center or the Post Office.

#### Kinko's/FedEx

327 Congress Ave Phone: (512) 472-4448  
Austin, TX 78701 Fax: (512) 472-4480  
EMail: ..... [usa0228@fedexkinkos.com](mailto:usa0228@fedexkinkos.com)  
Web site: ..... [www.fedex.com/us/](http://www.fedex.com/us/)  
(Approximately 4 blocks from the Hilton Hotel)

#### The UPS Store

815 Brazos Phone: (512) 476-5316  
Austin, TX 78701 Fax: (512) 482-0457  
EMail: ..... [store0233@theupsstore.com](mailto:store0233@theupsstore.com)  
Web site: ..... [www.theupsstore.com/](http://www.theupsstore.com/)  
(Approximately 7 blocks from the Hilton Hotel)

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

You can print papers from the APEC Proceedings  
CD-ROM at the Hilton Hotel's Business Center  
from your computer, or if you don't have a  
computer with you, you can rent one of theirs.

Printing of papers from the APEC Proceedings  
CD-ROM is also available at the Kinko's/Fedex  
(address, phone number and email above). The  
Quick Print shop (515 Congress, southeast corner  
of Sixth and Congress, 512-477-2014) can also  
print papers from the APEC 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 only provides 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. Requests for meeting space from any  
other organization will be denied.

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.

Please note that no meetings will be scheduled  
during the Plenary Session and meetings while  
the Exhibit Hall is open are strongly discouraged.

## IMPORTANT NOTICES

---

### 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.

### RECRUITING

IEEE Policy #10.18 prohibits recruiting at IEEE sponsored conferences. Consequently, recruiters and recruiting advertisements will not be permitted in the APEC 2005 hotel space, meeting facilities or Exhibit Hall.

### DISTRIBUTION OF COMMERCIAL MATERIAL

Distribution of commercial material by organizations not participating in the Exposition is prohibited in the APEC 2005 hotel space, meeting space and Exhibit Hall.

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

## 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 2005 Web site](#).

## PROFESSIONAL EDUCATION SEMINARS

---

APEC 2005 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 2005 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 6, 9:30 AM – 1:00 PM**

#### S.1 Inside the Power Supply

**Chuck Mullett, ON Semiconductor  
Governor's Ballroom, Salon A**

This presentation is designed for those who deal with power supplies, rather than those who are highly experienced designers. It is appropriate for entry-level engineers in power supply design as well as those associated with them, such as sellers, buyers, evaluators and specifiers. Using the desktop computer power supply as an example, it conducts a tour through the entire ac-to-dc power supply, beginning at the input and ending at the several outputs used in today's personal computers. It also includes an overview of the electrical specifications and the relevant safety and EMI standards.

Included in the course is a short discussion of each of the key components used in modern power supplies---resistors, capacitors, inductors, transformers, FETs, diodes and optocouplers. This is followed by an overview of the most popular circuit topologies and a very short course on magnetics to aid in the understanding of the tradeoffs in magnetic components, a major cost driver in switched-mode power supplies. The course also addresses the use of power factor correction (PFC) circuits to reduce the input current harmonics in compliance with standards for the worldwide markets.

Each of the major power supply circuits is explained, including the input filters, power converter and output regulator circuits. Photos of the inside of the power supply are included, with identification of all of the key components. Actual voltage and current waveforms enhance the understanding of today's modern power supplies.

## **S.2 Advanced Topics On Single-Phase Power Factor Correction**

**Jian Sun, Rensselaer Polytechnic Institute**

**Governor's Ballroom, Salon B**

This seminar introduces advanced modeling, analysis, control, and design techniques for single phase power-factor-correction (PFC) converters. It is designed to bring advanced theories and the latest development in these areas to practicing engineers who have some basic knowledge of PFC technologies. It will help the attendees to develop an in-depth understanding of the fundamentals, and provide them with advanced analytical tools and methods for practical development.

The seminar will first review the basics of single-phase power factor correction using boost and boost-derived topologies. Double averaging is then introduced as a systematic reduced-order modeling method for single-phase PFC converters, and design of both the input current loop and the output voltage loop using appropriate models is discussed.

The seminar then provides an in-depth treatment of the input current crossover distortion issue, identifying all major sources of such distortion and quantifying their effects using analytical methods. Advanced circuits and control techniques for reducing current crossover distortion will be introduced. Recently developed input current feedforward control and digital control techniques will also be covered. Additionally, the seminar will present input impedance models of boost PFC converters and discuss their applications in input filter design as well as in analysis and mitigation of undesirable converter-source interactions.

## **S.3 IGBT Selection for Designers**

**John Donlon, Eric Motto and William Kephart, Powerex**

**Governor's Ballroom, Salon E**

Information provided on IGBT module data sheets varies considerably between manufacturers and leaves the designer with some questions regarding the selection of devices. Issues the designer must deal with include interpretation of device ratings, gate drive requirements, and providing device and system protection. The intent of this seminar is to aid the designer in applying an IGBT to a new product. Questions and concerns a designer might have will be addressed by the various techniques and circuit examples that will be presented. IGBT chip technology and device packaging options will also be discussed. The attendee should leave the course with a better understanding of the IGBT, both specifically as a product and generally towards an application. The seminar's goal is to impart an understanding of the desirable features, characteristics, and limitations of the IGBT. This will include the application of IGBTs in power circuits, protecting the IGBT from internal and external disturbances, and an understanding of thermal design and handling considerations.

The seminar is intended for design engineers new to IGBTs as the main switch

in power conversion equipment as well as refresher for the experienced designer with questions about confusing or conflicting information on the data sheets from various manufacturers.

#### **S.4 Power Electronics In Distributed Generation**

**James Kokernak, Advanced Energy Conversion**

**Governor's Ballroom, Salon D**

Power electronics is an enabling technology that is fundamental to the deployment of distributed generation systems. As such, distributed generation represents a significant market opportunity for power electronics professionals. This seminar provides an introduction to distributed generation and its reliance on power electronics. A pragmatic approach is offered that considers the various types of resources that are considered to fall within distributed generation, followed by consideration of the regulatory requirements on the power converters. With this as background, system design features and architectures are discussed to give attendees with a solid introduction into the field.

#### **S.5 Advanced Control Techniques For Buck Converters In Power Management And VRM Applications**

**Richard Redl, ELFI and Gabor Reizik, Analog Devices**

**Room 406**

The buck converter is the most widely used dc-dc converter topology in power management and microprocessor voltage-regulator (VRM) applications. Those applications require fast load and line transient responses and high efficiency over a wide load current range. This seminar reviews advanced control techniques aimed at speeding up the transient responses and increasing the light-load efficiencies without adversely affecting the efficiency at full load. Three topics are covered:

1) Fast regulation of the output voltage using either a fast feedback loop (i.e. without a voltage-error amplifier), the combination of fast and slow feedback loops, or some type of power-equalizing control,

2) Voltage positioning solutions for VRM applications, and

3) Control techniques which ensure high efficiency over a wide load current range.

A section of the seminar is devoted to a novel switched noise filter concept that overcomes one of the disadvantages of the fast feedback loop, namely unwanted response to noise picked up from nearby converters and other sources of electromagnetic interference.

The seminar is targeted toward an audience with intermediate background in the topic.

#### **S.6 Optimal Control Of Adjustable Speed AC Motor Drives: A Microscopic Approach To Energy Conversion Process**

**Babak Fahimi, University of Texas at Arlington and Steve Pekarek, Purdue University**

**Room 408**

Adjustable speed motor drives play a crucial role in technology advancement for a variety of industries. This has motivated researchers around the world to pay special attention to engineer a quieter, more efficient, and more productive adjustable speed motor drive. Although significant advances have been made towards this goal, lack of an in-depth understanding of the electromechanical energy conversion at a microscopic level has impeded the quest for a quantum leap in enhancement of the performance. The proposed seminar offers a new perspective to the above problem by offering a microscopic point of view under which new excitation schemes for adjustable speed motor drives are extracted. The topics include control solutions for elimination of torque pulsation, mitigation of radial forces/pulsation of the radial forces, and optimization of torque density. Experimental results from a low cost torque

ripple minimization for PMSM drives will be demonstrated. Furthermore, special attention has been given to magnetic interpretation of field orientation in adjustable speed ac drives from a microscopic point of view. The proposed seminar provides an insightful and in-depth understanding of advanced energy conversion for practicing engineers in industry and graduate students who conduct research in the area of adjustable speed motor drives.

## PROFESSIONAL EDUCATION SEMINARS SESSION TWO

Sunday, March 6, 2:30 – 6:00 PM

### S.7 Using And Designing Point-Of-Load Converters

**Conor Quinn, Artesyn Technologies;  
Collon Lee, Emerson/Astec Power;  
Richard Garvey, Texas Instruments and  
Greg Miller, Intersil**

**Governor's Ballroom, Salon A**

This seminar presents the basic issues in choosing, applying, and designing POL converters for on-board power systems. A unique feature of this seminar is that there are four speakers, two from power supply companies, and two from semiconductor companies. This will expose the audience to a much wider range of experience, knowledge and opinion than normally available in a seminar.

The first portion of the seminar introduces the modern POL converter, its components and basic operation and finishes with a discussion of the key decision points of the "make versus buy" decision. The second portion of the seminar covers the basic issues of using POL converters: layout and voltage regulation, EMI, thermal management and protection against fault conditions.

The second half of the seminar gives an introduction to designing a POL converter. The basics of component selection and converter stability are presented. Three

different design examples of increasing complexity are presented to introduce the audience to the basic choices and tradeoffs.

The seminar concludes with a brief wrap-up and question and answer period for the audience. This seminar is intended for board or system designers charged with implementing POL converters but who are not necessarily experienced power supply designers. The level of the material is application focused and at an introductory to intermediate level.

### S.8 EMI: Theory, Coupling Mechanisms, Equivalent Circuits, and Solutions

**Michael Schutten, GE Global Research Center**

**Governor's Ballroom, Salon B**

This seminar is intended as a comprehensive introduction for engineers wishing to obtain a fundamental understanding of EMI issues, and experienced engineers with a desire for a thorough understanding of electromagnetic interference (EMI) issues.

This seminar introduces the concept of electromagnetic energy coupling between electronic circuits. The fundamentals of EMI are presented including terminology, energy transfer mechanisms, equivalent circuits, and EMI circuit fixes. The seminar provides several examples of how one electronic circuit has the ability to corrupt or damage a different circuit. The characteristics and electrical symptoms of the four methods of EMI energy transfer are presented: common impedance coupling, magnetic field coupling, electric field coupling, and radiation coupling. Simple methods for approximating the equivalent circuit and low-cost solutions at the board or component level are provided. PWB layout and IC decoupling procedures are derived from fundamental EMI concepts. Several videotaped experiments demonstrate fundamental EMI coupling techniques and electrical fixes.

## **S.9 Magnetic Integration For High Density** **Dan Jitaru, Delta Energy Systems** **Governor's Ballroom, Salon E**

The seminar will present a comprehensive overview of the integrated and quasi-integrated magnetic concepts and implementations. In the quest for higher power densities and higher efficiency integrated magnetic structures have become more popular. There will be presented many forms of integrated magnetic in close correlation with converter topologies. Included are several structures wherein the transformer and the storage elements are placed on the same magnetic core, forming the traditional integrated magnetic with emphasis on the latest trends. Also presented will be structures wherein two independent power trains are placed on the same standard magnetic core and structures wherein the main transformer and a signal transformer are sharing the same magnetic core without interference. The focus for the integrated magnetic will be for low profile or planar magnetic structures. Ripple steering in new applications will be also presented. There will be presented the advantages of different forms of magnetic integration in very high current and low voltage application.

The seminar will also show some present and future trends in magnetic integration and new forms of planar magnetics. The presentation will be highlighted with design guidance, design example and experimental results.

## **S.10 A Practical Introduction To Digital Power Supply Design** **Laszlo Balogh and David Figoli, Texas Instruments** **Governor's Ballroom, Salon D**

The quest for increased integration, more features and added flexibility is under constant cost pressure, and continually motivates the exploration for new avenues in power management. One area gaining significant attention is the application of

digital technology to power supply control techniques. Several topics will be discussed, including defining digital power design, interface between digital and analog components, determining key metrics for choosing an appropriate microcontroller or DSP to meet required performance when working with a sampled data system and realizing the importance of the development environment and software. Special focus will be on similarities and differences between analog and digital implementations of basic power supply control functions.

Initial discussions will include benefits, limitations, cost and performance of a digital power design. A second area of focus will be on interface techniques that simplify the task of control feedback. Finally, the presenters will suggest guidelines for selecting the microcontroller or DSP that provide the resources to implement a digitally controlled power supply with considerations to CPU utilization, interrupt overhead and MIPS flexibility. Presentation will also include examples that demonstrate configuration, supervision and full digital loop control.

## **S.11 Fundamentals Of State Plane Analysis Of Converters** **Prabjit Singh, IBM Corporation** **Room 406**

Converters with resonant elements are, in general, complex and difficult to understand and analyze. Solving them using the conventional approach involving differential equations is tedious. Even if successful, the conventional mathematical approach often lacks the physical insight essential for converter design. State-plane analysis allows the graphical representation of the behavior of converters containing resonant elements. It provides both the physical insight and the ability to quantitatively analyze converters, without resorting to complex mathematical operations.

The basis of state-plane analysis will be introduced. It will be shown how the technique handles the resonant sub-

intervals, during which a converter can be reduced to a simple circuit containing at most a resonant network inductor and capacitor, a constant voltage and a constant current source. The theoretical basis for the representation of a resonant sub-interval time-domain behavior as a circular trajectory on a normalized current versus normalized voltage plot will be explained. Output characteristics will be shown to be quite readily derived from trigonometric manipulations of the state-plane trajectory.

Three simple examples of the application of state-plane analysis to converter design will be presented. In the first example, the peak voltage across a flyback MOSFET will be derived; the second example will deal with the qualitative understanding of the behavior of a single switch forward converter with active clamp, and the third example will deal with the quantitative derivation of the output characteristics of a zero-voltage switching quasi-square-wave converter.

## **S.12 Electric Drives: Understanding Basics To Advanced Control And Encoder-Less Operation**

**Ned Mohan, University of Minnesota  
Room 408**

The objective of this seminar is two-fold. The first-half will begin with basics and analyze induction and permanent-magnet ac machines in a way that clearly explains how these machines operate on a physical basis, and hence how they ought to be controlled for optimum performance. The second-half of this seminar will examine the basis of vector control and encoder-less operation of ac machines in order to design speed and position controllers for such machines.

This approach is very simple such that entry-level practicing engineers can easily comprehend it. It provides a new way to look at electric drives and their control, thus it should be beneficial to intermediate and advance-level audience.

## **PROFESSIONAL EDUCATION SEMINARS SESSION THREE**

**Monday, March 7, 8:30 AM – Noon**

### **S.13 Digital Power System Management**

**Bob White, Artesyn Technologies  
Governor's Ballroom, Salon A**

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. The system management of digital control has been around for many years and is growing in popularity. This seminar, containing all new material, 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 addresses the basics of the "what" of digital power system management. The discussion starts with understanding what one wants to manage in a power system and proceeds to understanding the flow of information in the power system.

The second part of the seminar talks about the "how." The elements of a protocol are introduced along with an overview of existing protocols for power system management.

The third part of the seminar examines the details of the "what," taking a more in-depth look at issues like addressing, data integrity, and transport. It also looks at the various possible controls, configuration and status information in some detail.

### **S.14 EMC Enhanced Power Supply Design**

**Ernest Wittenbreder, Technical Witts  
Governor's Ballroom, Salon B**

The purpose of this course is to provide the power supply design engineer with a better understanding of the scientific and engineering principles of EMI generation, coupling mechanisms, EMI avoidance, and EMI reduction techniques and to provide the

engineer with very specific information that he can use to accomplish low noise power supply designs. Circuit synthesis methods that can be used to form new power supply topologies with much improved EMC from standard well known topologies will be presented. An exhaustive review of the many typical EMI problem areas is provided and proven methods are described to avoid those problem areas. PWB layout techniques and techniques applicable to construction, component design, circuit and component placement, shielding, and snubbing will be presented. The attendee will learn about EMI filter design and EMI filter component and interface issues. This course will be a benefit to all power supply design engineers regardless of their level of experience and ability.

## **S.15 Basic Planar And Integrated Magnetics Design Techniques**

**Ed Bloom, e/j Bloom Associates**  
**Governor's Ballroom, Salon E**

Power magnetics continue to be the major contributors to the cost and packaging difficulties of modern power conversion systems. Because of this situation, power supply designers are now turning to three new construction techniques for power magnetics. These techniques are planar, integrated (IM) and planar integrated (PIM) designs for both power transformer and power inductor components. Planar, or flat, construction methods for magnetics are those employing low-height ferrite core structures with windings often implemented in various printed-circuit formats. Planar construction approaches have many electrical advantages over conventional "hard-wired" techniques. In addition to improved performance, the simplicity of their construction allows them to be built and assembled in a cost-and-time-effective manner without the need for highly skilled labor or special winding equipment. Integrated (IM) designs are those that blend power transformer and power inductive functions together on a single magnetic core. PIM designs are simply IM

constructions employing planar approaches for windings and low-profile magnetic cores. This seminar is intended to provide basic design information for the practicing power electronics engineer on the developmental aspects of planar and integrated power magnetic components. Topics to be covered include general guidelines for core selection and winding designs. Advances in PIM constructions will also be presented.

## **S.16 Analyzing And Correcting Power Electronic Failures**

**Art Brockschmidt, Boeing Phantom Works**

**Room 406**

Anyone can search the net and assemble a thousand pages of 'failure analysis' literature in a few minutes -- finding straightforward practical examples and direct experience for power electronics is difficult. Failures range from development test failures to long-term reliability concerns. Power electronic hardware failures can be spectacular, are often costly, or cascade to other hardware. This seminar provides both the novice and the experienced designer with analytical techniques, case histories, and check lists to prevent and resolve failures. An overview of troubleshooting techniques and a checklist of what can zap your power electronics is provided. The seminar structure allows any particular issue to be discussed in detail. The designer controls internally generated transients, but not the external environment. This seminar summarizes external threats. Component drift requires a worst-case analysis to assure long-term reliability, and worst-case analysis techniques are included. The presentation of case histories is the author's preferred tool for transferring knowledge. In addition to presenting 15 specific case histories, sharing of "horror stories" by attendees will be encouraged. An extensive reference list is included. Using analytical tools such as PSpice is covered, while the use of mathematics is held to a minimum.

## **S.17 Design-Oriented Feedback Analysis: A Final Solution, V.2**

**R. David Middlebrook, California Institute of Technology**

**Governor's Ballroom, Salon D**

Feedback systems are usually designed with the familiar single-loop block diagram in mind. Various non-idealities, such as unavoidable minor loops and direct forward transmission, make the single-loop block diagram progressively less useful, especially at higher frequencies.

The general feedback theorem (GFT) defines a "natural" block diagram model that is identical in format to the single-loop model that is conventionally assumed, thus providing a desirable link between general feedback theory and a detailed circuit diagram analyzed in terms of factored pole-zero transfer functions.

