Advance Program

Fifteenth Annual Power Electronics Conference And Exposition

February 6-10, 2000

Fairmont Hotel

New Orleans, Louisiana

www.apec-conf.org

APEC® 2000

CoSponsored By

Power Sources Manufacturer's Association (PSMA)

IEEE Power Electronics Society

IEEE Industry Applications Society

Applied Power Electronics Conference and Exposition
February 6 - 10, 2000
Fairmont Hotel
New Orleans, Louisiana
www.apec-conf.org

Co-Sponsored By
IEEE Power Electronics Society
IEEE Industry Application Society
Power Sources Manufacturer's Association

APEC 2000, the fifteenth annual meeting, returns to the site of the first APEC, the Fairmont Hotel in New Orleans. From its modest beginning, I doubt that the founders of APEC envisioned it growing to be the premier conference in the world for the practicing power electronics professional. This year, APEC received over 400 digests from authors in 40 countries wishing to present their latest results and over thirty seminar proposals for the fifteen available seminar sessions. The Exposition, with 106 booths, has been sold out since the last APEC. Truly, there is no other power electronics conference like APEC.

APEC is planned and managed by the APEC Conference Committee. This committee consists of volunteers from industry and academia who work together with superb professional conference mangers. I would like to thank the committee, volunteers and professional managers alike, for their incredible devotion and countless hours of hard work spent making sure that every detail of the conference will be the best it can be.

On behalf of the sponsors of APEC and the Conference Committee, I invite you to join us in New Orleans for what promises to be the best APEC ever.

Robert V. White
General Chair

APEC WEB SITE

For the latest information on APEC, please consult the APEC web site at **www.apec-conf.org**. The web site has the latest news and information, access to on-line registration and downloadable registration forms.

FOR MORE INFORMATION

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

APEC 2000
2000 L Street, NW Suite 710
Washington DC 20036 USA
Telephone: +1-202-973-8664
Facsimile: +1-202-331-0111
Email: APEC@courtesyassoc.com

NEW FOR APEC 2000

APEC IS SERVING BREAKFAST!

For the first time, APEC will be serving breakfast. A continental breakfast buffet is being offered each day for a nominal charge of $4.00. While there will be a limited number of tickets available at the door, we recommend that tickets be purchased in advance. The breakfast is open to all registered attendees, exhibitors and spouses and guests. We hope that providing the convenience of a quick breakfast close to conference activities will enhance your enjoyment of APEC 2000.

EXPANDED SPOUSE & GUEST HOSPITALITY PROGRAM

With so much to see and do in New Orleans, APEC is offering an expanded program for spouses and guests accompanying APEC attendees. APEC will have a Spouse And Guest Hospitality Room open daily, a program of talks and tours to acquaint you with New Orleans and the French Quarter and information on a number of tours from which you can choose to best fit your interests.

ON-LINE REGISTRATION

Also for the first time, attendees can register for the conference via the World Wide Web through the APEC website, **www.apec-conf.org**. Payment by credit card is required for on-line registration.

SATURDAY REGISTRATION

Beat the Sunday morning rush at the registration desk by registering on Saturday afternoon! For those arriving early, the Conference Registration Center will be open on Saturday, February 5 from 3:00 PM to 6:00 PM.

NEW ORLEANS

New Orleans is the perfect city to host APEC 2000; no other location can boast the range of extraordinary cuisine, music, history, shopping and energy. Known as the Big Easy, New Orleans derives its blend of hospitality, irreverence, and beauty from its Creole roots, a merging of French and Spanish settlers in the 1700s. Now known as one of the premier conference city hosts in the country, New Orleans has superbly combined an appreciation for its history (Cajun music, zydeco, the French Quarter, St. Louis Cathedral, riverboat cruises) with excitement for all that contemporary culture has to offer (the Louisiana Superdome, the Aquarium of the Americas, the House of Blues). It is impossible not to fall in love with this unconventional city and all that it has to offer!

MARDI GRAS!

The Mardi Gras celebration in New Orleans is world-renowned. The city becomes one giant party - which can be a lot of fun but it can also be completely overwhelming.

Mardi Gras day itself is Tuesday, March 7, 2000 with the biggest parades and parties being held the weekend before. APEC, being held Sunday to Thursday, February 6-10, 2000, is a month before the big celebrations. New Orleans will be just starting the Mardi Gras celebration but will not yet be completely enveloped in the big crowds and overwhelming crush of the big weekend. This makes the week of APEC a perfect time to sample the spirit of a New Orleans Mardi Gras celebration without being overwhelmed by streets filled with rowdy revelers.

WHAT TO DO IN NEW ORLEANS

Whether you are interested in shopping, fine dining, live music, historical sightseeing or modern museums, New Orleans will not leave you wanting.

For the shopper, New Orleans offers a unique wonderland of the new and the old. There are numerous antique and estate sale shops in the French Quarter - just a few minutes walk from the Fairmont Hotel. Along Magazine Street there is Saks Fifth Avenue, Gucci, Laura Ashley and Brooks Brothers at Canal Place (downtown). Faulkner House Books, on Pirate's Alley, specializes in rare Southern literature. F & F Botanica, on North Broad Street offers votive candles, statues, powders and oils which promise good luck or hexing powers. And in the Warehouse District, there are dozens of contemporary art galleries.

Perhaps absorbing the music of the city is your goal. Adjacent to the conference site, you can listen to zydeco at Mulate's on Julia Street. Or find out who is playing at Tipitina's (uptown on Napolean Ave.). Known as "Tip's", this live music club helped launch the careers of Harry Connick, Jr., the Neville Brothers and other blues and R&B performers. If it is jazz that you crave, head over to Maxwell's Jazz Cabaret in the French Quarter. You can hear traditional jazz Dixieland, swing and sometimes vaudeville musical acts. At Preservation Hall, next door to the world famous Pat O'Brien's (renowned for its infamous Hurricane drink), you can listen to a night of excellent traditional jazz and ragtime for a cover charge of only $5.00!