The GFT is illustrated on a potentially unstable Darlington emitter/source follower stage, and leads to design criteria that limit the maximum peaking regardless of the value of the load capacitance.

Another example is a two-stage feedback amplifier having various non-idealities, including loading interactions at all points, direct forward transmission, and two minor loops.

The GFT is computer friendly, and emphasis is on the numerical and graphical results obtained by use of an Intusoft ICAP/4 circuit simulator.

## **S.18 Hybrid Vehicle Propulsion: Exploring the Electronic CVT**

**John M. Miller, J-N-J Miller**

**Room 408**

This seminar takes an in-depth look at the most widely applied hybrid electric vehicle powertrain – the power split electronic CVT. CVT, or continuously variable transmissions in their purely mechanical implementations have been applied for many years in automotive products owing to their seamless matching of vehicle speed to engine

characteristics without need for clutches or gear shifting. However, the main disadvantage of the mechanical CVT is that is not capable of high torque transmission nor of efficient torque transfer at ratio coverage of six to one or higher. The electronic CVT, e-CVT for short, circumvents this major disadvantage by doing away with mechanical belts and sheaves and of toroids and rollers. To realize electronic CVT functionality the e-CVT relies on a pair of electronically controlled electric machines and a power split device to achieve seamless, clutch free and no step ratio gear shifting to match vehicle speed with engine speed characteristics. This course presents the essentials of power split technology as it is currently being applied in the Toyota PRIUS gasoline-electric hybrid as well as the GM-Allison compound split. Sizing the electric machines and their attendant power inverters for use as engine starter-generator (input side) and main motor-generator (output side) are discussed along with system dynamics and state equations for each mode of operation. Power split, e-CVT, transmissions have five or more modes of operation, each of which will be discussed in depth including derivation of the modeling equations and application to simulation using Ansoft Simplorer. The participants will gain fundamental knowledge of how mechanical power flows through the device while electric power circulates between the pair of electric machines and electrical energy storage, ESS, system via dedicated power inverters. State-of-charge of the ESS is modeled and simulated as the vehicle executes a standard drive cycle to illustrate the complex electrical and mechanical interactions of power split. Participants will have acquired the knowledge to more fully appreciate the methodology of designing, modeling and simulation of hybrid electric propulsion systems at the drive train and vehicle level. Practical examples will be presented.

<b>SEMINARS AT A GLANCE</b>			
<b>TRACK</b>	<b>SESSION I Sunday, March 6 9:30 AM - 1:00 PM</b>	<b>SESSION II Sunday, March 6 2:30 – 6:00 PM</b>	<b>SESSION III Monday, March 7 8:30 AM – Noon</b>
<b>Fundamentals</b>	<b>S.1 Inside The Power Supply</b> Chuck Mullett, ON Semiconductor Governor's Ballroom, Salon A	<b>S.7 Using And Designing Point-Of-Load Converters</b> Conor Quinn, Artesyn Technologies; Collon Lee, Emerson/Astec Power; Richard Garvey, Texas Instruments and Greg Miller, Intersil Governor's Ballroom, Salon A	<b>S.13 Digital Power System Management</b> Bob White, Artesyn Technologies Governor's Ballroom, Salon A
<b>EMI, EMC And PFC</b>	<b>S.2 Advanced Topics On Single-Phase Power Factor Correction</b> Jian Sun, Rensselaer Polytechnic Institute Governor's Ballroom, Salon B	<b>S.8 EMI: Theory, Coupling Mechanisms, Equivalent Circuits, and Solutions</b> Michael Schutten, GE Global Research Center Governor's Ballroom, Salon B	<b>S. 14 EMC Enhanced Power Supply Design</b> Ernest Wittenbreder, Technical Witts Governor's Ballroom, Salon B
<b>Components</b>	<b>S.3 IGBT Selection for Designers</b> John Donlon, Eric Motto and William Kephart, Powerex Governor's Ballroom, Salon E	<b>S.9 Magnetic Integration For High Density</b> Dan Jitaru, Delta Energy Systems Governor's Ballroom, Salon E	<b>S.15 Basic Planar And Integrated Magnetics Design Techniques</b> Ed Bloom, e/j Bloom Associates Governor's Ballroom, Salon E
<b>General Design</b>	<b>S.4 Power Electronics In Distributed Generation</b> James Kokernak, Advanced Energy Conversion Governor's Ballroom, Salon D	<b>S.10 A Practical Introduction To Digital Power Supply Design</b> Laszlo Balogh and David Figoli, Texas Instruments Governor's Ballroom, Salon D	<b>S.16 Analyzing And Correcting Power Electronic Failures</b> Art Brockschmidt, Boeing Phantom Works Room 406
<b>Control</b>	<b>S.5 Advanced Control Techniques For Buck Converters In Power Management And VRM Applications</b> Richard Redl, ELFI and Gabor Reizik, Analog Devices Room 406	<b>S.11 Fundamentals Of State Plane Analysis Of Converters</b> Prabjit Singh, IBM Corporation Room 406	<b>S.17 Design-Oriented Feedback Analysis: A Final Solution, V.2</b> R. David Middlebrook, California Institute of Technology Governor's Ballroom, Salon D
<b>Motors And Drives</b>	<b>S.6 Optimal Control Of Adjustable Speed AC Motor Drives: A Microscopic Approach To Energy Conversion Process</b> Babak Fahimi, University of Texas at Arlington and Steve Pekarek, Purdue University Room 408	<b>S.12 Electric Drives: Understanding Basics To Advanced Control And Encoder-Less Operation</b> Ned Mohan, University of Minnesota Room 408	<b>S.18 Hybrid Vehicle Propulsion: Exploring the Electronic CVT</b> John M. Miller, J-N-J Miller Room 408

## EXPOSITION

---

### EXPOSITION HOURS

The Exposition, located in the Grand Ballroom on the sixth floor of the Hilton Hotel, will open on Monday, March 7 when the Plenary Session concludes (expected to be about 5:30 PM). Additional hours are as follows:

Monday, March 7 ..... 5:30 PM - 8:00 PM

Tuesday, March 8 ..... Noon - 5:00 PM

Wednesday, March 9 ..... 10:15 AM - 2:00 PM

### 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.

### EXHIBITOR SEMINARS

Several of the companies participating in the Exposition will be offering Exhibitor Seminars. These 45 minute seminars generally offer an in-depth look at solving one or more problems common to the industry. The descriptions of the Exhibitor Seminars will be in the Exposition Directory, available at the conference.

The Exhibitor Seminars will be held:

Tuesday, March 8 ..... 2:30 PM - 3:15 PM

Tuesday, March 8 ..... 3:45 PM - 4:30 PM

Wednesday, March 9 ..... 11:00 AM - 11:45 AM

### EXHIBIT HALL SOCIAL FUNCTIONS

#### *Exhibitor's Reception*

A Welcoming Reception will be held in the Exhibit Hall on Monday, March 7, 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 3:15 PM to 3:45 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 8 and Wednesday, March 9, 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.

### 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 by 4:00 PM Tuesday afternoon are entered in a drawing for a wonderful prize.

The drawing will take place in the Exhibit Hall on Tuesday, March 8th at 4:45 PM and you *must* be present to win!

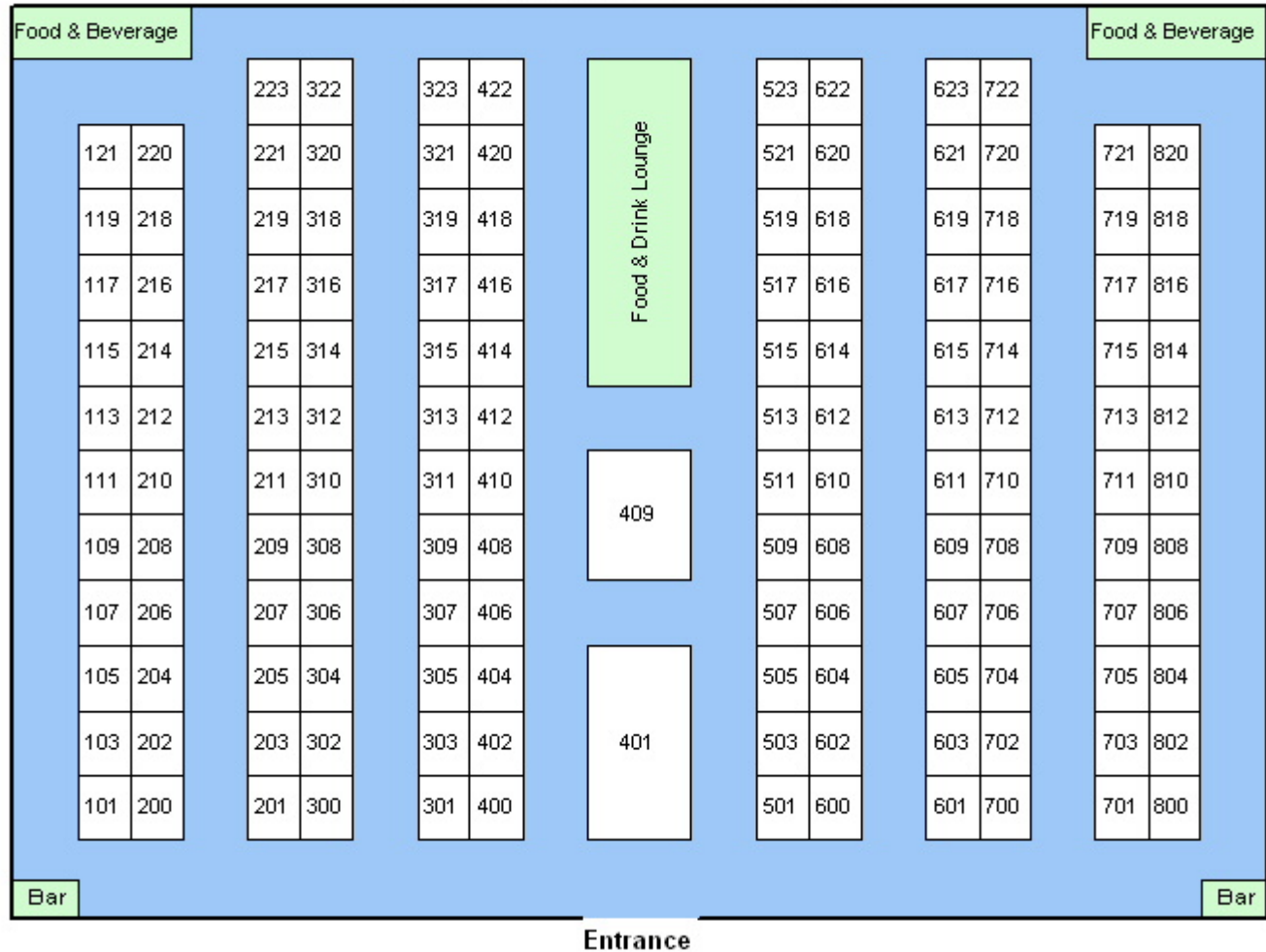
### INTERESTED IN EXHIBITING AT APEC 2005?

For the details on exhibiting at APEC 2005, 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 2005.

You should also feel free to contact the APEC Exposition Manager:

Ms. Pamela Wagner  
APEC Exposition Manager  
2025 M Street, NW, Suite 800  
Washington, DC 20036 USA  
Phone: +1-202-973-8664  
Fax: +1-202-331-0111  
Email: [exhibits@apcc-conf.org](mailto:exhibits@apcc-conf.org)

## APEC 2005 Exhibit Hall Layout



## APEC 2005 Exhibitors

The Exhibitors that are 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 2005 Exposition.

APEC 2005 Exhibitors		
ACME Magnetics USA Inc.	Actown Electrocoil, Inc.	AllStar Magnetics
AMETHERM	Analog Devices	Anderson Power Products
Ansoft Corporation	Apronic AG	Arnold Magnetics Limited
Autotest	AVNET	AVX Corporation
Bergquist Company (The)	BI Technologies/Magnetics Components Div.	Bose Research Private Limited
Broadband TelCom Power, Inc.	C & D Technologies	Cableco Technologies Corporation
Ceramic Magnetics, Inc.	CET Technology	Chang Sung Corporation
Chroma Systems Solutions	Coilcraft	Collmer.Com
Cornell Dubilier	CREE, Inc.	Custom Electronics

<b>APEC 2005 Exhibitors</b>		
Darnell Group	Delta Energy Systems	Dexter Magnetic Technologies, Inc.
EBG, LLC	ECl (Electronic Coils)	EFORE USA
Eldre Corporation	Electronic Concepts, Inc.	Elna Magnetics
ERM (Eastern Rochester Manufacturing Corp.)	Eupec, Inc.	Evox Rifa
Fairchild Semiconductor	Fair-Rite Products Corporation	Ferroxcube USA
Filter Concepts Inc.	Fuji Semiconductor, Inc.	Gaia Converter
GMW Associates	Henkel Loctite Corporation	High Voltage Components Associates (HV) And CKE
ICE Components, Inc.	Infineon Technologies NA Corporation	International Rectifier
Intersil Corporation	Isotek Corporation	ITW Paktron
Kaschke USA, Inc.	Littelfuse	Lodestone Pacific
Magnetics	Magsoft Corporation	Maxim Integrated Products
Methode Electronics, Inc.	MH&W International Corporation	Micrel Semiconductor
Micrometals, Inc.	Microsemi Corporation	National Instruments
National Semiconductor Corporation	NH Research	Northstar Technology Sales
NORWE, Inc	Ohmite Manufacturing Company	ON Semiconductor
Payton America	Pearson Electronics	Philips
Plexim GMBH	Positronic Industries, Inc.	Potrans International Inc.
Power Electronics Technology	Power Factor One, Inc.	Power Systems Design Europe
Powerex, Inc.	Precision Inc.	RAF Technologies, Inc.
Renco Electronics, Inc.	Ridley Engineering, Inc.	SB Electronics
SemiSouth Laboratories, Inc.	Silicon Laboratories	Simulation Research Caspoc
Standex Electronics, Inc.	STMicroelectronics, Inc.	Sumida
Tabtronics	Tektronix Inc.	Texas Instruments
Thermagon, Inc.	Tier Electronics	Tocos America
Transim Technology	Tribotek, Ink.	TSC Ferrite International Company
TT Electronics MMG	Tyco Electronics / Power Connector Products	United Chemi-Con
VAC Magnetics	Venable Industries, Inc.	Vishay Intertechnology, Inc.
Voltage Multipliers	Webcom	Wurth Electronics Inc.
Yokogawa Corporation of America		

## RAP SESSIONS

---

All Rap Sessions will be held Tuesday, March 8 from 5:00 PM, right after the close of the Exhibit Hall, and carry on until 6:30 PM.

### **Rap Session #1 Digital Control Of Power Supplies: Easy As Pie Or Mind Boggling?**

Moderator: Arnold Alderman, Anagenesis, Inc.

Governor's Ballroom, Salon B

Now that digital control is inevitable, the question remains: Will the product offered be simple and user friendly or will it take an IT department to program it? Are you going to be augmenting your 4 power designers with 14 software designers? Will digital control be cost competitive? Are users really going to look at "system cost"? What do you think? What do you know? What do you need? Come and share in this free-for-all "Debate of the Decade"! The future of power supplies is at stake!

### **Rap Session #2 Will Alliances Help Or Hinder?**

Moderator: Alix Paultre, Electronic Products

Governor's Ballroom, Salon A

What is the force behind the creation of the alliances in the power supply industry? Will the alliances help or hurt the power supply industry? Will they help or hurt the customers? What will be next ac-dc or dc-dc alliance? The PSA (Power Supply Alliance), DOSA (Distributed-power Open-Standards Alliance) and POLA (Point-Of-Load Alliance) are groups of power supply companies making power converters with various levels of compatibility. And what about the PMBus™ open standard effort? Where does that fit in? What happens to the small power supply firms? Do they need to join an alliance to stay in business? Who are the real winners? Are there going to be any losers? These are all important questions for the power supply industry and the discussion promises to be lively between those embracing alliances and those that think that something could be fishy.

### **Rap Session #3 What Will Power Supply Companies Look Like In Five Years?**

Moderator: Todd Hendrix, Artesyn Technologies

Room 400

What will be left of the power supply industry in five years? Will there only be a few companies left? Will the semiconductor companies be the next generation of power companies? Will we have more alliances, so everyone is making the same products? Will there be any American companies left? Will there be only a few American design engineers? With globalization advancing every day, everyone is concerned about the future of their job. There have even been suggestions that American companies should outsource their CEOs and CFOs to China and India. Come and give your opinion on how you think the industry will evolve in the next five years.

## SPECIAL PRESENTATION SESSIONS

The Special Presentation Sessions were introduced last year 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. They will only be available from the APEC Web site for a limited time starting on Friday, March 4, 2005.

**Session SP1** **Wednesday, March 9**  
**Power Electronics for a Greener World** **Governor's Ballroom**  
**Salon C**  
**8:30 – 10:15 AM**

**Session Chair: Arnold Alderman, Anagenesis Inc.**

- SP1.1 Power Electronics for Renewable Energy Systems**  
B. Kroposki; National Renewable Energy Laboratory (NREL), Golden, CO
- SP1.2 International Perspective on Hydrogen Fuel Cells**  
F. Flett; Ballard Power Systems, Vancouver, CANADA
- SP1.3 Solid Oxide Fuel Cells**  
D. Collins; National Energy Technology Laboratory (NETL), Morgantown, WV
- SP1.4 Energy Efficiency Efforts in China**  
T. Li; China Certification Center for Energy Conservation Products (CECP), Beijing, CHINA



**Session SP2** **Wednesday, March 9**  
**Current Topics in Power Electronics Research** **Governor's Ballroom**  
**Salon C**  
**2:00 – 5:30 PM**

**Session Chairs: Ionel Dan Jitaru, Delta Energy Systems and Wayne Bowman, SynQor**

- SP2.1 Power Electronics Laboratory**  
J. Kyyrä; Helsinki University of Technology, Espoo, FINLAND
- SP2.2 Kyushu University**  
T. Ninomiya; Kyushu University, Fukuoka-shi, JAPAN

- SP2.3 Universidad de Concepción (Chile)**  
L. Morán; Universidad de Concepción, CHILE
- SP2.4 Silicon-Carbide Power Devices for High Voltage, High Frequency Power Conversion**  
A. Hefner; National Institute of Standards and Technology, Gaithersburg, MD
- SP2.5 The Convergence of Microelectronics and Power Electronics**  
S. Sanders; University Of California, Berkeley, CA
- SP2.6 One-Cycle Control and Its Applications in Power Quality Control and Renewable Power Generation**  
K. Smedley; University of California, Irvine, CA
- SP2.7 Assuring High Reliability in Higher Temperature and Power Packaging**  
D. Hopkins; State University of New York at Buffalo, NY



**Session SP3** **Thursday, March 10**  
**Power Electronics Industry Predictions** **Governor's Ballroom**  
**Salon C**  
**8:30 – 11:20 AM**

**Session Chairs: Carl Blake, International Rectifier and Conor Quinn, Artesyn Technologies**

- SP3.1 Transforming the Telephone Network: Implications for DC Power**  
J. Celantano; Skyline Marketing Group, Owings Mills, MD
- SP3.2 Wireless Communications Power Needs and Challenges**  
S-M Jonasson; Ericsson AB, Stockholm, SWEDEN
- SP3.3 Prospects for Automotive Electronics in the Next Decade**  
J. Nagashima; General Motors, Torrance, CA
- SP3.4 Solid State Power in the Home Appliance Industry**  
H. Marcy; Whirlpool, Benton Harbor, MI
- SP3.5 Future Power Solutions**  
S. Varma; Tyco Electronics Power Systems, Dallas, TX
- SP3.6 Superior Solutions from Customer's Feedback**  
L. Pechi; Power-One, Camarillo, CA



## PRESENTATION SESSIONS

---

These are the traditional APEC presentations. These papers have been selected through a rigorous peer review process and they are represented by papers in the APEC Proceedings. These papers were selected for oral presentation by the APEC Program Committee because they generally have a broader appeal than the papers selected for the Dialogue Sessions.