Don't think that New Orleans ignores the more traditional music offerings: opera is performed be the New Orleans Opera Association at the Mahalia Jackson Theatre of the Performing Arts and the Louisana Philharmonic Orchestra performs 25 shows a season.

New Orleans is also an historian's delight. From the historical houses of the French Quarter to the plantations and estates that surround the city, from the bayous to the riverbanks of the Mississippi River, the historian will not lack for places to go and see.

If you are drawn to something a bit spookier, take a tour of one of the local cemeteries whose elaborate tombs date back to the 1700s. Follow that with a visit to the New Orleans Historic Voodoo Museum in the French Quarter where you can learn how African slaves preserved their voodoo rituals by hiding them under Christian rituals. If you are tired at this point, hire yourself a carriage to continue your tour of the French Quarter (Rampart Street).

If you don't find all that your needs satisfied here, visit www.alanet.com for an insider's guide to New Orleans;
www.lonelyplanet.com/dest/nam/new.htm; or
www.neworleans.about.com for much more information about the Big Easy.

DINING IN NEW ORLEANS

While New Orleans is best known for its Creole cuisine, you can find every kind of restaurant in New Orleans in almost every price range. Whether you prefer international cuisines from Asia to Europe, fine steaks or seafood or even American fast-food hamburgers, there is sure to be a place near the Fairmont that will satisfy.

However, APEC does suggest that you try some of the authentic Creole and Cajun food developed in New Orleans and the surrounding regions. One of the most popular restaurants is K-Paul's Louisiana Kitchen, home of the original blackened redfish. Or try Andrew Jaeger's House of Seafood for casual New Orleans flavors and nightly music. Or Bon Ton Cafe, New Orleans oldest Cajun restaurant for crawfish etouffee or shrimp and oyster jambalaya. Taste some gumbo or po-boys at Liuzza's, a New Orleans relic in the finest tradition of the genre. Or relax in the shade of the gardens of the Commander's Palace in the Garden District and enjoy an unparalleled dining experience. Give it a try and chase all of that spicy food down at the Fairmont Hotel's bar - the one that introduced the gin fizz to the world!

WEATHER IN NEW ORLEANS

February and March is the best time of year to visit New Orleans. It is prior to the rainy season and before the high heat that can make the summer quite oppressive. A typical day has a high temperature of about 15 °C (60 °F). The evenings can be downright cool with the temperature dipping to 5 °C (40 °F) so pack accordingly.

APEC HIGHLIGHTS

TECHNICAL SESSIONS

APEC will once again offer a total of 26 Technical Sessions with a wide range of topics including AC-DC power supplies, DC-DC converters, motor drives, inverters, lamp ballasts and magnetics. The Plenary Session on Monday afternoon features a combination of papers on special topics from noted industry experts as well as a selection of papers from those submitted for general review.

PROFESSIONAL EDUCATION SEMINARS

APEC's Professional Education Seminars give you a unique opportunity to hear some of the world's foremost authorities in power electronics

for a fraction of the price that other conferences charge. This year, APEC received over thirty excellent proposals for the fifteen available seminar sessions. Choosing was not easy but APEC 2000 will have another superb seminar program.

One of the seminars will be a special one-time event that should not be missed by anyone in the power supply industry. The PSMA sponsored a study of the State of Power Electronics Packaging (STATPEP) that was performed by the Power Electronics Ireland group in Cork, Ireland. A paper at last year's APEC presented the first results of that study. This year, several of the outside experts that guided and evaluated the study will review the results for the seminar attendees. This will be a unique opportunity to get a comprehensive look at today's state of the art in power electronics packaging.

EXPOSITION

The APEC Exposition is once again sold out! The Exposition Hall will be packed from wall to wall with 106 booths featuring all the latest and greatest products and services from the leading companies in the power electronics industry.

The Exposition Hall is also the social center of APEC. Whether it is during one of the conference receptions or during the luncheons, the Exposition 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.

MICROMOUSE CONTEST

According to one spectator, "Just too much fun". APEC will once again host the premier Micromouse contest in North America, drawing contestants from all over the world. Come by the Grand Ballroom at 8:00 PM on Monday to cheer your favorite mouse to victory.

RAP SESSIONS

Hot, current, controversial and even emotional topics are traditionally explored at APEC's Rap Sessions and this year is no different. APEC is pleased that three of the industry's most well known contributors are leading discussions on topics that will affect everyone at the conference. Don't miss your chance to hear the industry pundits on both sides of these issues and to let your opinion be heard.

CONFERENCE BANQUET

This year's conference banquet promises to be one not soon forgotten. We will be taking advantage of a unique opportunity that only New Orleans at Mardi Gras time can offer. If you thought the Mardi Gras banquet at APEC '97 in Atlanta was a good time, you haven't seen anything yet!

REGISTRATION

In order to participate in APEC 2000 activities, one must register with the conference. Registration for the Professional Education Seminars and Technical Sessions requires payment of the appropriate registration fees.

Admission to the Exposition Hall is complimentary, but one must register at the Conference Registration Center and receive a badge that allows entrance. Exposition Only registrations are only done at the conference and cannot be done in advance.

Spouses and guests who wish to participate in the Spouse And Guest Hospitality Program are required to register with the conference but there is no charge.

REGISTRATION FEES

Membership

Member registration rates are available to all current IEEE members and employees of companies that are current members of the Power Sources Manufacturer's Association (PSMA).

To make sure there is no delay in processing your registration or checking in at the Conference, please indicate on the registration form how you qualify for the Member rates by providing either your IEEE membership number or the name of your employer in the space provided.

Advance Registration

Professional Education Seminars

Member $250.00
Non-Member $300.00

Technical Sessions

Member $350.00
Non-Member $425.00

Late Or On-Site Registration

Professional Education Seminars

Member $300.00
Non-Member $350.00

Technical Sessions

Member $425.00
Non-Member $500.00

IEEE Life Members And Students

Professional Education Seminars $50.00
Technical Sessions $100.00

When registering at the conference, you will be required to show identification to receive the Life Member and Student rates. Student rates require full time registration at an accredited institution.

ADVANCE REGISTRATION DEADLINE

Registrations must be received at the APEC registration offices or on the on-line registration system no later than the close of business on **Friday, January 7, 2000** to be eligible for the Advance Registration rates.

WHAT'S INCLUDED

Professional Education Seminars

Registration for the Professional Education Seminars includes one copy of the Seminar Workbook in hard copy and admission to any or all of the Professional Education Seminars. Unlike some conferences that require a separate registration fee for each seminar, APEC gives you your choice of as many seminars as you can attend for one low registration fee.

Also included in the registration fee for the Professional Education Seminars is admission to the:

- Exposition Hall,
- Exposition Hall receptions,
- Exhibitor's Seminars,
- MicroMouse Contest and
- Rap Sessions.

Technical Sessions

Registration for the Technical Sessions includes one copy of the Proceedings in hard copy, one copy on CD-ROM and admission to any or all of the Technical Sessions.

Also included in the registration fee for the Technical Session is admission to the:

- Conference Banquet,
- Exposition Hall,
- Exposition Hall receptions,
- Exhibitor's Seminars,
- MicroMouse Contest and
- Rap Sessions.

Exposition Only

Included in the no-charge Exposition Only registration is admission to the:

- Exposition Hall,
- Exposition Hall receptions,
- Exhibitor's Seminars,
- MicroMouse Contest and
- Rap Sessions.

Exposition Only registrations must be done at the conference; they cannot be done in advance.

Spouse And Guest Registration

Spouses and guests accompanying APEC attendees are encouraged to register with the conference. Spouses and Guests who register with the conference will receive a badge allowing admission to the:

- APEC Spouse And Guest Hospitality Room,
- Welcoming Breakfast And New Orleans Orientation Talk,
- Exposition Hall,
- Exposition Hall receptions,
- Exposition Hall luncheons (with separately purchased ticket),
- Conference Breakfasts (with separately purchased ticket),
- MicroMouse Contest and
- Rap Sessions.

Those Spouses and Guests registering in advance will also receive a welcoming packet when checking in at the conference. This packet will include:

- Registration badge,
- Tickets for the New Orleans Bus Tour and French Quarter Walking Tour for which registration was received in advance and space permitted,
- A listing of all APEC Spouse and Guest Hospitality Program events and
- Information on the hotel, the area around the hotel and New Orleans in general.

HOW TO REGISTER

On-Line Registration

New to APEC this year is the ability to register on-line at the APEC website, **www.apec-conf.org**. A Master Card, Visa or American Express card will be required.

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 website, **www.apec-conf.org**.

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

APEC 2000/RHS
6901 K Avenue, Suite 106
Plano, Texas 75074 USA
Facsimile: +1-972-881-1747

For registrations that are sent by mail, payment must be included. You may make payment by either credit card or with a personal, business or certified check or a money order 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. Items returned unpaid or for which payment was refused will be assessed an additional handling charge of $25.00.

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. If your credit card payment is refused, an additional handling charge of $25.00 will be assessed.

CONFIRMATION OF REGISTRATION

All Advance Registrants will be sent a post card confirming that their registration has been received. The post card 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 Advance Registration Deadline do not allow time for a confirmation to be sent by mail.

REGISTRATION CENTER AT THE CONFERENCE

The Conference Registration Center will be located in the foyer of the Imperial Ballroom and will be open as follows:

Saturday, February 5.....3:00 PM - 6:00 PM

Sunday, February 6.....8:00 AM - 6:00 PM

Monday, February 7 .....7:30 AM - 5:00 PM

Tuesday, February 8 .....7:30 AM - 5:00 PM

Wednesday, February 9 ...7:30 AM - 2:00 PM

Thursday, February 10 .....7:30 AM - 12:00 Noon

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 **Friday, January 7, 2000**. All refunds will processed after the conclusion of the conference and will be subject to a $25.00 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 Fairmont Hotel in New Orleans, Louisiana will be the center of activity for APEC 2000. The

Fairmont Hotel is located at 123 Baronne Street, just off of Canal Street and a block away from Bourbon Street and the French Quarter and a short walk to the thriving riverfront.

Built in 1893, the New Orleans Fairmont is one of nation's truly grand hotels and one of the city's most colorful historic treasures. The Fairmont has been magnificently restored and offers a charm and beauty that cannot be matched by a modern business hotel. By simply stepping into the lobby with its frescoed, vaulted ceilings and ornate, gilded carvings, you will know that a special experience awaits you in the days ahead. APEC is most pleased to return to this classic hotel and for the best conference experience, we highly recommend that you stay at the Fairmont.

Reservations

A block of rooms at preferred rates has been reserved for APEC 2000 participants at the Fairmont Hotel. To make a reservation, please complete the hotel registration form included in this program and mail or fax it to:

The Fairmont Hotel
123 Baronne Street
New Orleans, LA 70140
Tel: +1-504-529-7111
Fax: +1-504-522-2303

A hotel registration form in Adobe® Acrobat® format can also be downloaded from the APEC website, **www.apec-conf.org.**

Hotel Rates

The Fairmont Hotel is offering the following special rates to APEC participants. Please mention that you are with APEC 2000 when making your reservations.

Single $169.00

Double $189.00

Current city and state taxes are additional.

In order to receive the preferred conference rates listed above, **it is imperative that you make your reservations before January 6, 2000**. After January 6, these preferred rates will not be available.

AIRLINE DISCOUNT PROGRAM

American Airlines will be the official airline for APEC 2000. They are offering a number of discount fares for APEC attendees traveling to New Orleans. The earlier you make your reservations, the better the discount. To take advantage of these low fares, give the IEEE Applied Power Electronics Conference identifier number, 972OUD, to your travel agent or call American Airlines at their special Meeting Services Desk Toll Free Number: 1-800-433-1790.

GROUND TRANSPORTATION

Airport Shuttle, Inc. is the official transportation company providing shuttle service for the city of New Orleans to and from the New Orleans International Airport. Current prices are $10 per person one-way and $20 per person round-trip. Upon arrival at the airport, guests can purchase tickets from the Airport Shuttle information desks. Vans depart the airport every 15 minutes.