**Session 1** **Monday, March 7**  
**Plenary** **Governor's Ballroom**  
**1:30 – 5:30 PM**

**Session Chairs: Van Niemela, Fairchild Semiconductor and Russ Spyker, Air Force Research Laboratory**

- 1.1 The Role of Power Electronics in Raising Our Standard of Living**  
A. Lidow; International Rectifier, El Segundo, CA
- 1.2 Technology Trends in Computer Architecture and Their Impact on Power Subsystems**  
K. Kettler; Dell Inc., Round Rock, TX
- 1.3 Emerging Silicon Carbide Power Electronics Components**  
J.C. Zolper; Defense Advanced Research Projects Agency, Arlington, VA
- 1.4 Awards Presentation, 2005 Efficiency Challenge Design Competition**  
A. Fanara; US Environmental Protection Agency, Washington, DC
- 1.5 The Future of Power Semiconductors**  
I. Bencuya; Fairchild Semiconductor, San Jose, CA
- 1.6 Changing the Rules in Power Electronics**  
H. Stork; Texas Instruments, Dallas, TX



**Session 2**  
**Digital Control**  
**Techniques &**  
**Application**

**Tuesday, March 8**  
**Governor's Ballroom**  
**Salon C**  
**8:30 AM– Noon**

**Session Chairs: Stephen Bissell, Venable Industries and Mark Nelms, Auburn University**

- 2.1 High-Frequency Digital Controller for DC-DC Converters Based on Multi-Bit Sigma-Delta Pulse-Width Modulation**  
Z Lukic, K Wang, A Prodic; University of Toronto, CANADA
- 2.2 Piecewise Digital Control Method for DC-DC Converter**  
J. A. Abu Qahouq<sup>1</sup>, E. Shoubaki<sup>1</sup>, Y. Wen<sup>1</sup>, I. Batarseh<sup>1</sup>, G. Potter<sup>2</sup>; <sup>1</sup>University of Central Florida (UCF), Orlando, FL, <sup>2</sup>ASTEC Power, Andover, MA
- 2.3 A 16-bit Fixed-Point Digital Signal Processor for Digital Power Converter Control.**  
E. O'Malley, K. Rinne; University of Limerick, IRELAND
- 2.4 Practical On-Line Identification of Power Converter Dynamic Responses**  
B. Miao, R. Zane, D. Maksimovic; University of Colorado, Boulder, CO
- 2.5 Detection of Instability and Adaptive Compensation of Digitally Controlled Switched-Mode Power Supplies**  
M. Botao, R. Zane, D. Maksimovic; University of Colorado, Boulder, CO
- 2.6 A Flexible Rapid-Prototyping System for Digital-Controlled High Power Converters**  
C.L. Smith<sup>1,2</sup>, M.B. Gilliom<sup>1,2</sup>; <sup>1</sup>Fairchild Controls, Frederick, MD, <sup>2</sup>Virginia Tech, Blacksburg, VA
- 2.7 "Wireless" Control of Spatially Distributed Power Electronics**  
S.K. Mazumder, K. Acharya, M. Tahir; University of Illinois at Chicago, IL



**Session 3**  
**Fuel Cell Power**  
**Conditioning**  
**Tuesday, March 8**  
**Room 408**  
**8:30 AM– Noon**

**Session Chairs: Donald Collins, National Energy Technology Lab and Fang Peng, Michigan State University**

- 3.1 A Wide Input and High Efficiency DC-DC Converter for Fuel Cell Applications**  
L.E. Zubieta, G Panza; Versa Power Systems, Calgary, CANADA
- 3.2 Utilizing Fuel Cell and Supercapacitors for Automotive Hybrid Electrical System**  
P. Thounthong, S. Raël, B. Davat; Institut National Polytechnique de Lorraine, Nancy, FRANCE
- 3.3 Analysis and Minimization of Input Ripple Current in PWM Inverters for Designing Reliable Fuel Cell Power Systems**  
W. Shireen<sup>1</sup>, M. Arefeen<sup>2</sup>, R. Kulkarni<sup>1</sup>;  
<sup>1</sup>University of Houston, TX, <sup>2</sup>Texas Instruments Inc., Stafford, TX
- 3.4 An Improved Anti-Islanding Algorithm for Utility Interconnection of Multiple Distributed Fuel Cell Powered Generations**  
C Jeraputra<sup>1</sup>, E Aeloiza<sup>1</sup>, P Enjeti<sup>1</sup>, S Choi<sup>2</sup>;  
<sup>1</sup>Texas A&M University, College Station, TX,  
<sup>2</sup>Seoul National University of Technology, Seoul, KOREA
- 3.5 Novel Seamless Transfer Strategies for Fuel Cell Inverters from Grid-Tied Mode to Off-Grid Mode**  
G. Shen, D. Xu, D. Xi; Zhejiang University, Hangzhou, CHINA
- 3.6 Fuel Cell and Power Conditioning System Interactions**  
M.E. Schenck<sup>1,2</sup>, J.S. Lai<sup>1</sup>, K. Stanton<sup>1</sup>;  
<sup>1</sup>Virginia Tech, Blacksburg, VA, <sup>2</sup>American Power Conversion Corporation, Billerica, MA
- 3.7 A Small-Signal Equivalent Circuit Model for PEM Fuel Cells**  
E. Hernandez, B. Diong; University of Texas at El Paso, TX



**Session 4A**  
**Thermal Management**  
**Tuesday, March 8**  
**Room 406**  
**8:30 – 10:15 AM**

**Session Chair: Kevin Parmenter, Fairchild Semiconductor**

- 4A.1 Thermal Performance of Water-Cooled Heat Sinks**  
T. E. Salem<sup>1</sup>, D. Porschet<sup>2</sup>, S. B. Bayne<sup>2</sup>, Y. Chen<sup>3</sup>; <sup>1</sup>United States Naval Academy, Annapolis, MD, <sup>2</sup>Army Research Laboratory, Adelphi, MD, <sup>3</sup>Halfmoon Power Technologies, LLC, Clifton Park, NY
- 4A.2 Thermal Design Considerations for Voltage Regulator Modules**  
A.H. Ball, J. Zhou, F.C. Lee; Virginia Polytechnic Institute and State University, Blacksburg, VA
- 4A.3 Two-Phase Cooling Method Using R134a Refrigerant to Cool Power Electronic Devices**  
J.B. Campbell<sup>1</sup>, L.M. Tolbert<sup>1,2</sup>, C.W. Ayers<sup>2</sup>, B. Ozpineci<sup>2</sup>; <sup>1</sup>The University of Tennessee, Knoxville, TN, <sup>2</sup>Oak Ridge National Laboratory, Oak Ridge, TN
- 4A.4 Implementing PWM Fan Speed Control within a Computer Chassis Power Supply**  
A. Arredondo, R. Partha, E. Wofford; JMC Products, Austin, TX



**Session 4B**  
**The Business of Power**  
**Electronics**  
**Wednesday, March 9**  
**Room 406**  
**10:45 AM – Noon**

**Session Chair: Bruce Miller, Dell**

- 4B.1 Ac-Dc Server Power Supplies: Making the Leap to Higher Efficiency**  
C. Calwell<sup>1</sup>, A. Mansoor<sup>2</sup>; <sup>1</sup>Ecos Consulting, Durango, CO, <sup>2</sup>EPRI Power Electronics Applications Center, Knoxville, TN
- 4B.2 AC-DC Power Supply Growth Variation in China and North America**  
J.P. Bryant; Darenll Group, Corona, CA
- 4B.3 Trends in Digital Power Management: Power Converter and System Demand Characteristics**  
L.C. Brush; Darnell Group, Corona, CA



**Session 5**  
**Power System**  
**Architectures**

**Tuesday, March 8**  
**Governor's Ballroom**  
**Salon A**  
**8:30 AM– Noon**

**Session Chairs: Benoit Herve, Zilker Labs and Jose Cobos, Universidad Politecnica de Madrid, Spain**

- 5.1 Coordination of Design Issues in the Intermediate Bus Architecture**  
H. Huang; Astec Power of Emerson Network Power, Andover, MA
- 5.2 Digital Power System Management**  
R. White; Artesyn Technologies, Westminster, CO
- 5.3 Effect of Resonant Free Power Delivery Network Design on VRM Performance**  
O.M.P. Mandhana; Freescale Semiconductor, Inc., Austin, TX
- 5.4 Analysis of Input Filter Interactions in Switching Power Converters**  
D. Kim<sup>1</sup>, B. Choi<sup>1</sup>, D. Lee<sup>1</sup>, J. Sun<sup>2</sup>;  
<sup>1</sup>Kyungpook National University, Taegu, KOREA, <sup>2</sup>Rensselaer Polytechnic Institute, Troy, NY
- 5.5 Bi-Directional Power System for Laptop Computer**  
T. Cleveland; Microchip Technology Inc., Chandler, AZ
- 5.6 High Efficiency Battery Discharge Regulator with Parallel Power Processing**  
J.B. Ejea, A. Ferreres, E. Sanchis-Kilders, E. Maset, J. Jordán, V. Esteve; Univ. de Valencia, Burjassot, SPAIN
- 5.7 A High Power Density High Voltage Distributed Power System for Pulse Power Applications**  
B. Lu<sup>1</sup>, Y. Qiu<sup>1</sup>, C. Wang<sup>1</sup>, Y. Kang<sup>1</sup>, J. Sun<sup>1</sup>;  
<sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA, <sup>2</sup>GES Inc., Navarre, FL, <sup>3</sup>U.S. Army Research Lab, Adelphi, MD



**Session 6**  
**AC-DC Power Supplies**

**Tuesday, March 8**  
**Governor's Ballroom**  
**Salon B**  
**8:30 AM– Noon**

**Session Chairs: Bill Peterson, E&M Power and Khai Ngo, University of Florida**

- 6.1 Hold-Up Time Extension Circuit with Integrated Magnetics**  
Y. Jang, M.M. Jovanovic, D. L. Dillman; Delta Products Corporation, Research Triangle Park, NC
- 6.2 Converter and Controller for Micro-Power Energy Harvesting**  
S. Xu<sup>1</sup>, K.D.T. Ngo<sup>1</sup>, T. Nishida<sup>1</sup>, G.B. Chung<sup>2</sup>, A. Sharma<sup>1</sup>; <sup>1</sup>University of Florida, Gainesville, FL, <sup>2</sup>Hongik University, Jochiwon, KOREA
- 6.3 Five-Terminal Average Modeling and AC Analysis of PFC Converters in PSPICE**  
K. Rustom<sup>1</sup>, W. Qiu<sup>2</sup>, C. Iannello<sup>2</sup>, O. Abdel-Rahman<sup>2</sup>, I. Batarseh<sup>2</sup>; <sup>1</sup>APECOR Corp, Orlando, FL, <sup>2</sup>University of Central Florida, Orlando, FL
- 6.4 A Passive Coupled-Inductor Flying-Capacitor Lossless Snubber Circuit for Plasma Cutting Power Supply**  
G. R. Kamath; Hypertherm, Inc., Hanover, NH
- 6.5 Design of Half-Bridge Piezo-Transformer Converters in the AC Adapter Applications**  
S.J. Choi, T.I. Kim, B.H. Cho; Seoul National University, Seoul, KOREA
- 6.6 Resonant Rectifier for Piezoelectric Sources**  
S. Ben-Yaakov, N. Krihely; Ben-Gurion University, Beer Sheva, ISRAEL
- 6.7 A 10 kW Single-Stage Converter for Welding with Inherent Power Factor Correction & Soft Switching**  
N.C. Huang<sup>1</sup>, D.R. Zhang<sup>1</sup>, T.T. Song<sup>1</sup>, M.W. Fan<sup>1</sup>, G.L. Liu<sup>1</sup>, Y. Zhao<sup>2</sup>, F. Zhang<sup>2</sup>; <sup>1</sup>Sichuan University, Chengdu, CHINA



**Session 7**  
**Voltage Regulator**  
**Modules**

**Tuesday, March 8**  
**Governor's Ballroom**  
**Salon D**  
**8:30 AM– Noon**

**Session Chairs: Ashraf Lotfi, Enpirion and Siamak**  
**Abedinpour, Freescale Semiconductor**

- 7.1 Design Methodology for Dynamic Voltage Scaling in the Buck Converter**  
A. Soto, P. Alou, J.A. Cobos; Universidad Politécnica de Madrid, SPAIN
- 7.2 The Design of a High-Frequency Multiphase Voltage Regulator with Adaptive Voltage Positioning and All Ceramic Capacitors**  
W. Huang; International Rectifier, North Kingstown, RI
- 7.3 Accuracy Analysis of Hysteretic Current-Mode Voltage Regulator**  
C. Song, J. Nilles; National Semiconductor Corporation, Santa Clara, CA
- 7.4 Practical Design Considerations of Current Sharing Control for Parallel VRM Applications**  
W. Qiu, G. Liang; Intersil Corp., Kent, WA
- 7.5 A Novel Input Side Current Sensing Method to Achieve AVP for Future VRs**  
J. Sun, J. Zhou, M. Xu, F.C. Lee; Virginia Polytechnic Institute and State University, Blacksburg, VA
- 7.6 1.8 MHz, 48 V Resonant VRM**  
L. Huber<sup>1</sup>, K. Hsu<sup>2</sup>, M.M. Jovanovic<sup>1</sup>; <sup>1</sup>Delta Products Corporation, RTP, NC, <sup>2</sup>Delta Electronics, Inc., Chung Li, TAIWAN
- 7.7 A Novel Non-Isolated Half Bridge DC-DC Converter**  
Z. Yang, S. Ye, Y.F. Liu; Queen's University, Kingston, CANADA



**Session 8**  
**Discrete Semiconductor**  
**Devices**

**Tuesday, March 8**  
**Governor's Ballroom**  
**Salon E**  
**8:30 AM– Noon**

**Session Chairs: Charles Mullett, ON**  
**Semiconductor and Tom Nath, Intel Corporation**

- 8.1 Novel 600 V GaN Schottky Diode Delivering SiC Performance at Si Prices**  
I. Cohen<sup>1</sup>, T.G. Zhu<sup>2</sup>, L. Liu<sup>2</sup>, M. Murphy<sup>2</sup>, M. Pophristic<sup>2</sup>, M. Pabisz<sup>2</sup>, M. Gottfried<sup>2</sup>, B.S. Shelton<sup>2</sup>, B. Peres<sup>2</sup>, A. Ceruzzi<sup>2</sup>, R.A. Stall<sup>2</sup>; <sup>1</sup>Lambda, Plainview, NY, <sup>2</sup>Emcore Corporation, Somerset, NJ
- 8.2 High Temperature Operation of a DC-DC Power Converter Utilizing SiC Power Devices**  
B. Ray<sup>1</sup>, J.D. Scofield<sup>2</sup>, R.L. Spyker<sup>2</sup>, B. Jordan<sup>2</sup>, S.H. Ryu<sup>3</sup>; <sup>1</sup>Bloomsburg University, Bloomsburg, PA, <sup>2</sup>Air Force Research Laboratory, AFRL/PRPE, Wirtgh-Patterson AFB, OH, <sup>3</sup>CREE, Inc., Durham, NC
- 8.3 High-Temperature and High-Frequency Performance Evaluation of 4H-SiC Unipolar Power Devices**  
M.S. Chinthavali<sup>1</sup>, B. Ozpineci<sup>1</sup>, L.M. Tolbert<sup>1,2</sup>; <sup>1</sup>Oak Ridge National Laboratory, Oak Ridge, TN, <sup>2</sup>The University of Tennessee, Knoxville, TN
- 8.4 Characterization of 6.5 kV IGBT Modules for Hard- and Soft-Switching Operation in Medium Voltage Applications**  
U. Schwarzer, R. W. De Doncker; Institute for Power Electronics and Electrical Drives, Aachen, GERMANY
- 8.5 Design Considerations for a New Generation Mid-Voltage Power MOSFET Technology**  
Q. Zhao, G. Stojcic; International Rectifier, El Segundo, CA
- 8.6 P-Channel Chip-Scale Lateral Power MOSFET for Portable Electronics Applications**  
Z. J. Shen<sup>1,2</sup>, D. Okada<sup>1</sup>, F. Lin<sup>1</sup>, X. Cheng<sup>2</sup>, S. Anderson<sup>1</sup>; <sup>1</sup>Great Wall Semiconductor, Tempe, AZ, <sup>2</sup>University of Central Florida, Orlando, FL
- 8.7 Development of a Scalable Power Semiconductor Switch (SPSS)**  
H. Wang<sup>1</sup>, A.Q. Huang<sup>2</sup>, B. Chen<sup>2</sup>, F. Wang<sup>1</sup>; <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA, <sup>2</sup>North Carolina State University, Raleigh, NC

◆  
◆  
◆

**Session 9**  
**Physical Design & Packaging**

**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon A**  
**8:30 – 10:15 AM**

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

- 9.1 High Temperature Embedded Power Chip Module**  
J. Yin, Z. Liang, J.D. van Wyk; Virginia Tech, Blacksburg, VA
- 9.2 Design of Integrated LLCT Module for LLC Resonant Converter**  
W. Liu, J. D. van Wyk; Virginia Polytechnic Institute and State University, Blacksburg, VA
- 9.3 Design of an Embedded Bi-Planar Coil-Based Integrated Current Sensor for Power Module Integration**  
J. Xu, L. Zhao, Z. Liang, J.D. van Wyk; Virginia Polytechnic Institute and State University, Blacksburg, VA
- 9.4 Functional Integration in Active IPEM Using a Planar Integration Technology**  
Z. Liang, J. D. van Wyk; Virginia Polytechnic Institute and State University, Blacksburg, VA