Taxis are also available at the airport. The one way fare from the airport to the Fairmont Hotel is $21 for one or two people and $8 per person for three or more.

CAR RENTAL

AVIS will offer attendees a special conference rate from January 30—February 17, 2000. To take advantage of this special rate, call the AVIS Meeting Reservation and Information Desk at 1-800-331-1600. Identify yourself as eligible for the APEC rate by the giving the AWD discount number, A606092.

SPOUSE & GUEST PROGRAM

New Orleans is a fabulous city to visit with much to see and do. APEC 2000 would like to extend a special invitation to the spouses and other guests of our attendees to join us in New Orleans.

To make your visit rewarding and enjoyable, APEC has put together a comprehensive Spouse and Guest Hospitality Program for registered spouses and guests including:

- A Hospitality Room that will be open daily,
- A complimentary orientation program including a continental breakfast, a guest speaker, a bus tour

of the city and a walking tour of the French Quarter, and

- Information on a number of tours available through commercial tour companies.

HOSPITALITY ROOM

So that the spouses and guests of APEC attendees can have a place to meet friends old and new, chat over a cup of coffee, plan the next expedition into the city or just hang out, the **ORLEANS ROOM** has been reserved. The Spouse and Guest Hospitality room will be open as follows:

Sunday, February 6 ..... 12:00 Noon - 5:00 PM

Monday, February 7 ..... 8:30 AM - 5:00 PM

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

Wednesday, February 9 .... 8:30 AM - 5:00 PM

Thursday, February 10 ..... 8:30 AM - 12:00 Noon

TOURS AND EVENTS

Monday, February 7, 9:00 – 11:00 AM
Welcoming Breakfast And City Orientation
Orleans Room

To help you get ready for your time in New Orleans, APEC is presenting a Welcoming Breakfast and City Orientation for registered spouses and guests.

While enjoying a deluxe continental breakfast, speakers from the New Orleans Convention And Visitor's Bureau will welcome you to New Orleans. They will give an overview of the city, describe the major attractions and activities in the city, and even present some tips on staying safe in the Big Easy.

Available for you to browse and to keep will be brochures and information on attractions in the city and tours available from commercial tour companies. The representatives of the New Orleans Convention and Visitor's Bureau will be on hand to answer any questions you might have about sightseeing, dining and shopping in New Orleans.

This event is complimentary to registered spouses and guests but you must have your name badge to be admitted.

Monday, February 7, 1:30 – 4:30 PM
New Orleans City Tour

To further your introduction to New Orleans, there will be a motorcoach tour that will give you a first hand look at the city. This tour, narrated by a licensed guide, includes historic Esplanade Avenue where you will see the mansions of Creole merchants nestled among 100-year-old oak trees. The tour continues to St. Louis III Cemetery, often called the "city of the dead" because of the above ground tombs. You will then proceed along Lake Pontchartrain and then wind through the old town of Carrollton. The tour proceeds along St. Charles Street, following the streetcar route, where you'll see Tulane and Loyola Universities, Audubon Park and beautifully restored mansions.

Tour participants should meet in the Spouse And Guest Hospitality Room no later than 1:15 PM.

This tour is complimentary to registered Spouses and Guests but space is limited. If you are interested in this tour, your are encouraged to make your reservations as early as possible.

Tuesday, February 8, 9:00 AM – 12:00 Noon
Walking Tour Of The French Quarter

The French Quarter is synonymous with New Orleans to many people. It is a charming section of the city that is filled with eighteenth and nineteenth century architecture, fabulous restaurants, the world famous Bourbon Street and Preservation Hall, and shopping that ranges from the breathtaking antiques of Royal Street to modern boutiques.

The only way to really get to see and know the French Quarter is by walking through it. APEC is providing a walking tour, led by a licensed guide, to properly introduce you to this part of the city. The tour includes admission to two historic homes featuring fine examples of antique furniture, decorative plaster cornices and ornamental ironwork as well as romantic, Spanish influenced courtyards and patios.

Participants should meet in the Spouse And Hospitality Guest Room no later than 8:45 AM. Wear comfortable walking shoes and clothing appropriate to the weather. Lunch is not included.

This tour is complimentary to registered Spouses and Guests but space is limited. If you are interested in this tour, your are encouraged to make your reservations as early as possible.

Wednesday, February 9, 9:30 AM til ??? Group Shopping Safari

Those interested in a joining with others to take advantage of the unique shopping available in New Orleans should meet in the Spouse And Guest Hospitality Room at 9:30 AM. Based on the interests of those that assemble, groups will be organized to visit the French Quarter antique shops, riverfront boutiques or other shopping areas in the city. Brave volunteers from the ranks of the APEC Spouses And Guests will lead the groups.

Wear comfortable walking shoes and clothing appropriate to the weather. Lunch will be no-host and at the discretion and choice of each group.

OTHER TOURS

New Orleans has such a variety of places of interest that we were unable to choose tours or attractions that would appeal to all. APEC will have available information on a number of different tours, sightseeing expeditions and attractions so that you can choose the ones that best suit your needs and interests. These tours are offered through regular tour companies. The cost varies depending on the tour but typically cost from $15 to $35 each. There are too many to list here, but a sampling of the tours that are available includes:

- Tours of a number of different plantations and antebellum homes and estates,
- The New Orleans School of Cooking,
- Riverboat cruises,
- The Garden District,
- A Swamp Tour, and
- The New Orleans Mint Museum.

APEC encourages the Spouses, Guests and Attendees to be creative and adventurous in exploring New Orleans. Whether it is taking a riverboat cruise, relaxing with a Hurricane drink in Pat O'Brien's famous courtyard, or rounding up a group of old and new friends to try out one of New Orleans' fabulous restaurants for lunch, the opportunities to relax and enjoy are limited only by your imagination.

SPOUSES AND GUESTS ARE WELCOME AT…

…all APEC social and dining events. In particular, spouses and guests are welcome at the Exhibitor Receptions (badge required), Conference Breakfasts (ticket required), Exposition Hall Luncheons (ticket required), the Conference Banquet (ticket required), Rap Sessions (badge required) and the MicroMouse Contest.

CONFERENCE BANQUET

Wednesday, February 10, 2000, 6:00 – 10:00 PM

After four days of intense reading, listening and discussing our trade, this will be a time to slow down, enjoy a special meal with friends and colleagues and relax in high New Orleans Style.

We will be leaving the Fairmont Hotel and going across the Mississippi River to **Blaine Kern's Mardi Gras World**. This is the largest float builder in the world and it will be hopping as everyone prepares for the coming Mardi Gras parade! We will have a chance to see the floats up close and how they are built, have a banquet dinner, be entertained by a zydeco band and even be treated to our own Mardi Gras mini-parade. This is a unique opportunity that is not to be missed.

The buses will start loading from the hotel lobby entrance at 6:00 PM. The last bus will leave the Fairmont for Mardi Gras World at 6:30 PM. You will be required to have a banquet ticket in order to board the bus.

To provide the most convenience, the first bus to return to the hotel will be available for boarding at 8:30 PM. It will depart as soon as it is full. Buses will continue to board and leave when full so that you can return to the hotel when you wish. The last bus will leave Mardi Gras World for the Fairmont Hotel at 10:00 PM.

DINING AT APEC

DINING IN THE HOTEL

There are two restaurants in the hotel: The Sazerac Grill and the Fairmont Court Restaurant & Bar.

Sazerac Grill

With views of The Fairmont's opulent lobby, this renowned dining room has been updated to reflect a more contemporary, bistro-style setting with original wooden flooring, crisp wall coverings and white tablecloths.

Guests can start their day with a delectable breakfast menu and heart-healthy buffet. Lunch and dinner feature many of The Sazerac's signature dishes such as Lobster bisque, Fairmont Salad, and Creole Bouillabaisse, along with grilled fresh seafood and meats, pasta creations, creative salads, appetizers and tempting desserts.

The Sazerac Grill is located on the Lobby Level and serves breakfast, lunch and dinner.

Breakfast .....6:00 AM - 11:30 AM
Lunch .....11:30 AM – 2:00 PM
Dinner.....5:30 PM – 10:00 PM

Fairmont Court Restaurant & Bar

The Fairmont Court is a warm, intimate setting overlooking the lobby. Served are cocktails, an appetizer menu, and an express breakfast to go. Dixie-land jazz entertainment is provided on weekends. The Fairmont Court is open from 9:00 AM to 1:00 AM.

The Sazerac Bar

The Sazerac Bar is a world-renowned historic bar featuring America's first cocktail, the Sazerac, along with the famous Ramos Gin Fizz, cocktails, wines and champagnes by the glass.

The Sazerac Bar, located on the Lobby Level, also serves breakfast and light meals.

Breakfast .....6:00 AM – 11:30 AM
Light Meals.....11:30 AM - 11:00 PM

DINING AROUND THE FAIRMONT HOTEL

The Fairmont Hotel is right at the edge of the French Quarter. There, generally within a few blocks walk, one can find any number of wonderful restaurants for dining. For example, the Redfish Grill is only two blocks away on Bourbon Street and offers excellent nouvelle Creole and seafood (dinner entrees are in the range of $18-25). Only a few steps further down Bourbon Street is Mike Anderson's Seafood.

The Gumbo Shop, at 630 St. Peter Street, is a favorite of the APEC General Chair. It is a little further walk (nine blocks) but offers very good New Orleans standards such as jambalaya and gumbo for moderate prices (dinner entrees for $7-12). In between one can find the full range of New Orleans dining.

For quick and economical breakfast and lunch, there are several good restaurants within two blocks of the Fairmont Hotel. Here are some of the most promising restaurants near the Fairmont:

- Pete's Deli – 225 Baronne Street – Sandwiches and deli fare
- O'Henry's – 305 Baronne Street – Hamburgers and pub food
- Bayou Bagelry – 830 Gravier Street – Bagels and deli sandwiches
- New City Diner – 828 Gravier Street – Home-style cooking, cafeteria style
- Subway – 312 Baronne – Submarine and deli style sandwiches
- Dunkin' Donuts – Corner of Common & Carondolet Streets – Coffee, donuts and sweet rolls

These restaurants are generally open from 7:00 AM until about 2:00 PM.

And for the most economy minded or time-pressed, several stores of national hamburger and fried chicken restaurant chains are just steps away from the Fairmont on Canal Street.

If you are interested in other suggestions, please ask the Fairmont Hotel concierge for recommendations.

CONFERENCE BREAKFAST

For the convenience of APEC participants, APEC will be serving a continental breakfast each day. The breakfast menu includes:

- Chilled Juices,
- Fresh Baked Pastries, Muffins and Croissants,
- Sliced Fresh Fruit,
- Assorted Fruit Yogurts and
- Coffee (Regular and Decaffeinated), Hot Tea and Milk.

The cost is $4.00 for each breakfast. You are encouraged to buy your tickets in advance. Tickets can be used on any day. A limited number of tickets will be available at the door.

Breakfast will be served in the Blue Room, located off the main hotel lobby:

Sunday, February 6 ..... 8:00 AM – 9:30 AM

Monday, February 7 ..... 7:00 AM – 8:30 AM

Tuesday, February 8 ..... 7:00 AM – 8:30 AM

Wednesday, February 9 ..... 7:00 AM – 8:30 AM

Thursday, February 10 ..... 7:00 AM – 8:30 AM

LUNCH WITH THE EXHIBITORS

Lunch will be served in the Exposition Hall on Tuesday and Wednesday. Advance purchase of a ticket is required. For details, please see *Exposition Hall Luncheons* on page 18.

ADDITIONAL INFORMATION

PURCHASING ADDITIONAL CONFERENCE PROCEEDINGS AND SEMINAR WORKBOOKS

Through Advance Registration

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

Conference Proceedings or Seminar Workbooks can be purchased through Advance Registration without registering for the conference. The books will be shipped after the conference and requires payment of a shipping and handling charge. Orders for Proceedings and Workbooks without registration for the conference will not be accepted after the Advance Registration deadline.