◆  
◆

**Session 10**  
**New Topologies for Non-Integrated DC-DC Converters**

**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon B**  
**8:30 – 10:15 AM**

**Session Chairs: Wisam Moussa, C&D Technologies and Byungcho Choi, Kyungpook National University, Korea**

- 10.1 Tight Magnetic Coupling in Multiphase Interleaved Converters Based on Simple Transformers**  
P. Zumel<sup>1</sup>, O. Garcia<sup>2</sup>, J. Cobos<sup>2</sup>, J. Uceda<sup>2</sup>; <sup>1</sup>Universidad Carlos III de Madrid, Leganes, SPAIN, <sup>2</sup>Universidad Politécnica de Madrid, SPAIN
- 10.2 The Multi-Frequency Small-Signal Model for Buck and Multiphase Interleaving Buck Converters**  
Y. Qiu, M Xu, K Yao, J Sun, F Lee; Virginia Polytechnic Institute and State University, Blacksburg, VA

**10.3 Analysis and Design of an Active-Clamp Buck Converter with Coupled Inductors**  
T.-F. Wu<sup>1</sup>, J.-C. Hung<sup>1</sup>, Y.-S. Lai<sup>1</sup>, H.-S. Nien<sup>1</sup>, H.-M. Su<sup>2</sup>; <sup>1</sup>National Chung Cheng University., Chia-Yi, TAIWAN, <sup>2</sup>Industrial Technology Research Institute, Hsin-Chu, TAIWAN

**10.4 A New Zero Voltage Switching Boost DC-DC Converter with Active Clamping**  
X.K Wu, X. Ye, Z. Qian, J. Zhang; Zhejiang University, Hangzhou, CHINA

◆  
◆

**Session 11**  
**Multilevel Converters**

**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon D**  
**8:30 – 10:15 AM**

**Session Chairs: Burak Ozpineci, Oak Ridge National Lab and Dai Min, Ohio State University**

- 11.1 Hysteresis-Band Control Based PWM Strategy for Three-Level Inverter's Neutral-Point Balance**  
W. Yao, Z. Lu, R. Zhao, W. Fei, Z. Qian; National Laboratory of Power Electronics, HangZhou, CHINA
- 11.2 Modulation Extension Control for Multilevel Converters Using Triplen Harmonic Injection with Low Switching Frequency**  
Z. Du<sup>1</sup>, L. M. Tolbert<sup>1,2</sup>, J. N. Chiasson<sup>1</sup>; <sup>1</sup>The University of Tennessee, Knoxville, TN, <sup>2</sup>Oak Ridge National Laboratory, Oak Ridge, TN
- 11.3 A New Three-Phase Five-Level Current-Source Inverter**  
X Xiong, L Li, Y Yang, Z Zhang, W Wei; Zhejiang University, Hangzhou, CHINA
- 11.4 A Half-Bridge Single-Phase Two-Wire PV Inverter System with Active Power Filtering and Real Power Injection**  
T.-F. Wu<sup>1</sup>, H.-S. Nien<sup>1</sup>, C.-L. Shen<sup>2</sup>, H.-M. Hsieh<sup>1</sup>, Y.-M. Chen<sup>1</sup>; <sup>1</sup>National Chung Cheng University, Chia-Yi, TAIWAN, <sup>2</sup>Nan-Jeon Institute of Technology, Tainan, TAIWAN



**Session 12** **Wednesday, March 9**  
**Adjustable Speed** **Room 406**  
**Induction Motor Drives** **8:30 – 10:15 AM**

**Session Chairs: Tim A. Haskew, University of Alabama and Brent J. Brzezinski, University of Alabama**

- 12.1 Optimum Torque Control of Induction Machines in the Field-Weakened Region**  
G. Gallegos-Lopez, F.S. Gunawan, J.E. Walters; Delphi Corporation, Kokomo, IN
- 12.2 Impact of Hybrid Multilevel Modulation Strategy on Input and Output Harmonic Performances**  
C. Rech, J. R. Pinheiro; Federal University of Santa Maira, BRAZIL
- 12.3 Sensorless Control of an Induction Motor Using Natural Variables with Loss Minimization**  
O. Ojo, G. Dong; Tennessee Technological University, Cookeville, TN
- 12.4 Reduced Switch Count Dual-Winding AC Drive System With Common-Mode Voltage Mitigation**  
M.B.R. Correa<sup>1</sup>, C.B. Jacobina<sup>1</sup>, C.R. da Silva<sup>1,2</sup>, A.M.N. Lima<sup>1</sup>; <sup>1</sup>LEIAM - DEE - UFCG, Campina Grande, BRAZIL, <sup>2</sup>CEFET-CE, Fortaleza, BRAZIL



**Session 13** **Wednesday, March 9**  
**Energy Systems for** **Room 408**  
**Transportation** **8:30 – 10:15 AM**

**Session Chairs: John Miller, J-N-J Miller, PLC and Joel Gouker, John Deere Corporate Technologies**

- 13.1 A Novel Digital Power Controller for Fuel Cell/Battery Hybrid Power Sources**  
Z Jiang, R Dougal, R Leonard; University of South Carolina, Columbia, SC
- 13.2 Design and Implementation of a Hybrid Energy Supply System for Railway Vehicle**  
R. Li, A. Pottharst, K. Witting, O. Znamenshchikov, J. Böcker, N. Fröhleke, R. Feldmann, M. Dellnitz; University of Paderborn, GERMANY

**13.3 An Assessment of Ultra-capacitors as the Power Cache in Toyota THS-II, GM-Allison AHS-2 and Ford FHS Hybrid Propulsion Systems**

J.M Miller<sup>1</sup>, M. Everett<sup>2</sup>; <sup>1</sup>J-N-J Miller Design Services, P.L.C., Cedar, MI, <sup>2</sup>Maxwell Technologies Inc., San Diego, CA

**13.4 Simulation and Field-Testing of Hybrid Ultra-Capacitor/Battery Energy Storage Systems for Electric and Hybrid-Electric Transit Vehicles**

J. Anstrom<sup>2</sup>, B. Zile<sup>2</sup>, K. Smith<sup>2</sup>, H. Hofmann<sup>1</sup>, A. Batra<sup>1</sup>; <sup>1</sup>The Pennsylvania State University, University Park, PA, <sup>2</sup>Pennsylvania Transportation Institute



**Session 14** **Wednesday, March 9**  
**Three-Phase Rectifiers** **Governor's Ballroom**  
**Salon E**  
**8:30 – 10:15 AM**

**Session Chair: Regan Zane, Colorado University - Boulder**

**14.1 A Novel Hysteresis Current Control for Three-Phase Three-Level PWM Rectifiers**  
L. Dalessandro, U. Drogenik, S. D. Round, J. W. Kolar; Power Electronic Systems Laboratory, ETH Zurich, SWITZERLAND

**14.2 A New Controller for Three-phase Boost Rectifiers Lacking Balance in Source Voltages and Impedances**  
O. Ojo, Z. Wu; Tennessee Tech. University, Cookeville, TN

**14.3 A Novel Three-Phase Single-Switch Buck-Type Rectifier**  
J. Shah, G. Moschopoulos; University of Western Ontario, London, CANADA

**14.4 Ultra Compact Three-Phase Rectifier with Electronic Smoothing Inductor**  
K. Mino, M. L. Heldwein, J. W. Kolar; Swiss Federal Institute of Technology (ETH) Zurich, SWITZERLAND



**Session 15**  
**Uninterruptible Power**  
**Supplies**

**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon A**  
**2:00 – 5:30 PM**

**Session 16**  
**Electronic Ballasts**

**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon B**  
**2:00 – 5:30 PM**

**Session Chairs: Jian Sun, Rensselaer Polytechnic Institute and Michael Schenck, American Power Conversion**

**Session Chairs: Jianwen Shao, STMicroelectronics and Javier Ribas, University of Oviedo, Spain**

**15.1 Design and Implementation of a Paralleled Inverter System with Failure Isolation and Hot-Swap Features**

T.-F. Wu<sup>1</sup>, H.-M. Hsieh<sup>1</sup>, Y.-E. Wu<sup>1,2</sup>, Y.-K. Chen<sup>3</sup>, W.-Z. Pen<sup>1</sup>; <sup>1</sup>National Chung Cheng University, Chia-Yi, TAIWAN, <sup>2</sup>Wu-Feng Institute of Technology, Chia-Yi, TAIWAN, <sup>3</sup>National Huwei Institute of Technology, YunLin, TAIWAN

**15.2 Fast Controller Based on Active-Power-Feed-Forward for PFC Converter Applied to UPS**

Z.Jiang, J.Tan, Y. Cheng, H. Gan; Delta Electronics Co., Ltd, Shanghai, CHINA

**15.3 Input Stage of Double-Conversion UPSs Using Integration Concept of ZVT Auxiliary Commutation Circuit**

L. Schuch, C. Rech, J.R. Pinheiro; Federal University of Santa Maria, BRAZIL

**15.4 A PWM Rectifier Control Technique for Three-Phase Double Conversion UPS under Unbalanced Load**

M. Dai, M.N. Marwali, J.W. Jung, A. Keyhani; The Ohio State University, Columbus, OH

**15.5 State-Feedback-with-Integral Control plus Repetitive Control for UPS Inverters**

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

**15.6 Steady-State Invariant Frequency and Amplitude Droop Control Using Adaptive Output Impedance for Parallel-Connected UPS Inverters**

J.M. Guerrero, L. Garcia de Vicuña, J. Matas, J. Miret, J. Cruz; Universitat Politecnica de Catalunya, Barcelona, SPAIN

**15.7 Optimized Design of Single-Phase Uninterruptible Power Supply (UPS) System**

Q. Zhu, J.Tan, Y. Li, J. Ying; Delta Electronics Co., Ltd, Shanghai, CHINA



**16.1 An Automatic Lamp Detection Technique for Electronic Ballasts**

L.M. Lee, S.Y.R. Hui, H.S.H. Chung; City University of Hong Kong, CHINA

**16.2 A New Building Block to Light the Way to Rapid Ballast Design**

C. Contenti, Z. Huang; International Rectifier, El Segundo, CA

**16.3 Constant Power Control Based Self-oscillating Electronic Ballast**

R.L. Lin, Y.D. Lee; National Cheng Kung University, Tainan City, TAIWAN

**16.4 A Low Cost and Reliable Dimmable Ballast Topology with Inherent Power Regulation and Insensitivity to Lamp Characteristics**

C.P. Liu, N.K. Poon, Y.P. Chan, D.D.C. Lu, M.H. Pong; University of Hong Kong, Pokfulam, HONG KONG

**16.5 Electronic Ballast for Metal Halide Lamps based on a Class E Resonant Inverter Operating at 1 MHz**

J. Ribas, J. Cardesin, J. Garcia, M.A. Dalla-Costa, J.M. Alonso; Univ. de Oviedo, Gijon, SPAIN

**16.6 Single-Stage CCM PFC Electronic Ballast**

R. L. Lin, Y. M. Lan, F. Y. Chen, T. J. Liang, J. F. Chen; National Cheng Kung University, Tainan City, TAIWAN

**16.7 Design of Piezoelectric Transformer for PFC Electronic Ballast**

W. Huang<sup>1</sup>, D. Chen<sup>2</sup>, E. Baker<sup>3</sup>, J. Zhou<sup>4</sup>, F. Lee<sup>4</sup>; <sup>1</sup>Picor Corporation, North Smithfield, RI, <sup>2</sup>National Taiwan University, Taipei, TAIWAN, <sup>3</sup>Crown International, Inc., Elkhart, IN, <sup>4</sup>Virginia Tech, Blacksburg, VA



**Session 17**  
**Multi-Phase PFC Circuits**  
**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon D**  
**2:00 – 5:30 PM**

**Session Chairs: Richard Farrington, SynQor and Alireza Bakhshai, Queen's University, Kingston, Ontario, Canada**

- 17.1 Practical Aspects of the Unity Power Factor Isolated Three-Phase Rectifier Based on the Scott Transformer**  
S.K.T. Miller, I. Barbi; Federal University of Santa Catarina, Florianopolis, BRAZIL
- 17.2 Modification of Double Vector Control Algorithm to Filter Out Grid Harmonics**  
H. Awad<sup>1</sup>, F. Blaabjerg<sup>2</sup>; <sup>1</sup>Faculty of Industrial Education, Cairo, EGYPT, <sup>2</sup>Aalborg University, Aalborg, DENMARK
- 17.3 Evaluation of Harmonic Detection Methods for Active Power Filter Applications**  
L. Asiminoaei<sup>1</sup>, F. Blaabjerg<sup>1</sup>, S. Hansen<sup>2</sup>; <sup>1</sup>Aalborg University, Aalborg, DENMARK, <sup>2</sup>Danfoss Drives A/S, Graasten, DENMARK
- 17.4 A Novel Zero Voltage Switching SVM (ZVS-SVM) Controlled Three-Phase Boost Rectifier**  
B. Feng, D. Xu, W. Wang, J. Xu; Zhejiang University, Hangzhou, CHINA
- 17.5 A DSP based Digitally Controlled Interleaved PFC Converter**  
S. Choudhury<sup>1</sup>, J. Noon<sup>2</sup>; <sup>1</sup>Texas Instruments Inc., Stafford, TX, <sup>2</sup>Oztek Corporation, Merrimack, NH
- 17.6 Control and Topologies for Three-Phase Three-Level Active Power Filters**  
T. Jin, J. Wen, K. Smedley; University of California, Irvine, CA
- 17.7 A Robust 18-Pulse Rectifier for Adjustable Speed Drive (ASD) Systems**  
E. Aeloiza<sup>1</sup>, Y. Durrani<sup>1</sup>, M. Rayner<sup>2</sup>, R. Gopinath<sup>2</sup>, P. Enjeti<sup>1</sup>; <sup>1</sup>Texas A&M University, College Station, TX, <sup>2</sup>Toshiba International Corporation, Bryan, TX



**Session 18**  
**DC-DC Isolated**  
**Topologies**  
**Wednesday, March 9**  
**Governor's Ballroom**  
**Salon E**  
**2:00 – 5:30 PM**

**Session Chairs: Andrzej Wojtasik, Ericsson Power Modules and Bo Cho, Seoul National University, Korea**

- 18.1 A Novel Zero-Current-Transition Full Bridge DC-DC Converter**  
J.M. Zhang, X.G. Xie, X.K. Wu, Z. Qian; Zhejiang University, Hangzhou, CHINA
- 18.2 A Transformer Assisted ZVS Scheme For Flyback Converter**  
S. Chen, Y. Gu, Z. Lu, Z. Qian, W. Yao; Zhejiang University, Hangzhou, CHINA
- 18.3 Interleaved Boost-Input-Type Full Bridge Converter**  
H. Terashi<sup>2</sup>, T. Sonoda<sup>1</sup>, S. Tomioka<sup>2</sup>, K. Sato<sup>2</sup>, T. Ninomiya<sup>1</sup>; <sup>1</sup>Kyushu University, Fukuoka, JAPAN, <sup>2</sup>Densei Lambda K.K, Niigata, JAPAN
- 18.4 Simple Feedback Linearizing Controller to Reduce Audiosusceptibility and Load Disturbance in the Full-Bridge Current Doubler Synchronous Rectifier**  
J.M. Guerrero, L. Garcia de Vicuña, N. Berbel, J. Sosa, M. Castilla; Universitat Politècnica de Catalunya, Barcelona, SPAIN
- 18.5 Emulation of Fractional Turns in Push-Pull Topologies**  
K.D. Papastergiou, C.K.R.M. Loh, D.E. Macpherson, J.K.H. Shek; The University of Edinburgh, UK
- 18.6 Synchronous Rectifier MOSFET Driver Substantially Reduces Power Adapter Heat**  
C. Wang; Anachip USA, Inc, San Jose, CA
- 18.7 Transient Response Improvement in Isolated DC-DC Converter With Current Injection Circuit**  
X. Wang<sup>1</sup>, I. Batarseh<sup>1</sup>, Q. Li<sup>2</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>Zhejiang University of Technology, Hangzhou, CHINA





**Session 21**  
**Digital Control of Single-Phase PFC**  
Thursday, March 10  
Governor's Ballroom  
Salon A  
8:30 AM– Noon

**Session Chairs: Joseph Thottuvelil, Tyco Electronics Power Systems and Kai Zhang, Huazhong University of Science and Technology (HUST), Wuhan, China**

- 21.1 A New Duty Cycle Parallel Control Method and FPGA Implementation for AC-DC Converters with Power Factor Correction (PFC)**  
W. Zhang<sup>1</sup>, G. Feng<sup>1</sup>, Y.-F. Liu<sup>1</sup>, B. Wu<sup>2</sup>;  
<sup>1</sup>Queen's University, Kingston, CANADA,  
<sup>2</sup>Ryerson University, Toronto, CANADA
- 21.2 Bridgeless PFC Implementation Using One Cycle Control Technique**  
M. Soldano<sup>1</sup>, B. Lu<sup>2</sup>, R. Brown<sup>1</sup>; <sup>1</sup>International Rectifier Corp., El Segundo, CA, <sup>2</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA
- 21.3 Digital Implementation of a Unity Power Factor Constant Frequency DCM Boost Converter**  
Z.Z. Ye, M.M. Jovanovic, B.T. Irving; Delta Products Corporation, Research Triangle Park, NC
- 21.4 One Cycle Control IC Simplifies PFC Designs**  
M. Soldano, R. Brown; International Rectifier Corp., El Segundo, CA
- 21.5 A Novel Multimode Digital Control Approach for Single Stage Flyback Power Supplies with Power Factor Correction and Fast Output Voltage Regulation**  
J. Zheng, A. Shteynberg, D. Zhou, J. McCreary; iWatt Inc., Los Gatos, CA
- 21.6 DSP Implementation of a Single-Cycle Predictive Current Controller in a Boost PFC Rectifier**  
P. Athalye, D. Maksimovic, R.W. Erickson; University of Colorado at Boulder, CO



**Session 22**  
**AC-Output Converter Circuits**  
Thursday, March 10  
Governor's Ballroom  
Salon B  
8:30 AM– Noon

**Session Chairs: Qinghong Yu, Osram Sylvania and Leon Tolbert, The University of Tennessee**

- 22.1 A Novel Split Phase Dual Buck Half Bridge Inverter**  
C. Zhu, F. Zhang, Y. Yan; Nanjing University of Aeronautics & Astronautics, Nanjing, CHINA
- 22.2 Multi-Input Inverter for Grid-Connected Hybrid PV/Wind Power System**  
Y.-M. Chen, S.-C. Hung, C.-S. Cheng, Y.-C. Liu; National Chung Cheng University, Chia-Yi, TAIWAN
- 22.3 Utility Interactive Two-Switch Edge-Resonant DC Link Snubber-Assisted Three-Phase V-Connection Soft Switching Sinewave Inverter with Two Quadrant Soft Switching Chopper**  
T. Ahemd<sup>1</sup>, S. Nagai<sup>2</sup>, E. Hiraki<sup>1</sup>, M. Nakaoka<sup>1</sup>;  
<sup>1</sup>Yamaguchi University, Yamaguchi, JAPAN,  
<sup>2</sup>Sanken Electric Co., Ltd., Saitama, JAPAN
- 22.4 Constant-Frequency Resonant Inverter for AC-Bus Distribution System**  
Y. Jang, M.M. Jovanovic; Delta Products Corporation, Research Triangle Park, NC
- 22.5 Bus-Tie Synchronization and Load Share Technique in a Ring Bus System with Multiple Power Inverters**  
C. Mak, L. Bolster; L-3 Communications Power Paragon Inc., Anaheim, CA
- 22.6 Analytical Calculation of the Conduction and Switching Losses of the Conventional Matrix Converter and the (Very) Sparse Matrix Converter**  
F. Schafmeister, C. Rytz, J.W. Kolar; Power Electronic Systems Laboratory, ETH Zurich, SWITZERLAND



**Session 23** **Thursday, March 10**  
**Analysis & Control of** **Governor's Ballroom**  
**Non-Isolated DC-DC** **Salon D**  
**Converters** **8:30 AM– Noon**

**Session Chairs: Philip McKenzie, Zilker Labs and**  
**Howard Ambramowitz, Systel-USA**

**23.1 A Digital Current Mode Control Technique**  
**for DC-DC Converters**

S. Chattopadhyay, S. Das; Indian Institute of  
Technology Madras, Chennai, INDIA

**23.2 Analysis of High-performance**  
**Synchronous-Asynchronous Digital**  
**Control for DC-DC Boost Converters**

S Saggini<sup>1</sup>, G. Garcea<sup>2</sup>, M. Ghioni<sup>2</sup>, P.  
Mattavelli<sup>3</sup>; <sup>1</sup>ST Microelectronics, Cornaredo  
(MI), ITALY, <sup>2</sup>DEI, Politecnico di Milano,  
ITALY, <sup>3</sup>DIEGM, University of Udine, ITALY

**23.3 Digital Current-Mode Controller for DC-DC**  
**Converters**

H. Peng, D. Maksimovic; University of  
Colorado at Boulder, CO

**23.4 Small Signal Modeling for Current Mode**  
**Controlled Cuk and SEPIC Converters**

W. Gu; National Semiconductor Corporation,  
Santa Clara, CA

**23.5 Sensorless Optimization of Dead Times in**  
**DC-DC Converters with Synchronous**  
**Rectifiers**

V. Yousefzadeh, D. Maksimovic; University of  
Colorado at Boulder, CO

**23.6 Switched Noise Filter For the Buck**  
**Converter Using the Output Ripple as the**  
**PWM Ramp**

R. Redl<sup>1</sup>, G. Reizik<sup>2</sup>; <sup>1</sup>ELFI S.A., Farvagny,  
SWITZERLAND, <sup>2</sup>Analog Devices, Inc., San  
Jose, CA



**Session 24** **Thursday, March 10**  
**Permanent Magnet Motor** **Room 406**  
**Drives** **8:30 AM– Noon**

**Session Chairs: Thomas Hopkins, ST**  
**Microelectronics and Lei Hao, Wavecrest**  
**Laboratories**

**24.1 A Novel Brushless DC Motor Speed**  
**Estimator Based on Space-Frequency**  
**Localized Wavelet Neural Networks (WNNs)**

Y. Song, F. Ponci, A. Monti, L. Gao, R. Dougal;  
University of South Carolina, Columbia, SC

**24.2 Further Improvement of Direct Back EMF**  
**Detection for Sensorless Brushless DC**  
**(BLDC) Motor Drives**

J. Shao, D. Nolan; STMicroelectronics,  
Schaumburg, IL

**24.3 Research on the Commutation Current**  
**Prediction Control in Brushless DC Motor**

K. Wei, ZH.L. Lou, ZH.C Zhang; Zhejiang  
University, Hangzhou, CHINA

**24.4 On-Line Minimum-Copper-Loss Control of**  
**Interior Permanent-Magnet Synchronous**  
**Machines for Automotive Applications**

Y. Jeong<sup>1</sup>, S. Sul<sup>1</sup>, S. Hiti<sup>2</sup>, K. Rahman<sup>2</sup>; <sup>1</sup>Seoul  
National University, Seoul, KOREA, <sup>2</sup>General  
Motors, Torrance, CA

**24.5 Sensorless Vector Control of Super High**  
**Speed Turbo Compressor**

J.S. Yim<sup>1</sup>, W.J. Lee<sup>1</sup>, S.K. Sul<sup>1</sup>, H.S. Yang<sup>2</sup>,  
J.T. Kim<sup>2</sup>; <sup>1</sup>Seoul National University, Seoul,  
KOREA, <sup>2</sup>Samsung Techwin Co., Seoul,  
KOREA

**24.6 Closed-Loop Control of Torsional**  
**Harmonics in a Permanent Magnet**  
**Synchronous Machine Without Use of a**  
**Position Encoder**

P. Beccue<sup>1</sup>, S. Pekarek<sup>1</sup>, B. Fahimi<sup>2</sup>; <sup>1</sup>Purdue  
University, West Lafayette, IN, <sup>2</sup>University of  
Texas at Arlington, TX



**Session 25** **Thursday, March 10**  
**Capacitors & Chargers** **Room 408**  
**8:30 AM– Noon**

**Session Chairs: Mark Wojcicki, Anderson Power**  
**Products and Herb Hess, University of Idaho**

**25.1 Failure Prediction of the Electrolytic**  
**Capacitor Using DSP Methods**

A.M. Imam, T.G. Habetler, R.G. Harley, D.  
Divan; Georgia Institute of Technology,  
Atlanta, GA

**25.2 An Indirect Method of Measuring DC Bus**  
**Capacitor Current**

R.W. Reese, L. Wei, R.A. Lukaszewski;  
Rockwell Automation, Mequon, WI

**25.3 Large Signal Dielectric Characterization for**  
**Integrated Electromagnetic Power Passives**

Y. Liang, R. Chen, J.D. van Wyk; Virginia  
Polytechnic Institute and State University,  
Blacksburg, VA

**25.4 Positive/Negative Pulse Battery Charger with Energy Feedback and Power Factor Correction**

Y.-S. Chu, R.-Y. Chen, T.-J. Liang, S.-K. Changchien, J.-F. Chen; National Cheng Kung University, Tainan, TAIWAN

**25.5 A Combined SOC Estimation Method Under Varied Ambient Temperature for a Lead-Acid Battery**

M. Coleman<sup>1</sup>, C.B. Zhu<sup>2</sup>, C.K. Lee<sup>1</sup>, W.G. Hurley<sup>1</sup>; <sup>1</sup>National University of Ireland, Galway, IRELAND, <sup>2</sup>Harbin Institute of Technology, Harbin, CHINA

**25.6 Wavelet Neural Network based Battery State-of-Charge Estimation for Portable Electronics Applications**

L. Gao, Y. Song, R. Dougal; University of South Carolina, Columbia, SC



**Session 26  
Automotive Electronics**

**Thursday, March 10  
Governor's Ballroom  
Salon E  
8:30 AM– Noon**

**Session Chairs: Frank Cirolia, Artesyn Technologies and Gui-Jia Su, Oak Ridge National Laboratory**

**26.1 Bimodal DC-DC Converter with an Efficient Pass-Through Zone**

C. Mullett; ON Semiconductor, Phoenix, AZ

**26.2 Development of the Control logic for the 42 V HEV System**

J.H Lee, B.H Cho; Seoul National Univ., Seoul, KOREA

**26.3 A Low Cost, Triple-Voltage Bus DC-DC Converter for Automotive Applications**

G.-J. Su<sup>1</sup>, F.Z. Peng<sup>2</sup>; <sup>1</sup>Oak Ridge National Laboratory, Knoxville, TN, <sup>2</sup>Michigan State University, East Lansing, MI

**26.4 Control Methods for EMI Noises Appearing in Electric Vehicle Drive Systems**

M. Nobuyoshi, N. Mikiharu, N. Joji, K. Masaki; Tokyo Metropolitan Institute of Technology, Tokyo, JAPAN

**26.5 Arc Fault Management By Solid State Switches For Enhanced Automotive Safety**

A. Martinez, B. Diong, S. Arunachalam, S. Dulluru; University of Texas at El Paso, TX

**26.6 Reduction of Engine Torque Ripple at Starting with Belt Driven Integrated Starter Generator**

T.-S. Kwon, D.-H. Lee, S.-K. Sul; Seoul National University, Seoul, KOREA



**Session 27  
Ballasts for HID and CCF  
Lamps**

**Thursday, March 10  
Governor's Ballroom  
Salon A  
2:00 – 5:30 PM**

**Session Chairs: Michael Andersen, Technical University of Denmark and Ray-Lee Lin, National Cheng Kung University, Taiwan**

**27.1 Design and Analysis of High-Voltage Transformer for HID Lamp Igniter**

W.S. Kim<sup>1</sup>, B.H. Cho<sup>1</sup>, K.C. Lee<sup>2</sup>; <sup>1</sup>Seoul National Univ., Seoul, KOREA, <sup>2</sup>Interpower Co., Ltd., Seoul, KOREA

**27.2 A Novel Single-Stage Low-Frequency Square-Wave Electronic Ballast for Low-Wattage HID Lamps**

Y. Yang, Z. Qian, X. Wu; Zhejiang University, Hangzhou, CHINA

**27.3 Design of Resonant Inverters for Optimal Efficiency Over Lamp Life in Electronic Ballast with Phase Control**

F.J. Azcondo<sup>1</sup>, R. Zane<sup>2</sup>, Ch. Brañas<sup>1</sup>; <sup>1</sup>University of Cantabria, Santander, SPAIN, <sup>2</sup>University of Colorado, Boulder, CO

**27.4 A New Control Method for a Low Frequency Inverter of MHD Lamp Ballasts with a Synchronous Rectifier**

I.K. Lee, B.H. Cho; Seoul National University, Seoul, KOREA

**27.5 Fully Integrated Ballast Controller with Digital Phase Control**

Y. Yin, M. Shirazi, R. Zane; University of Colorado, Boulder, CO

**27.6 Low Frequency Architecture for Multi-Lamp CCFL Systems with Capacitive Ignition**

M. Doshi<sup>1</sup>, J. Bian<sup>1</sup>, R. Zane<sup>1</sup>, F. Azcondo<sup>2</sup>; <sup>1</sup>University of Colorado, Boulder, CO, <sup>2</sup>Universidad de Cantabria, Santander, SPAIN

**27.7 A SPICE Compatible Behavioral Model of a Heated Tungsten Filament**

S. Ben-Yaakov<sup>1</sup>, M.M. Peretz<sup>1</sup>, B. Hesterman<sup>2</sup>; <sup>1</sup>Ben-Gurion University, Beer-Sheva, ISRAEL, <sup>2</sup>Advanced Energy Industries, Inc., Fort Collins, CO



**Session 28** **Thursday, March 10**  
**AC-Output Converter** **Room 408**  
**Control** **2:00 – 5:30 PM**

**Session Chairs: Keyue Smedley, University of California, Irvine and Huibin Zhu, MKS Instrumentation**

- 28.1 High-Bandwidth High-Power Gradient Driver for Magnetic Resonance Imaging with Digital Control**  
J.A. Sabate<sup>1</sup>, L.J. Garces<sup>1</sup>, P.M. Szczesny<sup>1</sup>, Q. Li<sup>3</sup>, W.F. Wirth<sup>2</sup>; <sup>1</sup>General Electric Global Research Center, Niskayuna, NY, <sup>2</sup>General Electric Health Care, Milwaukee, WA, <sup>3</sup>GE-Global Research, CTC, Shanghai, CHINA
- 28.2 Current Sharing for Multi-Channel Solar Power System with Maximum Power Point Tracking**  
H. Al-Atrash<sup>1</sup>, K. Rustom<sup>2</sup>, I. Batarseh<sup>1</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>Advanced Power Electronics Corporation, Orlando, FL
- 28.3 Small Signal Analysis Applied to a Single Phase Inverter Connected to Stiff AC System Using a Novel Improved Power Controller**  
É.P. Paiva, J.B. Vieira Jr., L.C. Freitas, V.J. Farias, E.A.A. Coelho; Federal University of Uberlândia, BRAZIL
- 28.4 Protection of Digitally Controlled Modular Inverter Units in Rapid Prototyping Applications**  
J. Van den Keybus, K. De Brabandere, B. Bolsens, J. Driesen; K.U.Leuven - ESAT, Leuven, BELGIUM
- 28.5 Modeling and Control of a Fuel Cell Based Z-Source Converter**  
J.W. Jung, M. Dai, A. Keyhani; The Ohio State University, Columbus, OH
- 28.6 A Three-Level Power Factor Correction Converter with Digital Control**  
L.Chen, J.Tan, Z.Jiang, J. Ying; Delta Electronics Co., Ltd, Shanghai, CHINA

- 28.7 Two-Switch Boost Half Bridge and Boost Active Clamped ZVS-PWM AC-AC Converters for Consumer High Frequency Induction Heater**  
H. Tanimatsu<sup>1</sup>, T. Ahmed<sup>1</sup>, I. Hirota<sup>2</sup>, K. Yasui<sup>2</sup>, T. Iwai<sup>2</sup>, H. Omori<sup>2</sup>, N. A. Ahmed<sup>3</sup>, H. W. Lee<sup>3</sup>, M. Nakaoka<sup>1,3</sup>; <sup>1</sup>Yamaguchi University, Yamaguchi, JAPAN, <sup>2</sup>Matsushita Electric Industrial Co., Ltd., Osaka, JAPAN, <sup>3</sup>Kyungnam University, Masan, KOREA



**Session 29** **Thursday, March 10**  
**Single Phase Power** **Governor's Ballroom**  
**Factor Correction** **Salon B**  
**2:00 – 5:30 PM**

**Session Chairs: Rakesh Dhawan, Wavecrest Laboratories and Sam Ben-Yaakov, Ben-Gurion University, Israel**

- 29.1 Inductor Design Considerations for Optimizing Performance & Cost of Continuous Mode PFC Converters**  
S. Basu<sup>1</sup>, T.M. Undeland<sup>2</sup>; <sup>1</sup>Bose Research P Ltd., Bangalore, INDIA, <sup>2</sup>Chalmers University of Technology, Gothenburg, SWEDEN
- 29.2 Soft-Switched PFC Boost Rectifier with Integrated ZVS Two-Switch Forward Converter**  
Y. Jang, D.L. Dillman, M.M. Jovanovic; Delta Products Corporation, Research Triangle Park, NC
- 29.3 Input Voltage Sensorless Average Current Control Technique for High-Power-Factor Boost Rectifiers Operated in Discontinuous Conduction Mode**  
R. Ghosh, G. Narayanan; Indian Institute of Science, Bangalore, INDIA
- 29.4 Improving Efficiency of the Active-Clamped SEPIC Rectifier at High Line Frequencies**  
P. Athalye, D. Maksimovic, R.W. Erickson; University of Colorado at Boulder, CO
- 29.5 Design Considerations for Single-Stage, Input-Current Shapers for Low Output Voltage Ripple**  
J. Villarejo<sup>1</sup>, J. Sebastián<sup>2</sup>, F. Soto<sup>1</sup>; <sup>1</sup>Universidad Politécnica de Cartagena, SPAIN, <sup>2</sup>Universidad de Oviedo, SPAIN, <sup>3</sup>Universidad Politécnica de Cartagena, SPAIN

**29.6 Simple Control and High Efficiency in the Boost Converter Used to Shape the Line Current to Comply with the IEC 61000-3-2 Regulations**

J. Sebastián, A. Fernández, M. M. Hernando, D. G. Lamar; Universidad de Oviedo, Gijon, SPAIN

**29.7 Influence of Non-Linear Magnetic Inductance in Passive Mains Harmonic Reduction Circuits**

T. Duerbaum<sup>1</sup>, D. Kuebrich<sup>1</sup>, K. Schettters<sup>2</sup>, A. Stadler<sup>1</sup>; <sup>1</sup>Friedrich-Alexander University Erlangen-Nuremberg, GERMANY, <sup>2</sup>Philips Semiconductors, Nijmegen, NETHERLANDS



**Session 30  
DC-DC Power  
Conversion and Control**

**Thursday, March 10  
Governor's Ballroom  
Salon C  
2:00 – 5:30 PM**

**Session Chairs: Cahit Gezgin, Tyco Electronics and Isaac Cohen, Lambda Electronics**

**30.1 Comparative Performance Evaluation of Current-Mode Controls Adapted to Asymmetrically-Driven Bridge-Type Pulse-Width Modulated DC-DC Converters**

W. Lim<sup>1</sup>, B. Choi<sup>1</sup>, J. Sun<sup>2</sup>; <sup>1</sup>Kyungpook National University, Taegu, KOREA, <sup>2</sup>Rensselaer Polytechnic Institute, Troy, NY

**30.2 An Active-Clamped Push-Pull Converter for Battery Sourcing Applications**

J.-C. Hung, T.-F. Wu, C.-T. Tsai, J.-Z. Tsai, Y.-M. Chen; National Chung Cheng University, Chia-Yi, TAIWAN

**30.3 A New Peak Current Control Scheme for Duty-Cycle-Shifted Half-Bridge DC-DC Converters**

S. Deng<sup>1</sup>, H. Mao<sup>2</sup>, G Potter<sup>2</sup>, I Batarseh<sup>1</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>Astec Power Advanced Technology, Andover, MA

**30.4 Dual-Voltage Quarter-Brick DC-DC Converter with Control in Secondary Side**

P. Alou<sup>1</sup>, A. Soto<sup>1</sup>, J.A. Cobos<sup>1</sup>, M. Rascon<sup>2</sup>; <sup>1</sup>Universidad Politecnica de Madrid, SPAIN, <sup>2</sup>Alcatel, Madrid, SPAIN

**30.5 A Novel Energy Recycling Clamp Circuit**

X. Guo, T. Liu, J. Zeng, J. Ying; Delta Power Electronics Center, Shanghai, CHINA

**30.6 High Frequency ZVS Self-Driven Full-Bridge Using Full Integration of Magnetics**

D. Sterk, M. Xu, F.C. Lee; Virginia Polytechnic Institute and State University, Blacksburg, VA

**30.7 Digital Controller for an Isolated Half-Bridge DC-DC Converter: Design, Simulation, and Experimental Results**

J. A. Abu Qahouq<sup>1</sup>, Y. Wen<sup>1</sup>, L. Yao<sup>1</sup>, E. Shoubaki<sup>1</sup>, I. Batarseh<sup>1</sup>, G. Potter<sup>2</sup>; <sup>1</sup>University of Central Florida (UCF), Orlando, FL, <sup>2</sup>ASTEC Power, Andover, MA



**Session 31  
DC-DC Converters: High  
Voltage or High Power**

**Thursday, March 10  
Governor's Ballroom  
Salon D  
2:00 – 5:30 PM**

**Session Chairs: David Cooper, Potentia Semiconductor, Ottawa, Canada and Per Lindeman, Ericsson Power Modules**

**31.1 Full-Bridge DC-DC Converter with Common Mode Chokes**

A. Pratt<sup>1</sup>, G. Drummond<sup>2</sup>; <sup>1</sup>Advanced Energy Industries, Inc., Fort Collins, CO, <sup>2</sup>Colorado Power Electronics, Fort Collins, CO