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

Remember that Advance Registration closes at the end of business on **Friday, January 7, 2000**.

Advance Purchase prices with registration for the conference:

Conference Proceedings $70.00
(Includes both Hardcopy and CD-ROM)

Seminar Workbook $60.00
(Hardcopy only)

Both Proceedings And Seminar Workbook
..... $120.00

Advance Purchase prices without registration for the conference (includes shipping and handling):

Conference Proceedings $95.00
(Includes both Hardcopy and CD-ROM)

Seminar Workbook $85.00
(Hardcopy only)

Both Proceedings And Seminar Workbook
..... $165.00

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, February 9. If there are any extra copies available, the prices will be:

Conference Proceedings $100.00
(Includes both Hardcopy and CD-ROM)

Seminar Workbook $100.00
(Hardcopy only)

Both Proceedings And Seminar Workbook
..... $175.00

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
Website: www.ieee.org/products/

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 Advance Registration.

SPONSOR MEMBERSHIP DESK

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 Fairmont Hotel and ask for the IEEE APEC 2000 Message Center. APEC participants are encouraged to regularly check the message board.

SACK SITTERS

Sack Sitters will be on site from Monday, February 7 through Thursday, February 10. Sack Sitters offers packaging and shipping of APEC Proceedings, Seminar Workbooks and conference materials to any destination. The Sack Sitters desk will be near the main registration area. Please check at the conference for Sack Sitters' operating hours.

IMPORTANT NOTICES

BADGES

Badges are required for admission to all Professional Education Seminars, Technical Sessions, Rap Sessions and the Exposition 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 2000 hotel space, meeting facilities or Exposition Hall.

DISTRIBUTION OF COMMERCIAL MATERIAL

Distribution of commercial material by organizations not participating in the Exposition is prohibited in the APEC 2000 hotel space, meeting space and Exposition Hall.

PROFESSIONAL EDUCATION SEMINARS

APEC 2000 features 15 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 experiences of experts in the field, the APEC 2000 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.

SEMINARS AT A GLANCE

SUNDAY 9:30am-1:00pm	SUNDAY 2:30pm-6:00pm	MONDAY 8:30am-12:00noon
S.1 Design and Analysis of Magnetic Devices W. Dunford, University of British Columbia	**S.6 Planar Magnetics Technologies** I. D. Jitaru, Rompower	**S.11 Compact Models of Power Devices and Power ICs for Circuit Simulation** H. A. Mantooth, University of Arkansas and P. O. Lauritzen, University of Washington
S.2 Intellectual Property, Patents and Ethical Issues for Engineers R. Severns, Springtime Enterprises, J. Bianco, Testa, Hurwitz & Thibeault	**S.7 Telecomm Power System Specification** D. Cooper and Y.-F. Liu, Astec Advanced Power Systems	**S.12 The State of Power Electronics Packaging** PSMA STATPEP Report Panel
S.3 Switching Power Supply Design Basics M. Brown, Sierra Energy Management Systems	**S.8 Selecting Switchmode Topologies for Various Applications** B. Carsten, Bruce Carsten Associates	**S.13 Latest Developments in Power-Factor Correction** R. Redl, ELFI S. A.
S.4 Introduction to High Efficiency Electronically Commutated Motor Drives J. Kokernak and S. Salon, Rensselaer Polytechnic Institute	**S.9 Switched Reluctance Motor Drives: Recent Advances and State of the Art** M. Ehsani and B. Fahimi, Texas A&M University	**S.14 Sensorless Control of Induction Motors and Permanent Magnet Synchronous Motors** M. Schrödl, Technical University of Vienna
S.5 Introduction to Small-Signal Modeling and Measurement of Switching Converters A. Witulski, University of Arizona	**S.10 Feedback Control Design** S. Leeb, Massachusetts Institute of Technology	**S.15 Connecting Theory with Design of Controllers in Switch-Mode Power Supplies, Power Factor Correction Circuits, and Motor Drives** N. Mohan, University of Minnesota

PROFESSIONAL EDUCATION SEMINARS SESSION ONE

Sunday, February 6, 9:30 AM – 1:00 PM

S.1 Design and Analysis of Magnetic Devices

William Dunford, University of British Columbia

Emerald Room

This is an introductory/revision course in magnetics. The emphasis is on power devices and there is minimal use of vectors. The goal is to revise material that may have been forgotten and to introduce material that may not have been met in basic courses in electrical engineering. Topics include: Ampere's Law; Faraday's Law; magnetic circuits and equivalent magnetic elements (reluctance, etc); basic inductor and transformer design equations - the difference between a multi winding transformer and a set of coupled inductors; current and voltage phasor relationships (for sinusoidal excitation); combinations of transformers; the dot convention; a brief discussion of three and two phase transformers; the rating of transformers for sinusoidal and non-sinusoidal excitation; referred and per unit loads; skin and proximity effects; transmission lines and printed circuit boards; the use of duality to design complex magnetic devices based on the electrical network to be implemented; forces in magnetic systems (Maxwell field stresses and virtual work); reluctance and Lorentz forces; the Biot Savart law; and the design of simple actuators and rotating machines.

S.2 Intellectual Property, Patents and Ethical Issues for Engineers

Rudy Severns, Springtime Enterprises, and John Bianco, Testa, Hurwitz & Thibeault

Grand Ballroom

The work of an engineer is not limited to a deliverable product. Of equal importance are the intangible resources of an engineer's imagination, such as concepts, ideas, design innovations and manufacturing processes, all of which make realization of a product possible. We live in a world where such intangible resources have great value and are actively sought by competing practitioners. Consequently, It is important for the practicing engineer, and the organization for which he or she may work, to know how to protect these resources and how to avoid infringing on the protected intellectual property rights of others. In

a world where engineering labor is expensive and in short supply, it is important to avoid wasting time repeatedly reinventing the same ideas. Effective prior art searching techniques help engineers to avoid such reinvention.

This seminar provides an overview, from an engineering perspective, of intellectual property, including patents and the patenting process, trade secrets, trademarks and copyrights. This tutorial further provides an overview of effective prior art searching and discusses security concerns, ethical issues and other topics relevant to practicing engineers and related to intellectual property.