**31.2 Magnetic Integration for Hybrid Phase Modulated Converter with Current-Doubler Rectifier**

R. Jain<sup>1</sup>, N. Mohan<sup>1</sup>, R. Ayyanar<sup>2</sup>; <sup>1</sup>University of Minnesota, Minneapolis, MN, <sup>2</sup>Arizona State University, Tempe, AZ

**31.3 A Novel Double Phase-Shift Control Scheme for Full-Bridge Three-Level Converter**

Z. Zhang, X. Ruan; Nanjing University of Aeronautics and Astronautics, Nanjing, CHINA

**31.4 Three-Level Zero-Voltage Zero-Current Soft-Switching (ZVZCS) DC-DC Converter Using A Tapped Inductor**

Z. Lou, Y. Li, K. Wei, Z. Zhang; Zhejiang University, Hangzhou, CHINA

**31.5 The Properties and Design of a New Family of ZVT-PWM Converters**

G. Moschopoulos, W. Huang; University of Western Ontario, London, CANADA

**31.6 A High Power Density, High Efficiency Front-End Converter for Capacitor Charging Applications**  
C. Wang<sup>1</sup>, Y. Kang<sup>1</sup>, B. Lu<sup>1</sup>, J. Sun<sup>1</sup>, M. Xu<sup>1</sup>, W. Dong<sup>1</sup>, F. C. Lee<sup>1</sup>, W. C. Tipton<sup>2</sup>; <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA, <sup>2</sup>U.S. Army Research Lab, Adelphi, MD

**31.7 Interleaved Zero Current Transition Buck Converter**  
M. Ilic<sup>1</sup>, D. Maksimovic<sup>2</sup>; <sup>1</sup>Advanced Energy, Fort Collins, CO, <sup>2</sup>University of Colorado, Boulder, CO



**Session 32 Magnetics** **Thursday, March 10 Room 406 2:00 – 5:30 PM**

**Session Chairs: Marius Rosu, Ansoft Corporation and Matt Wilkowski, Enpirion**

- 32.1 300 C High Temperature Magnetics**  
R. Spyker<sup>1</sup>, J. Huth<sup>2</sup>, I. Mehdi<sup>3</sup>, A. Brockschmidt<sup>3</sup>; <sup>1</sup>Air Force Research Lab, Dayton, OH, <sup>2</sup>Spang Corporation, Pittsburgh, PA, <sup>3</sup>Boeing Phantom Works, Tukwila, WA
- 32.2 A New Low Loss Ferrite for 1-10 MHz Power Conversion**  
W.A. Roshen; SSPower Technology, Hilliard, OH
- 32.3 Design and Experimental Analysis of a DC to 1 MHz Closed Loop Magneto-resistive Current Sensor**  
G. Laimer, J.W. Kolar; Power Electronic Systems Laboratory, ETH Zurich, SWITZERLAND
- 32.4 Frequency-Dependent Resistance in Litz-Wire Planar Windings for All-Metal Domestic Induction Heating Appliances**  
J Acero, R Alonso, JM Burdio, LA Barragan, D Puyal; University of Zaragoza, SPAIN
- 32.5 Planar Inductor with Structural Winding Capacitance Cancellation for PFC Boost Converters**  
R. Chen, J.D. van Wyk; Virginia Tech, Blacksburg, VA
- 32.6 A Practical and General Core Loss Model for Non-Sinusoidal Waveforms with Applications to High frequency Power Conversion and Motors**  
W.A. Roshen; SSPower Technology, Hilliard, OH

**32.7 Bridging the Gap Between FEA Field Solution and the Magnetic Component Model**  
R. Prieto, R. Asensi, C. Fernandez, J. Cobos; Universidad Politecnica de Madrid, SPAIN



**Session 33 Simulation & Modeling** **Thursday, March 10 Governor's Ballroom Salon E 2:00 – 5:30 PM**

**Session Chairs: Allen Hefner, National Institute of Standards and Technology and Ernest Wittenbreder, Technical Witts**

- 33.1 Quality Assurance Verification using a Virtual Prototyping System**  
L McGarry<sup>1</sup>, T.G Wilson<sup>2</sup>; <sup>1</sup>Astec Power, Emerson, HONG KONG, <sup>2</sup>Transim Technology Corp., Portland, OR
- 33.2 Design and Implementation of a Power-Hardware in the Loop Interface: a Non-Linear Load Case Study**  
X. Wu, S. Lentijo, A. Deshmuk, A. Monti, F. Ponci; University of South Carolina, Columbia, SC
- 33.3 Practical Issues of Input/Output Impedance Measurements in Switching Power Supplies and Application of Measured Data to Stability Analysis**  
Y. Panov, M. Jovanovic; Delta Products Corporation, Durham, NC
- 33.4 Dynamic Performance Analysis of Outer-Loop Current Sharing Control for Paralleled DC-DC Converters**  
J. Sun<sup>1</sup>, Y. Qiu<sup>1</sup>, B. Lu<sup>1</sup>, M. Xu<sup>1</sup>, F.C. Lee<sup>1</sup>, W.C. Tipton<sup>2</sup>; <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, VA, <sup>2</sup>U.S. Army Research Lab, Adelphi, MD
- 33.5 A Large Signal Averaged Modelling and Control of Paralleled DC-DC Converters with Automatic Load Sharing**  
F. Musavi<sup>1</sup>, K. Al-Haddad<sup>1</sup>, H.Y. Kanaan<sup>2</sup>; <sup>1</sup>École de Technologie Supérieure, Montreal, CANADA, <sup>2</sup>Saint-Joseph University, Beirut, LEBANON
- 33.6 A General Approach to Averaged Modeling and Analysis of Active-Clamped Converters**  
M. Chen, J. Sun; Rensselaer Polytechnic Institute, Troy, NY

**33.7 Equivalent Circuit Modeling of a Multilayer Planar Winding Array Structure for Use in a Universal Contactless Battery Charging Platform**

X. Liu, S.Y.R. Hui; City University of Hong Kong, CHINA



## DIALOGUE SESSIONS

---

**Thursday, March 10, 11:30 AM – 2:00 PM**

**Austin Grand Ballroom**

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: DC-DC Conversion & Control

---

- D1.1 A Novel Soft Switching Isolated Boost Converter**  
S. Xie, F. Li; Nanjing University of Aeronautics & Astronautics, Nanjing, CHINA
- D1.2 A Novel Self-Powered, Isolated Power Management Device for 48 V Power Systems**  
D. Cooper, R. Duvnjak; Potentia Semiconductor Corporation, Ottawa, CANADA
- D1.3 Unified Analog and Digital Models for Half-Bridge DC-DC Converter with Current-Doubler Rectifier**  
L. Yao, J. A. Abu-Qahouq, I. Batarseh; University of Central Florida (UCF), Orlando, FL
- D1.4 Power Losses and Efficiency Analysis of Multilevel DC-DC Converters**  
Z. Pan, F. Zhang, F.Z Peng; Michigan State University, East Lansing, MI



## Session D2: VRM & POL Non-Isolated DC-DC Converters

---

- D2.1 High Current DC-DC Converter with SMT Components**  
O. Garcia, P. Zumel, A. de Castro, J.A. Cobos; Universidad Politecnica de Madrid, SPAIN
- D2.2 Effect and Utilization of Common Source Inductance in Synchronous Rectification**  
B. Yang, Z. Jason; International Rectifier, Irvine, CA
- D2.3 An Area-Efficient Digital Pulsewidth Modulation Architecture Suitable for FPGA Implementation**  
R. F. Foley, R. C. Kavanagh, W. P. Marnane, M. G. Egan; University College Cork, IRELAND
- D2.4 Power Junction FETs (JFETs) for Very Low-Voltage Applications**  
D. Chang<sup>1</sup>, M. Lee<sup>2</sup>, D. Chen<sup>2</sup>, V. Liva<sup>1</sup>; <sup>1</sup>Lovoltech Inc., Santa Clara, CA, <sup>2</sup>National Taiwan University, Taipei City, TAIWAN
- D2.5 Modeling of Unbalanced Multiphase Buck Converters with Applications to Voltage Regulator Module Control**  
J.T. Mossoba, P.T. Krein; University of Illinois at Urbana-Champaign, Urbana, IL
- D2.6 VR Transient Improvement at High Slew Rate Current Load-Active Transient Voltage Compensator**  
X. Wang, I. Batarseh, S. Xiao, A. Jaber; University of Central Florida, Orlando, FL
- D2.7 Fast Transient Three-Level Converters with Sliding-Mode Control**  
Z.B. Hu<sup>1</sup>, B. Zhang<sup>1</sup>, G.P. Du<sup>3,4</sup>, L. Zhong<sup>2</sup>, W. H. Deng<sup>1</sup>; <sup>1</sup>South China University of Technology, Guangzhou, CHINA, <sup>2</sup>Astec Electronics Company Ltd, Shenzhen, CHINA, <sup>3</sup>Guangzhou Electric Apparatus Research Institute, Guangzhou, CHINA, <sup>4</sup>Foshan University, Foshan, CHINA
- D2.8 Multi-Phase 48 Volt Conversion for Low Noise Applications in an Instrument Grade Power Supply**  
T. Emmons; Teradyne Corporation, Fridley, MN
- D2.9 Design and IC Implementation of an Ultra-Low-Ripple Switched-Capacitor-Based Buck DC-DC Converter**  
J. Han, A. von Jouanne, G. C. Temes; Oregon State University, Corvallis, OR

- D2.10 A New Simple Current-Compensation Circuit System for POL**  
K. Itoh<sup>1</sup>, Y. Ishizuka<sup>1</sup>, H. Matsuo<sup>1</sup>, M. Ueno<sup>1,2</sup>; <sup>1</sup>Nagasaki University, Nagasaki, JAPAN, <sup>2</sup>Sanken Electric Co., Ltd., Saitama, JAPAN
- D2.11 A Generic Algorithm for Global Steady-State Characterization of POL Converters**  
M. Plesnik<sup>1</sup>, M.S. Nakhla<sup>2</sup>; <sup>1</sup>Nortel Networks, Nepean, CANADA, <sup>2</sup>Carleton University, Ottawa, CANADA
- D2.11 A Generic Algorithm for Global Steady-State Characterization of POL Converters**  
M. Plesnik<sup>1</sup>, M.S. Nakhla<sup>2</sup>; <sup>1</sup>Nortel Networks, Nepean, CANADA, <sup>2</sup>Carleton University, Ottawa, CANADA
- D2.12 Microprocessor Platform Impedance Characterization using VTT Tools**  
S. Chickamenahalli<sup>1</sup>, K. Aygun<sup>1</sup>, M. J. Hill<sup>1</sup>, K. Radhakrishnan<sup>1</sup>, K. Eilert<sup>1</sup>, E. Stanford<sup>2</sup>; <sup>1</sup>Intel Corporation, Chandler, AZ, <sup>2</sup>Intel Corporation, Dupont, WA



## Session D3: Isolated DC-DC Power Conversion

---

- D3.1 Analysis and Design of Switched Capacitor Converters**  
J.W. Kimball, P.T. Krein; University of Illinois at Urbana-Champaign, IL
- D3.2 A High Efficiency Gate-Driver Scheme of Synchronous Rectifiers for Magamp Regulation Applications**  
W. Lin<sup>1,2</sup>, K. Rinne<sup>1</sup>, Z. Lu<sup>2</sup>, G. Hua<sup>3</sup>; <sup>1</sup>University of Limerick, IRELAND, <sup>2</sup>Fuzhou University, Fuzhou, CHINA
- D3.3 A Simple Structure of LLC Resonant DC-DC Converter for Multi-Output Applications**  
Y.L. Gu, L.J. Hang, H.M. Chen, Z.Y. Lu, Z.M. Qian, J. Li; Zhejiang University, Hangzhou, CHINA
- D3.4 Method to Improve Total Dose Radiation Hardness in a CMOS DC-DC Boost Converter**  
H.D. Pan<sup>1</sup>, H.L. Hess<sup>1</sup>, K.M. Buck<sup>1</sup>, B.M. Wilamowski<sup>2</sup>, M.M. Mojarradi<sup>3</sup>; <sup>1</sup>University of Idaho, Moscow, ID, <sup>2</sup>Auburn University, Auburn, AL, <sup>3</sup>California Institute of Technology, Pasadena, CA

- D3.5 High-Efficiency Series-Parallel Resonant Converter for the Non-Contact Power Supply**  
Y.S Kong, E.S Kim, I.G Hwang, H.K Lee;  
Jeonju University, Jeonju, KOREA
- D3.6 Discrete Model of DCS-Controlled Half-Bridge DC-DC Converter with Current-Doubler for Digital Controller Design**  
E. Shoubaki, J.A. Abu Qahouq, I. Batarseh;  
University of Central Florida (UCF), Orlando, FL
- D3.7 Design and Implementation of Simple Fuzzy Logic Controller (SFLC) for the Voltage Control of Resonant Converter**  
S. Arulselvi, G. Uma, L. Hema chandiran, V. and Saminath; Annauniversity, Chennai, INDIA
- D3.8 A Simple Configured Reducing Noise Peak DC-DC Converter Introducing Delta-Sigma Modulation Circuit**  
A. Hirota<sup>1</sup>, S. Nagai<sup>2</sup>, M. Nakaoka<sup>1,3</sup>;  
<sup>1</sup>Kyungnam University, Masan, KOREA,  
<sup>2</sup>Tsuyama National College of Technology, Tsuyama, JAPAN, <sup>3</sup>Yamaguchi University, Ube, JAPAN
- D3.9 A Driving Strategy Dedicated to S.R.: The Theory of Waveform Modification with Periodical Driving Circuit Regulation**  
Y.L. Gu<sup>1</sup>, Y. Du<sup>1</sup>, Z.Y. Lu<sup>1</sup>, Z.M. Qian<sup>1</sup>, G.S. Huang<sup>2</sup>, W.X. Yao<sup>1</sup>; <sup>1</sup>Zhejiang University, Hangzhou, CHINA, <sup>2</sup>Delta Power Electronics Center, Shanghai, CHINA
- D3.10 Unified Steady-State and Dynamic Modeling for Symmetric and Asymmetric Half-Bridge DC-DC Converters with Current Doubler Rectifiers (CDRs)**  
Y. Wen<sup>1</sup>, S. Deng<sup>1</sup>, H. Mao<sup>2</sup>, I. Batarseh<sup>1</sup>;  
<sup>1</sup>University of Central Florida, Orlando, FL,  
<sup>2</sup>Astec Power Advanced Technology, Andover, MA
- D3.11 DC Bias and Small-Signal Characteristic of Active-Clamp Flyback-Forward DC-DC Converter with a Current Doubler Rectifier**  
Y. Wen<sup>1</sup>, H. Mao<sup>2</sup>, I. Batarseh<sup>1</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>ASTEC Power Advanced Technology, Andover, MA
- D3.12 Investigation of Candidate Topologies for Brick DC-DC**  
Y.L. Gu, H.M. Chen, Z.Y. Lu, Z.M. Qian, K. Wei; Zhejiang University, Hangzhou, CHINA



## Session D4: Other DC-DC Power Conversion

---

- D4.1 A Novel Full-Bridge DC-DC Converter using Energy-Recovery Driving Circuit with Regenerative Transformer**  
D.Y Lee<sup>1</sup>, W.S. Kim<sup>2</sup>, B.H. Cho<sup>2</sup>; <sup>1</sup>Samsung SDI, Cheonan, KOREA, <sup>2</sup>Seoul National Univ., Seoul, KOREA
- D4.2 Next Generation High Efficiency High Power DC-DC Converter Incorporating Active Switch and Snubbing Capacitor Assisted Full-Bridge Soft-Switching PWM Inverter with High Frequency Transformer for Large Current Output**  
K. Morimoto<sup>1</sup>, T. Doi<sup>1</sup>, H. Manabe<sup>1</sup>, M. Nakaoka<sup>3</sup>, T. Ahmed<sup>2</sup>, E. Hiraki<sup>2</sup>, N.A. Ahmed<sup>3</sup>, H.W. Lee<sup>3</sup>; <sup>1</sup>DAIHEN Corporation, Osaka, JAPAN, <sup>2</sup>Yamaguchi University, Yamaguchi, JAPAN, <sup>3</sup>Kyungnam University, Masan, KOREA
- D4.3 A Family of Asymmetrical Dual Switch Forward DC-DC Converters**  
Y.L. Gu, H.M. Chen, Z.Y. Lu, Z.M. Qian, K. Wei; Zhejiang University, Hangzhou, CHINA
- D4.4 Inherently Safe DC-DC Converter Using a Normally-On SiC JFET**  
R. Kelley<sup>1</sup>, M. Mazzola<sup>2</sup>, W. Draper<sup>1</sup>, J. Casady<sup>1</sup>; <sup>1</sup>SemiSouth Laboratories, Inc., Starkville, MS, <sup>2</sup>Mississippi State University, MS State, MS
- D4.5 Efficiency and EMI Comparisons between Prototyped 8 kW Hard and Soft-Switched Buck Choppers**  
R.W. Ashton<sup>1</sup>, J.G. Ciezki<sup>2</sup>; <sup>1</sup>Naval Postgraduate School, Monterey, CA, <sup>2</sup>U.S. Naval Academy, Annapolis, MD
- D4.6 An Assessment of Resonant Gate Drive Techniques for use in Modern Low Power DC-DC Converters**  
P. Dwane, D. O' Sullivan, M. G. Egan; PEI Technologies, UCC, Cork, IRELAND
- D4.7 A Single Switch Boost Converter with a High Conversion Ratio**  
D.M. Van de Sype, K. De Gussemé, A.P. Van den Bossche, B. Renders, J.A. Melkebeek; Ghent University, Gent, BELGIUM
- D4.8 Three-Level Buck Converter for Envelope Tracking in RF Power Amplifiers**  
V. Yousefzadeh<sup>1</sup>, D. Maksimovic<sup>1</sup>, E. Alarcon<sup>2</sup>;  
<sup>1</sup>University of Colorado, Boulder, CO,  
<sup>2</sup>Technical University of Catalunya, Barcelona, SPAIN

- D4.9 Proposal of a Switch-mode Power Supply by the Association of an Interleaved Boost-flyback Converter and an Interleaved Forward Topology for Audio Application**  
C.A. Gallo, J.B. Vieira Jr, L.C. Freitas, V.J. Farias, E.A.A. Coelho, M.T. Galelli, E.A. Coelho; Universidade Federal de Uberlandia, Uberlandia, BRAZIL
- D4.10 Transient Current Suppression Scheme for Bi-Directional DC-DC Converters in 42 V Automotive Power Systems**  
C.G. Yoo<sup>1,2</sup>, W.C. Lee<sup>1</sup>, K.C. Lee<sup>2</sup>, B.H. Cho<sup>3</sup>; <sup>1</sup>Hankyong National University, Kyonggi-do, KOREA, <sup>2</sup>Interpower Co., Ltd., Seoul, KOREA, <sup>3</sup>Seoul National University, Seoul, KOREA
- D4.11 Current-Fed Phase Shift Controlled Full Bridge ZCS DC-DC Converter with Reverse Block IGBT**  
X. Zhu<sup>1</sup>, D. Xu<sup>1</sup>, H. Umida<sup>2</sup>, K. Mino<sup>2</sup>; <sup>1</sup>Zhejiang University, Hangzhou, CHINA, <sup>2</sup>Fuji Electric Advanced Technology Co., Ltd., Tokyo, JAPAN
- D4.12 Simple Zero Voltage Switching (ZVS) Full-Bridge DC Bus Converters**  
W. Fan, G. Stojic; International Rectifier, El Segundo, CA



## Session D5: AC-DC Power Conversion I

- D5.1 A Boost PFC Converter with Programmable Harmonic Resistance**  
K. De Gussemé<sup>1</sup>, W.R. Ryckaert<sup>1</sup>, D.M. Van de Sype<sup>1</sup>, J.A. Ghijselen<sup>2</sup>, J.A. Melkebeek<sup>1</sup>; <sup>1</sup>Ghent University, Gent, BELGIUM, <sup>2</sup>Inverto N.V., Evergem, BELGIUM
- D5.2 A Novel Control Strategy of Post Buck Converters Cascading LLC-SRC**  
H. Gan; Delta Electronics Co., Ltd, Shanghai, CHINA
- D5.3 A Novel Single stage AC-DC Self-oscillating Series-Parallel Resonant Converter**  
M Youssef<sup>1</sup>, H Pinheiro<sup>2</sup>, P Jain<sup>1</sup>, M Orabi<sup>3</sup>; <sup>1</sup>Queen's University, Kingston, CANADA, <sup>2</sup>Santa Maria University, Santa Maria, BRAZIL, <sup>3</sup>South Valley University, Aswan, EGYPT
- D5.4 Digital Current Control of a Voltage Source Converter with Active Damping of LCL Resonance**  
E. Wu, P.W. Lehn; University of Toronto, CANADA

- D5.5 Current Equalizing for a Multi-Modular Current Source Converter**  
J. Li<sup>1</sup>, D.H. Xu<sup>1</sup>, K.W.E. Cheng<sup>2</sup>; <sup>1</sup>Zhejiang University, Hangzhou, CHINA, <sup>2</sup>The Hong Kong Polytechnic University, Kowloon, HONG KONG
- D5.6 A Novel Charge Pump High Power Factor AC-AC Converter**  
Y. Xie, Y. Fang; Yangzhou University, Yangzhou, CHINA
- D5.7 Optimum Controller Design for a Multilevel AC-DC Converter System**  
O. Aydin<sup>1</sup>, A. Akdag<sup>2</sup>, P Stefanutti<sup>3</sup>, N Hugo<sup>3</sup>; <sup>1</sup>State University of New York at Binghamton, NY, <sup>2</sup>ABB Switzerland Ltd., Baden, SWITZERLAND, <sup>3</sup>ABB Secheron SA., Geneva, SWITZERLAND
- D5.8 A Unity Power Factor Converter Using the Synchronous Reference Frame Based Hysteresis Current Control**  
A.I. Maswood, F.R. Liu; Nanyang Technological University, SINGAPORE
- D5.9 Shunt Active Power Filter Implementation for Induction Heating Applications**  
R. Bojoi<sup>1</sup>, G. Griva<sup>1</sup>, F. Profumo<sup>1</sup>, M. Cesano<sup>2</sup>, L. Natale<sup>2</sup>; <sup>1</sup>Politecnico di Torino, ITALY, <sup>2</sup>SAET S.p.A., Leini, ITALY
- D5.10 The Operation of the Vector Modulated and Vector Controlled VIENNA I Rectifier Under Distorted and Unbalanced Mains Voltages.**  
T. Viitanen, H. Tuusa; Tampere University of Technology, Tampere, FINLAND



## Session D6: AC-DC Power Conversion II

- D6.1 Parallel Operation of One-Cycle Controlled Three-Phase PFC Rectifiers**  
Y. Chen, K. Smedley; Univ. of California, Irvine, CA
- D6.2 Current Sensorless Control of a Voltage-Source Active Power Filter**  
M. Routimo, M. Salo, H. Tuusa; Tampere University of Technology, Tampere, FINLAND
- D6.3 Resistive Load Synthesis in Three-Phase Four-Wire Systems Using a Parallel Active Power Filter**  
C.A. Busada<sup>1</sup>, H.G. Chiacchiarini<sup>1,3</sup>, J.C. Balda<sup>2</sup>; <sup>1</sup>Universidad Nacional del Sur, Bahía Blanca, ARGENTINA, <sup>2</sup>University of Arkansas, Fayetteville, AR, <sup>3</sup>CONICET, Bahía Blanca, ARGENTINA

**D6.4 Hybrid Control Method for a Single Phase PFC Using a Low Cost Microcontroller**  
L.T. Jakobsen<sup>1</sup>, N. Nielsen<sup>1</sup>, C. Wolf<sup>2</sup>, M.A.E. Andersen<sup>1</sup>; <sup>1</sup>Technical University of Denmark, Kgs. Lyngby, DENMARK, <sup>2</sup>Grundfos A/S, Bjerringbro, DENMARK

**D6.5 Feedforward Current Control of Boost-Derived Single-Phase PFC Converters**  
P.T. Prathapan, M. Chen, J. Sun; Rensselaer Polytechnic Institute, Troy, NY

**D6.6 Power Factor Correction with a Partial Power Processing Converter**  
A. Fernandez, J. Sebastian, M.M. Hernando, D.G. Lamar; Universidad de Oviedo, Gijon, SPAIN

**D6.7 A Unity Power Factor Single-Phase Three-Level Rectifier Associated with a Passive Nondissipative Snubber**  
F.L. Tofoli, D.S. Oliveira Jr.<sup>1</sup>, J.B. Vieira Jr., M.T. Galelli, L.C. Freitas, V.J. Farias, E.A.A. Coelho, C.A. Gallo; Federal University of Uberlandia, BRAZIL

**D6.7 A Unity Power Factor Single-Phase Three-Level Rectifier Associated with a Passive Nondissipative Snubber**  
F.L. Tofoli, D.S. Oliveira Jr.<sup>1</sup>, J.B. Vieira Jr., M.T. Galelli, L.C. Freitas, V.J. Farias, E.A.A. Coelho, C.A. Gallo; Federal University of Uberlandia, BRAZIL, <sup>2</sup>Federal University of Ceara, Fortaleza, BRAZIL

**D6.8 Proposal of a Timer Controller with Constant Switching Frequency and Power Factor Correction**  
M.T. Galelli, M.S. Vilela, L.C. Freitas, J.B. Vieira, V.J. Farias; Federal University of Uberlândia, BRAZIL

**D6.9 Proposal of a Hysteresis Controller with Constant Switching Frequency**  
M.T. Galelli, M.S. Vilela, L.C. Freitas, J.B. Vieira, V.J. Farias; Federal University of Uberlandia, BRAZIL



## Session D7: Lighting Systems & Ballasts

---

**D7.1 Modeling of CCFL using Lamp Delay and Stability Analysis of Backlight Inverter for Large Size LCD TV**  
C. G. Kim<sup>1</sup>, K. C. Lee<sup>1</sup>, B. H. Cho<sup>2</sup>; <sup>1</sup>Interpower Co. Ltd., Seoul, KOREA, <sup>2</sup>Seoul National University, Seoul, KOREA

**D7.2 A Single-Stage Dimmable Electronic Ballast with High Power Factor**  
L.-W. Lin<sup>1</sup>, H.-M. Huang<sup>1</sup>, H.-J. Chiu<sup>1</sup>, S.-C. Mou<sup>2</sup>; <sup>1</sup>Chung-Yuan Christian University, Chung-Li, TAIWAN, <sup>2</sup>Ching-Yun University, Chung-Li, TAIWAN

**D7.3 Design Orientated Model and Application of Electronic Ballasts for Two Toroidal Ferrite Coupled Electroless Lamps**  
X.H. Cao; Zhejiang University, Hangzhou, CHINA



## Session D8: AC-Output Converter Modeling, Analysis & Control

---

**D8.1 Statistical Modeling of DSP-based Hill-Climbing MPPT Algorithms in Noisy Environments**  
H. Al-Atrash<sup>1</sup>, K. Rustom<sup>2</sup>, I. Batarseh<sup>1</sup>; <sup>1</sup>University of Central Florida, Orlando, FL, <sup>2</sup>Advanced Power Electronics Corporation, Orlando, FL

**D8.2 Experiment and Research on Control Strategy for a New-Type Three-Phase Solid-State Current Limiter**  
Z. Zhao, Z. Lu, W. Yao; Zhejiang University, Hangzhou, CHINA

**D8.3 Sensorless Operation of a PWM Rectifier with En-Gen Set as a Distributed Generation**  
J.H. Kim, H. Yoo, S.K. Sul; Seoul National University, Seoul, KOREA

**D8.4 A Novel Safe Shutdown Strategy for Matrix Converter Even Under Fault Condition**  
L.N. Wang, F.Y. Xv, K. Sun, L.P. Huang; Tsinghua University, Beijing, CHINA

**D8.5 Emulation of Output Characteristics of Rotor Blades Using a Hardware-In-Loop Wind Turbine Simulator**  
S. Song<sup>1</sup>, B. Jeong<sup>1</sup>, H. Lee<sup>1</sup>, J. Kim<sup>1</sup>, J. Oh<sup>2</sup>, G. Venkataramanan<sup>3</sup>; <sup>1</sup>Chonbuk National University, Jeonju, KOREA, <sup>2</sup>LG Industrial Systems, Anyang, KOREA, <sup>3</sup>University of Wisconsin, Madison, WI

**D8.6 A Novel, Digitally-Controlled, Portable Photovoltaic Power Source**  
Z. Jiang, R. Dougal; University of South Carolina, Columbia, SC



## Session D9: Power Quality

---

- D9.1 Reduction of the Voltage Distortion with a Converter Employed as Shunt Harmonic Impedance**  
W.R. Ryckaert<sup>1</sup>, K. De Gussemé<sup>1</sup>, D.M. Van de Sype<sup>1</sup>, J.A. Ghijselen<sup>2</sup>, J.A. Melkebeek<sup>1</sup>;  
<sup>1</sup>Ghent University, Gent, BELGIUM, <sup>2</sup>Inverto N.V., Evergem, BELGIUM
- D9.2 Application of Thyristor in Auto-tuning Arc Suppression Coils**  
Y. Liu<sup>1</sup>, C. Fu<sup>2</sup>; <sup>1</sup>Wuhan University, Wuhan, CHINA, <sup>2</sup>Zhejiang University, Hangzhou, CHINA
- D9.3 Delayless Harmonic Detection Based on DSP with High-Accuracy for Active Power Filter**  
Z. Chen, D.H. Xu; Zhejiang University, Hangzhou, CHINA
- D9.4 A Reconfigurable Uninterruptible Power Supply System for Multiple Power Quality Applications**  
C.-C. Yeh<sup>1</sup>, M.D. Manjrekar<sup>2</sup>; <sup>1</sup>Marquette University, Milwaukee, WI, <sup>2</sup>Eaton Corporation, Milwaukee, WI
- D9.5 Self-Excited Induction Generator with Regulated DC Voltage Scheme for Wind Power Applications**  
T. Ahmed<sup>1</sup>, K. Nishida<sup>1</sup>, O. Noro<sup>2</sup>, M. Nakaoka<sup>1</sup>; <sup>1</sup>Yamaguchi University, Yamaguchi, JAPAN, <sup>2</sup>Kawasaki Heavy Industry, Co. Ltd., Hyogo, JAPAN
- D9.6 A UPFC-Based Voltage Compensator with Current and Voltage Balancing Function**  
Y.I. Ikeda, T.K. Kataoka; Tokyo Denki University, Tokyo, JAPAN
- D9.7 Exact Harmonics Elimination in PWM Multi-Module Converters**  
J. Ghaisari<sup>1</sup>, A. Bakhshai<sup>2</sup>; <sup>1</sup>Isfahan University of Technology, Isfahan, IRAN, <sup>2</sup>Queens University, Kingston, CANADA
- D9.8 The Analysis of the Power Loss in a Zero-Voltage Switching Two-Inductor Boost Cell Operating under Different Circuit Parameters**  
Q. Li, P.J. Wolfs; Central Queensland University, Rockhampton, AUSTRALIA
- D9.8 The Analysis of the Power Loss in a Zero-Voltage Switching Two-Inductor Boost Cell Operating under Different Circuit Parameters**  
Q. Li, P.J. Wolfs; Central Queensland University, Rockhampton, AUSTRALIA

- D9.9 Development of a Scaled STATCOM Prototype Based on 21-Level Cascade H-Bridge Inverter**  
Q. Song<sup>1</sup>, W.H. Liu<sup>1</sup>, Z.C. Yuan<sup>1</sup>, W.H. Wei<sup>1</sup>, L.T. Teng<sup>2</sup>; <sup>1</sup>Tsinghua University, Beijing, CHINA, <sup>2</sup>Shanghai Electric Power Company, Shanghai, CHINA
- D9.10 Influence of Deep Bar Effect on Induction Machine Modeling with Gamma-Controlled Soft Starters**  
K.L. Lee<sup>1</sup>, W.E.B. Berkopec<sup>1</sup>, T.M.J. Jahns<sup>2</sup>, T.A.L. Lipo<sup>2</sup>; <sup>1</sup>Eaton Corporation, Milwaukee, WI, <sup>2</sup>University of Wisconsin, Madison, WI



## Session D10: Motor Drives & Controls

---

- D10.1 A Novel Method for Dead-Time Compensation Based on SVPWM**  
Q. Hu, H. Hu, Z. Lu, W. Yao; Zhejiang University, Hangzhou, CHINA
- D10.2 A New PWM Method for Common Mode Voltage Reduction in Inverter Fed Motor Drive**  
L.-H. Kim<sup>2</sup>, N.-K. Hahm<sup>1</sup>, C.-Y. Won<sup>2</sup>, K.-H. Han<sup>1</sup>, Y.-R. Kim<sup>3</sup>; <sup>1</sup>Myong-ji University, Seoul, KOREA, <sup>2</sup>Sung-Kyun-Kwan University, Seoul, KOREA, <sup>3</sup>An-Yang University, Seoul, KOREA
- D10.3 AC Drive System on Chip – A Peripheral Based Approach**  
R. Dubey, P. Agarwal, M.K. Vasantha; IIT Roorkee, Roorkee, INDIA
- D10.4 Design and Testing of a Modular Permanent Magnet Brushless Linear Drive**  
K. Patel<sup>1</sup>, S. D'Arco<sup>2</sup>, A. Monti<sup>1</sup>, D. Patterson<sup>1,3</sup>, R. Dougal<sup>1</sup>; <sup>1</sup>University Of South Carolina, Columbia, SC, <sup>2</sup>University Of Naples Federico II, Napoli, ITALY
- D10.4 Design and Testing of a Modular Permanent Magnet Brushless Linear Drive**  
K. Patel<sup>1</sup>, S. D'Arco<sup>2</sup>, A. Monti<sup>1</sup>, D. Patterson<sup>1,3</sup>, R. Dougal<sup>1</sup>; <sup>1</sup>University Of South Carolina, Columbia, SC, <sup>2</sup>University Of Naples Federico II, Napoli, ITALY, <sup>3</sup>University of Nebraska, Lincoln, NE
- D10.5 On-line Self-tuning of PI Controller for PMSM Drives Based on the Iterative Learning Control**  
M. Yang, Y. Gao, D.G. Xu, Y. Yu; Harbin Institute of Technology, Harbin, CHINA

**D10.6 B4 Topology Options for Operating Three Phase Induction Machines on Single Phase Grids**

T.B. Bashaw, T.A. Lipo; UW Madison, Madison, WI

**D10.7 New Design Concept of an FPGA-Based Chip with Considerations of Flexible Functions Applying Sliding Mode Control Strategy for Permanent Magnet Synchronous Motor Drives**

C.-H. Fang<sup>1</sup>, W.-N. Huang<sup>1,2</sup>, C.-H. Chen<sup>1</sup>, J.-K. Chen<sup>1</sup>, H.-Y. Chang<sup>2</sup>; <sup>1</sup>Industrial Technology Research Institute, Hsin-Chu, TAIWAN, <sup>2</sup>National Chiao-Tung University, Hsin-Chu, TAIWAN




---

**Session D11: Electrical Components**

---

**D11.1 Power PiN Diode Model for PSPICE Simulations**

G.M. Buiatti, F. Cappelluti, G. Ghione; Politecnico di Torino, Turin, ITALY

**D11.2 Study on Reverse Recovery Characteristics in Reverse-Blocking IGBT Applied in Matrix Converters**

S. Jia, K.J. Tseng, X. Wang; Nanyang Technological University, SINGAPORE

**D11.3 Coupled Inductor Design with Small Voltage Spike of SEPIC Converter**

W.H. Deng<sup>1</sup>, B. Zhang<sup>2</sup>, G.P. Du<sup>3,4</sup>, Z.B. Hu<sup>1</sup>; <sup>1</sup>South China University of Technology, GuangZhou, CHINA, <sup>2</sup>South China University of Technology, GuangZhou, CHINA, <sup>3</sup>Fo Shan University, FoShan, CHINA, <sup>4</sup>Guang Zhou Electric Apparatus Research, GuangZhou, CHINA

**D11.4 Finite Element Simulation of a Universal Contactless Battery Charging Platform**

X. Liu, P.W. Chan, S.Y.R. Hui; City University of Hong Kong, CHINA

**D11.4 Finite Element Simulation of a Universal Contactless Battery Charging Platform**

X. Liu, P.W. Chan, S.Y.R. Hui; City University of Hong Kong, CHINA

**D11.5 Modeling Ceramic and Tantalum Capacitors with New Model Structures and Parameter Extraction Methods**

J. Lu, N. L. Ou; International Rectifier Corporation, Santa Clara, CA

**D11.6 The Optimization of Transformers with Air Gapped Toroids**

A. Stadler, M. Albach, D. Kübrich; Friedrich-Alexander-University Erlangen-Nuremberg, GERMANY

**D11.7 A Very Simple Analytical Approach of Thermal Modeling for Magnetic Components**

L.M. Escribano<sup>1</sup>, P. Zumel<sup>2</sup>, R. Prieto<sup>1</sup>, J.A. Oliver<sup>1</sup>, J.A. Cobos<sup>1</sup>; <sup>1</sup>Universidad Politecnica de Madrid, SPAIN, <sup>2</sup>Universidad Carlos III de Madrid, SPAIN




---

**Session D12: Control, EMI & Simulation**

---

**D12.1 Using Spectrograms in EMI-analysis – An Overview**

M. Kuisma, P. Silventoinen; Lappeenranta University of Technology, Lappeenranta, FINLAND

**D12.2 Power Supply Quality Analysis in a Twelve-Pulse LCI Drive System Under Compensated Fault-Mode Operation**

A.N. Alcaso<sup>1</sup>, A.J.M. Cardoso<sup>2</sup>; <sup>1</sup>Polytechnic Institute of Guarda, PORTUGAL, <sup>2</sup>University of Coimbra, Coimbra, PORTUGAL