S.3 Switching Power Supply Design Basics

Marty Brown, Sierra Energy Management Systems, LLC

University Room

This seminar is aimed at those persons just beginning in the power field, such as novice power engineers and those persons who work in related fields such as non-power engineers, and technicians, technical sales and administrative personnel. The information will be organized to promote an appreciation of switching power supply technology and be presented on an intuitive level with few equations.

The content will include: what is a linear versus a switching power supply, description of how basic switching power supplies operate, what is the best topology for one's application, designing some of the key circuits, overview of magnetics design, what are the major losses and how does one identify them, and what are the new developments within the field.

The outcome of attending this seminar will be a greater appreciation of the operation of switching power supplies and a basic knowledge of their design. A list of related literature will help the attendee add to his or her knowledge in the design and understanding of switching power supplies.

S.4 Introduction to High Efficiency Electronically Commutated Motor Drives

James Kokernak and Sheppard Salon, Rensselaer Polytechnic Institute

Bayou I

As the application of adjustable speed drives expands into the next century, more emphasis is being placed on advanced motor technologies beyond the induction motor. This is witnessed even today in automotive, military and appliance markets where brushless dc and switched reluctance motors are being selected for many applications. This seminar provides the power electronics student or professional with a general discussion of the operation of electric motors. Of specific interest are the switched reluctance and brushless dc motors. A comparison of motor operation, torque ripple and noise issues will be presented along with a discussion of drive technologies and how they may be applied to improve torque performance, high speed operation and reduce noise. Finally, flux linkage models of the two motors will be developed and used to demonstrate how the practicing engineer can determine the proper implementation, operation and control of the power electronic drive.

S.5 Introduction to Small-Signal Modeling and Measurement of Switching Converters

Arthur Witulski, University of Arizona

Bayou II

This seminar is intended for the engineer who is relatively new to the power electronics field, or one who needs a refresher to design converter feedback loops. The goal is to enable the participant to derive basic small-signal models for converters and measure small-signal transfer functions of converters in the laboratory. We explain why small-signal models are necessary, and illustrate the special problems of modeling switching converters. We then illustrate how to write the large-signal equations for a given converter topology and perturb and linearize them to obtain small-signal circuit models. These small-signal circuit models are used in a design-oriented manner to find the control-to-output transfer function to close the feedback loop, the line-to-output transfer functions to find the line regulation, and the output impedance to find the load regulation. Once a circuit model for a single output converter has been derived, we illustrate in an introductory way how the model changes for discontinuous mode operation, current-mode control, or when multiple outputs are present. Finally, we examine the operation of a typical network analyzer and illustrate techniques for measuring impedances, transfer functions, and loop gain in the laboratory.

PROFESSIONAL EDUCATION SEMINARS SESSION TWO

Sunday, February 6, 2:30 – 6:00 PM

S.6 Planar Magnetics Technologies

Ionel Jitaru, Rompower

Grand Ballroom

The seminar will provide a comprehensive overview of the planar magnetic technologies for design engineers, project managers, and other professionals with interests in planar magnetics. The presentation will include design guidance, illustrated with design examples and experimental results from telecommunications and electric vehicle applications. New trends in planar magnetics will be presented, such as the three-dimensional packaging technology as an optimization between electric-magnetic-thermal design. Attendees will become familiar with different construction techniques, ranging from discrete planar magnetic elements to fully integrated construction techniques. The advantages and the limitations associated with these technologies will be presented. The elements of the seminar include: an overview of different low profile magnetic construction techniques; minimization of leakage and stray inductance in planar transformers; interwinding and intrawinding capacitance; improving copper utilization for low-cost planar magnetics; construction techniques employing fully integrated multi-layer PCB; and compliance with safety agency requirements.

S.7 Telecomm Power System Specification

David Cooper and Yan-Fei Liu, Astec Advanced Power Systems

Emerald Room

This seminar will address the key issues involved in specifying the requirements for a typical telecomm power system based on the standard 48V DC bus architecture. All aspects will be covered, including AC-to-DC conversion, 48V distribution, battery sizing, DC-to-DC conversion, and system control and monitoring, as well as issues affecting the overall power system such as grounding, EMI, reliability and regulatory approval.

This seminar will be of benefit to engineers involved in the specification and design of power systems, particularly those who may be new to the telecomm power business. It will also be of interest to power supply designers or marketing people who want to know the big picture in telecomm power. Focus will be on defining the requirements for a (hypothetical) new system, and on the specification of the system elements. Detailed design issues will not be covered.

S.8 Selecting Switchmode Topologies for Various Applications

Bruce Carsten, Bruce Carsten Associates

University Room

This broad survey of power conversion topologies is intended for beginning to intermediate level design engineers with 1-5 years of experience, although advanced engineers may well find material of interest. The largely new seminar is in three parts.

First is an introduction to the Component Load Factor, or CLF, a rough measure of the relative total “size” (in Volt-Amp/Watt output) of power transistors required for various converter topologies; a high CLF indicates that both cost and power loss will tend to be high. Contrary to common beliefs, a two or three stage power converter may be shown to be more efficient (and less costly) than a corresponding single stage design.

The second section discusses the pros and cons of the common converter topologies for various requirements of high or low input voltage, output voltage, output current, power level, and operating frequency. Also discussed are the broad relative merits of classical hard switching, quasi-resonant or resonant switching, near of full resonant, and ZVS or resonant transition operation.

Finally, there is a presentation of about two dozen less common power switching and rectifier circuits that may be advantageous in various applications.

S.9 Switched Reluctance Motor Drives: Recent Advances and State of the Art

Mehrdad Ehsani and B. Fahimi, Texas A&M University

Bayou I

Switched reluctance motor (SRM) drives attract considerable attention in industry due to their simplicity, ruggedness, fault tolerance, and extremely wide speed range. Low cost manufacturing along with a robust performance has paved the way for applying this emerging technology over a wide range of power and speed, such as office products, household

goods, electric and hybrid electric vehicles, and heavy duty earth moving and mining equipment.