**D12.3 Auto-tuning Self-compatibility of Power Converters**

G Tomasso, C Attaianese; University of Cassino, ITALY

**D12.4 Control of Dc-Dc Converters by Direct Pole Placement and Adaptive Feedforward Gain Adjustment**

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

**D12.5 Synergetic Control for Ultracapacitor Based High Dynamic Converters**

L. Solero, A. Lidozzi, F. Crescimbeni, A. Di Napoli; University ROMA TRE - DIMI, Roma, ITALY

**D12.6 FPGA-Based Control of Power Converter: Comparing Alternative Solutions**

J.L. Bastos, L.M. Farronato, H.P. Figueroa, D. Franzoni, S. Lentijo, A. Monti, A. Smith, W. Xin; University of South Carolina, Columbia, SC

**D12.7 A Behavioral SPICE Compatible Model of a Self-Oscillating Converter**

S. Ben-Yaakov, I. Fridman; Ben-Gurion University, Beer-Sheva, ISRAEL

**D12.8 A New Method to Measure the Switched Reluctance Motor's Flux**

J.H. Zhang, A.V. Radun; University of Kentucky, Lexington, KY

**D12.9 Fuzzy Logic Peak Current-Mode Control for DC-DC Converters Using an Inexpensive 8-Bit Microcontroller**

D. He, R.M. Nelms; Auburn University, Auburn, AL



**Session D13: Physical Design, Packaging, and Other Power Electronics**

---

**D13.1 Development of Current-Scalable Emitter Turn-Off (ETO) Thyristor Module**

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

**D13.2 A Novel Packaging Methodology for Spray Cooling of Power Semiconductor Devices Using Dielectric Liquids**

K. Vanam, J. Junghans, F. Barlow, R.P. Selvam, J.C. Balda, A. Elshabini; University of Arkansas, Fayetteville, AR

**D13.3 Modeling and Analysis of Thermoelectric Modules**

S. Lineykin, S. Ben-Yaakov; Ben-Gurion University of the Negev, Beer-Sheva, ISRAEL

**D13.4 Inductive Powering of Sensor Modules**

T. O'Donnell<sup>1</sup>, O. Chevalerias<sup>1</sup>, G. Grant<sup>1</sup>, S. O'Mathuna<sup>1</sup>, N. O'Donnovan<sup>2</sup>, D. Power<sup>2</sup>;  
<sup>1</sup>NMRC, Cork, IRELAND, <sup>2</sup>University College Cork, IRELAND

**D13.5 Application of Press-Pack IGBTs in Traction Refurbishment**

A. Golland, F J. Wakeman; Westcode Semiconductors Ltd, Chippenham, UK

**D13.6 Study of Maximum Linear Generator Output Power for Maglev Emergency Power Supply**

M. Chen<sup>1</sup>, D. Zhou<sup>1</sup>, D. Xu<sup>1</sup>, X. Wu<sup>2</sup>; <sup>1</sup>College of Electrical Engineering, Hangzhou, CHINA, <sup>2</sup>Dept. of Science Technology, Shanghai, CHINA



## APEC 2005 CONFERENCE COMMITTEE AND MANAGEMENT

Jason Lai, Virginia Polytechnic Institute And State University, General Chair

Van Niemela, Fairchild Semiconductor Program Chair

Russ Spyker, U.S.A.F. Research Laboratories, Assistant Program Chair

Ada Cheng, International Rectifier OEM Initiative Chair

Tom Habetler, Georgia Institute Of Technology Finance Chair

Bill Dillard, Auburn University Assistant Finance Chair

Tim Haskew, University of Alabama Seminar Chair

Bill Peterson, E&M Power, Assistant Seminar Chair

Chuck Mullett, ON Semiconductor Exposition Chair

John Bassett, Artesyn Technologies Exposition Subcommittee

Bruce Miller, Dell, Inc. Exposition Subcommittee

Tom Wilson, Jr., Transim Exposition Subcommittee

Kevin Parmenter, Fairchild Semiconductor Publicity Chair

Bob Houf, ON Semiconductor Assistant Publicity Chair

Frank Cirolia, Artesyn Technologies Rap Session Chair

Patrick Chapman, University of Illinois, Urbana-Champaign, Publications Chair

David Otten, Massachusetts Institute of Technology, MicroMouse Chair

Jane Wilson Spouse & Guest Hospitality Chair

Madeline White, Stone & Webster Assistant Spouse & Guest Hospitality Chair

Robert White, Artesyn Technologies Webmaster & OEM Initiative Subcommittee

Regan Zane, University of Colorado-Boulder Assistant Webmaster

James Kokernak, Advanced Energy Conversion Past General Chair & OEM Initiative Subcommittee

Mark Nelms, Auburn University APEC Administrator

### **Conference Management**

Pam Wagner, Courtesy Associates Senior Conference Manager

Shelbie Dumas, Courtesy Associates Conference Manager

Tonya Freeland, Courtesy Associates Conference Manager

Marc Plante, Courtesy Associates Conference Manager

Time	Sunday March 6	Monday March 7	Tuesday March 8	Wednesday March 9	Thursday March 10	Time
8:30 AM						8:30 AM
9:00 AM						9:00 AM
9:30 AM	Seminars 1-6	Seminars 8-18	Presentation Sessions 2-8	Presentation Sessions 9-14, SP1	Presentation Sessions 21-26, SP3	9:30 AM
10:00 AM						10:00 AM
10:30 AM				10:30 AM		
11:00 AM				11:00 AM		
11:30 AM				Exhibit Hall Open	Dialogue Sessions D1-D13	11:30 AM
Noon			Noon			
12:30 PM			Exhibit Hall Open	Presentation Sessions 15-20, SP2	Presentation Sessions 27-33	12:30 PM
1:00 PM						1:00 PM
1:30 PM						1:30 PM
2:00 PM						2:00 PM
2:30 PM	Seminars 7-12	Plenary Session	Rap Sessions	APEC 2005 Social Event	Technical Tour	2:30 PM
3:00 PM						3:00 PM
3:30 PM						3:30 PM
4:00 PM						4:00 PM
4:30 PM		Exhibitor's Reception	Exhibitor Hospitality Time			4:30 PM
5:00 PM						5:00 PM
5:30 PM		Micro- Mouse Contest				5:30 PM
6:00 PM						6:00 PM
6:30 PM						6:30 PM
7:00 PM						7:00 PM
7:30 PM						7:30 PM
8:00 PM						8:00 PM
8:30 PM						8:30 PM
9:00 PM						9:00 PM
9:30 PM						9:30 PM

### Saturday, March 5

Registration Desk Open	3:00 PM – 6:00 PM	Austin Grand Ballroom Foyer
------------------------	-------------------	-----------------------------

### Sunday, March 6

Registration Desk Open	8:00 AM – 5:00 PM	Austin Grand Ballroom Foyer
------------------------	-------------------	-----------------------------

Seminar 1	Inside The Power Supply	9:30 AM – 1:00 PM	Governor's Ballroom, Salon A
Seminar 2	Advanced Topics On Single-Phase Power Factor Correction	9:30 AM – 1:00 PM	Governor's Ballroom, Salon B
Seminar 3	IGBT Selection for Designers	9:30 AM – 1:00 PM	Governor's Ballroom, Salon E
Seminar 4	Power Electronics In Distributed Generation	9:30 AM – 1:00 PM	Governor's Ballroom, Salon D
Seminar 5	Advanced Control Techniques For Buck Converters In Power Management And VRM Applications	9:30 AM – 1:00 PM	Room 406
Seminar 6	Optimal Control Of Adjustable Speed AC Motor Drives: A Microscopic Approach To Energy Conversion Process	9:30 AM – 1:00 PM	Room 408
Seminar 7	Using And Designing Point-Of-Load Converters	2:30 PM – 6:00 PM	Governor's Ballroom, Salon A
Seminar 8	EMI: Theory, Coupling Mechanisms, Equivalent Circuits, and Solutions	2:30 PM – 6:00 PM	Governor's Ballroom, Salon B
Seminar 9	Magnetic Integration for High Density	2:30 PM – 6:00 PM	Governor's Ballroom, Salon E
Seminar 10	A Practical Introduction To Digital Power Supply Design	2:30 PM – 6:00 PM	Governor's Ballroom, Salon D
Seminar 11	Fundamentals Of State Plane Analysis of Converters	2:30 PM – 6:00 PM	Room 406
Seminar 12	Electric Drives: Understanding Basics To Advanced Control And Encoder-Less Operation	2:30 PM – 6:00 PM	Room 408

### Monday, March 7

Registration Desk Open	8:00 AM – 5:00 PM	Austin Grand Ballroom Foyer
------------------------	-------------------	-----------------------------

Seminar 13	Digital Power System Management	8:30 AM – Noon	Governor's Ballroom, Salon A
Seminar 14	EMC Enhanced Power Supply Design	8:30 AM – Noon	Governor's Ballroom, Salon B
Seminar 15	Basic Planar And Integrated Magnetics Design Techniques	8:30 AM – Noon	Governor's Ballroom, Salon E
Seminar 16	Analyzing And Correcting Power Electronic Failures	8:30 AM – Noon	Room 406
Seminar 17	Design-Oriented Feedback Analysis: A Final Solution, V.2	8:30 AM – Noon	Governor's Ballroom, Salon D
Seminar 18	Hybrid Vehicle Propulsion: Exploring the Electronic CVT	8:30 AM – Noon	Room 408
Session 1	Plenary	1:30 PM – 5:30 PM	Governor's Ballroom
Spouse & Guest Welcoming Breakfast		8:00 AM – 9:00 AM	Room 404
Spouse & Guest Tour 1 – Texas Legend And Lore		9:00 AM – 4:00 PM	Meet In Room 404
Welcoming Reception – (Exhibit Hall Opens When The Plenary Session Concludes)		5:30 PM – 8:00 PM	Austin Grand Ballroom
Micro Mouse Contest		8:00 PM – 10:00 PM	Governor's Ballroom, Salon C

### Tuesday, March 8

Registration Desk Open		8:00 AM – 5:00 PM	Austin Grand Ballroom Foyer
Session 2	Digital Control Techniques & Application	8:30 AM – Noon	Governor's Ballroom Salon C
Session 3	Fuel Cell Power Conditioning	8:30 AM – Noon	Room 408
Session 4A	Thermal Management	8:30 AM – 10:15 AM	Room 406
Session 4B	The Business of Power Electronics	10:45 AM – Noon	Room 406
Session 5	Power System Architectures	8:30 AM – Noon	Governor's Ballroom Salon A
Session 6	AC-DC Power Supplies	8:30 AM – Noon	Governor's Ballroom Salon B
Session 7	Voltage Regulator Modules	8:30 AM – Noon	Governor's Ballroom Salon D
Session 8	Discrete Semiconductor Devices	8:30 AM – Noon	Governor's Ballroom Salon E
Speaker's Briefing And Breakfast (Tuesday Presenting Speakers Only)		7:00 AM – 8:15 AM	Rooms 400 & 402
Spouse & Guest Tour 2 – Take A Walk On The Wild Side		9:00 AM – 4:00 PM	Meet In Room 404
Exhibit Hall Open		Noon – 5:00 PM	Austin Grand Ballroom
Lunch In The Exhibit Hall (Ticket Required)		Noon – 1:30 PM	Exhibit Hall
Exhibitor Seminars Session I—See Exposition Directory For Seminar Descriptions		2:30 PM – 3:15 PM	See Exposition Directory
Tuesday Afternoon Coffee Break And Ice Cream Social		3:15 PM – 3:45 PM	Exhibit Hall
Exhibitor Seminars Session II—See Exposition Directory For Seminar Descriptions		3:45 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: Digital Control Of Power Supplies...?	5:00 PM – 6:30 PM	Governor's Ballroom, Salon B
Rap Session II	Rap Session 2: Will Alliances Help Or Hinder?	5:00 PM – 6:30 PM	Governor's Ballroom, Salon A
Rap Session III	Rap Session 3: What Will Power Supply Companies Look Like...?	5:00 PM – 6:30 PM	Room 400
Exhibitor Hospitality Time – See Individual Exhibitors For Their Offering		6:30 PM – 10:00 PM	

### Wednesday, March 9

Registration Desk Open		8:00 AM – 3:00 PM	Austin Grand Ballroom Foyer
Session 9	Physical Design & Packaging	8:30 AM – 10:15 AM	Governor's Ballroom Salon A
Session 10	New Topologies for Non-Integrated DC-DC Converters	8:30 AM – 10:15 AM	Governor's Ballroom Salon B
Session 11	Multilevel Converters	8:30 AM – 10:15 AM	Governor's Ballroom Salon D
Session 12	Adjustable Speed Induction Motor Drives	8:30 AM – 10:15 AM	Room 406
Session 13	Energy Systems for Transportation	8:30 AM – 10:15 AM	Room 408
Session 14	Three-Phase Rectifiers	8:30 AM – 10:15 AM	Governor's Ballroom Salon E
Special Presentation Session 1 – Power Electronics For A Green World		8:30 AM – 10:15 AM	Governor's Ballroom Salon C
Speaker's Briefing And Breakfast (Wednesday Presenting Speakers Only)		7:00 AM – 8:15 AM	Rooms 400 & 402
Exhibit Hall Open		10:15 AM – 2:00 PM	Austin Grand Ballroom
Wednesday Morning Coffee Break		10:15 AM – 10:45 AM	Exhibit Hall
Exhibitor Seminars Session III—See Exposition Directory For Seminar Descriptions		11:00 AM – 11:45 AM	See Exposition Directory
Lunch In The Exhibit Hall (Ticket Required)		Noon – 1:30 PM	Exhibit Hall

### Wednesday, March 9 (Continued)

Session 15	Uninterruptible Power Supplies	2:00 PM – 5:30 PM	Governor's Ballroom Salon A
Session 16	Electronic Ballasts	2:00 PM – 5:30 PM	Governor's Ballroom Salon B
Session 17	Multi-Phase PFC Circuits	2:00 PM – 5:30 PM	Governor's Ballroom Salon D
Session 18	DC-DC Isolated Topologies	2:00 PM – 5:30 PM	Governor's Ballroom Salon E
Session 19	AC Motor Drives	2:00 PM – 5:30 PM	Room 408
Session 20A	Integrated Semiconductor Devices	2:00 PM – 3:45 PM	Room 406
Session 20B	EMI/EMC	4:15 PM – 5:30 PM	Room 406
Special Presentation Session 2 – Current Topics In Power Electronics Research		2:00 PM – 5:30 PM	Governor's Ballroom Salon C
Conference Social Event (See Conference Program For Details, Ticket Required)		6:45 PM – 10:00 PM	Austin Music Hall

### Thursday, March 10

Registration Desk Open		8:00 AM – Noon	Austin Grand Ballroom Foyer
Session 21	Digital Control of Single-Phase PFC	8:30 AM – 11:30 AM	Governor's Ballroom Salon A
Session 22	AC-Output Converter Circuits	8:30 AM – 11:30 AM	Governor's Ballroom Salon B
Session 23	Analysis & Control of Non-Isolated DC-DC Converters	8:30 AM – 11:30 AM	Governor's Ballroom Salon D
Session 24	Permanent Magnet Motor Drives	8:30 AM – 11:30 AM	Room 406
Session 25	Capacitors & Chargers	8:30 AM – 11:30 AM	Room 408
Session 26	Automotive Electronics	8:30 AM – 11:30 AM	Governor's Ballroom Salon E
Special Presentation Session 3 – Power Electronics Industry Predictions		8:30 AM – 11:30 AM	Governor's Ballroom Salon C
Dialogue Sessions See APEC Program for Details on Specific Sessions		11:30 AM – 2:00 PM	Austin Grand Ballroom
Dialogue Session Lunch		11:30 AM – 12:30 PM	Austin Grand Ballroom
Session 27	Ballasts for HID and CCF Lamps	2:00 PM – 5:30 PM	Governor's Ballroom Salon A
Session 28	AC-Output Converter Control	2:00 PM – 5:30 PM	Room 408
Session 29	Single Phase Power Factor Correction	2:00 PM – 5:30 PM	Governor's Ballroom Salon B
Session 30	DC-DC Power Conversion and Control	2:00 PM – 5:30 PM	Governor's Ballroom Salon C
Session 31	DC-DC Converters: High Voltage or High Power	2:00 PM – 5:30 PM	Governor's Ballroom Salon D
Session 32	Magnetics	2:00 PM – 5:30 PM	Room 406
Session 33	Simulation & Modeling	2:00 PM – 5:30 PM	Governor's Ballroom Salon E
Speaker's Briefing And Breakfast (Thursday Presenting Speakers Only (Includes Dialogue Session Presenters))		7:00 AM – 8:15 AM	Rooms 400 & 402
Technical Tour: Center For Electromechanics, University Of Texas At Austin		6:00 PM – 8:30 PM	Meet In Hotel Lobby

## REGISTRATION FORM

Mail or fax your registration to:

APEC 2005/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 Thursday, February 3, 2005**  
**Pre-Conference Registrations Must Be Received By Friday, February 25, 2005**  
**Save Time! [Register On-Line!](#)**

Name \_\_\_\_\_  
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: \_\_\_\_\_

**FULL REGISTRATION (INCLUDES TECHNICAL SESSIONS, CD-ROM PROCEEDINGS, SEMINARS, WORKBOOK AND SOCIAL EVENT)**

Member – After February 3, 2005	\$925
Non-Member – After February 3, 2005	\$1100
Students And IEEE Life Members	\$325

**TECHNICAL SESSIONS (INCLUDES CD-ROM PROCEEDINGS AND SOCIAL EVENT)**

Member – After February 3, 2005	\$550
Non-Member – After February 3, 2005	\$650
Students And IEEE Life Members	\$225

**PROFESSIONAL EDUCATION SEMINARS (INCLUDES SEMINAR WORKBOOK)**

Member – After February 3, 2005	\$425
Non-Member – After February 3, 2005	\$500
Students And IEEE Life Members	\$150

**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: Texas Legends And Lore	\$64
Tuesday Spouse & Guest Tour: Take A Walk On The Wild Side	\$80
Laboratory Tour: Center For Electromechanics	Free

**TOTAL DUE:** \_\_\_\_\_

**PAYMENT**

Payment can be by check or credit card. Checks should be made payable to **APEC 2005** 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 2004 offices by Thursday, February 3, 2005. All refund requests will be charged a \$50 handling fee and will be processed after the conference.

# APEC 2005

March 6–10, 2005  
Hilton Hotel  
Austin, Texas

## IEEE APEC HOTEL RESERVATION FORM

Mail or fax with one night's reservation payment to:

The Hilton Hotel– Reservations  
500 East 4th Street  
Austin, Texas 78701

Phone: 800-445-8667  
Phone: 512-482-8000  
Fax: 512-682-2769

**All Hotel Reservations Must Be Received By February 3, 2005!**

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 (\$170.00 + taxes)  Double Room (\$170.00 + taxes)

HILTON HHONORS 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 Hilton 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 512-482-8000 to cancel. Be sure to record your cancellation number.