Design and control strategies for the SRM drive will be introduced in this seminar. Special attention will be paid to advanced control strategies for optimization of drive performance under manufacturing imperfections. Furthermore, this seminar includes origins and practical solutions for torque pulsation and vibration associated with SRM drives.

Recently, the required rotor position sensors for these drives have been eliminated with a variety of methods. The fundamentals of these techniques and some of the more practical implementations will be presented. The seminar will also include examples of the application of SRM drive technology in various industries.

S.10 Feedback Control Design

Steven Leeb, Massachusetts Institute of Technology

Bayou II

Feedback control design is essential for constructing high performance power electronic regulators and drives. This seminar will review the basic principles of feedback control with emphasis on familiar power electronic circuit examples. Beginning with the Nyquist stability criterion and root locus plots, we will build up the linear system metrics and tools commonly used to design feedback loops, including gain and phase margin, series and minor loop compensation, and a kit of series compensators including PID, dominant pole, lead, and lag compensators. An important goal of this seminar is to review interesting and practical problems that challenge or break the typical interpretations of gain and phase margin, and to understand how to spot and deal with these difficult cases, e.g., right-half plane zeros, long-tailed transients, unstable open-loop systems, etc. The seminar is aimed at practicing electrical engineers at the entry and intermediate levels in the power electronics industry who have an undergraduate familiarity with signals and systems (Laplace or Fourier transforms, Black's formula).

PROFESSIONAL EDUCATION SEMINARS SESSION THREE

Monday, February 7, 8:30 AM – 12:00 Noon

S.11 Compact Models of Power Devices and Power ICs for Circuit Simulation

H. Alan Mantooth, University of Arkansas and P. O. Lauritzen, University of Washington

Emerald Room

Commonly used compact models for power semiconductor devices are reviewed based on four application-based model classification levels. Examples are given of specific diode, MOSFET, IGBT and SCR/GTO models. Simulation-based designs of power converter, snubber, synchronous rectifier, and electrothermal circuits are demonstrated. New standard analog HDL languages will enable sophisticated models to run on many different simulators. A standardization effort is needed to identify models appropriate for different applications. Device failure and reliability could be included in future compact models for circuit stress and reliability simulations. The seminar will begin with a broad survey and history of power device models and model applications. It will progress into greater depth on current model development activities. The intended audience level is entry level or intermediate with respect to power device modeling.

S.12 The State of Power Electronics Packaging

PSMA StatPEP Report Panel: Mark Jacobs, Lucent Technologies; Charles Mullett, Condor DC Power Supplies; Doug Hopkins, SUNY at Buffalo; Rudy Severns, Springtime Enterprises; Chris Soule, Aavid Thermal Systems; Forrest Sass, PowerQuotes; Jeff Fishbein, Electronic Concepts, Inc.; Dhaval Dalal, Texas Instruments; James Sarjeant, SUNY at Buffalo; Arnold Alderman, International Rectifier Corp.

University Room

The seminar is a series of papers that have been prepared by engineers that are widely recognized as leading experts in their field of expertise for the various areas of power supply design. These papers are the culmination of 18 months of work reviewing the various issues of power supplies which has been a specially sponsored "Status of Power Electronics Packaging (StatPEP)" sponsored by PSMA and its members. Covering both ac-dc and dc-dc power supplies, there are 10 subjects to be

covered from overall power supply design and packaging design to the development of the various components within the power supply which include passive and active component design. In each area, the important trends and development event of the past 15 years will be reviewed. Key figures of merit (FOM) are identified. These FOMs are reviewed against detailed benchmarking analysis of 1998/9 current production models of power supplies. Lastly, based on the trends, the FOMs and their relationship to benchmark data, each speaker will envision the technology developments and issues that will enable or be a barrier to future power supply development. The overall methodology of the StatPEP project has been presented at various technical conferences during the past year. This seminar is the presentation of the Expert Summary section of that work.

This seminar provides the attendee with a very comprehensive update of power supply and power supply component packaging design and provides a brief, thought provoking view to the future.

S.13 Latest Developments in Power-Factor Correction

Richard Redl, ELFI S. A.

Grand Ballroom

The harmonic limits of the European norm EN61000-3-2 take full effect in January 1st, 2001. To achieve compliance with the norm, harmonic-reduction (customarily called power-factor correction or PFC) circuits must be added to the line rectifier sections of most line-powered electronic equipment. Recently a number of new PFC circuits were introduced, with the purpose of reducing complexity, cost, size, or losses, and improving performance. This seminar reviews and evaluates the new approaches, and presents design considerations for the best solutions. The covered topics include: an overview of the harmonic limits; single-phase passive PFC circuits (series inductor; series capacitor; inductor-capacitor combinations; valley-fill circuits; LCD rectifier); low-frequency active PFC circuits (single-phase slow-switching boost converter, three-phase slow-switching boost converter); single-phase high-frequency active PFC circuits (unusual boost rectifier topologies; new control techniques: DCM, CCM with current-clamping; techniques for reducing switching losses); three-phase high-frequency active PFC circuits (single-switch rectifiers; single-switch DCM flyback; system considerations for three independent single-phase circuits); and, integrated PFC solutions for single-phase isolated power supplies (unison control in two-stage circuits; techniques for reducing storage-capacitor voltage variation and improving line current waveform; boost-QR flyback combination; single-stage circuits: switch combination, line-voltage augmentation, charge pump). The level of the seminar is intermediate.

S.14 Sensorless Control of Induction Motors and Permanent Magnet Synchronous Motors

Manfred Schrödl, Technical University of Vienna

Bayou I

This seminar shows methods of speed-sensorless control of induction machines and permanent magnet synchronous machines (PMSMs, EC motors, brushless dc motors, respectively). The presented methods offer the possibility of a relatively simple implementation in industrial drives and hence, methods with high mathematical expense will only be mentioned briefly. EMF-based models for high speed as well as saturation-based and reluctance-based models for low speed and standstill will be discussed.

Practical examples for realized drives will be shown. A practical demonstration example of a sensorless PMSM drive with high starting torque will be presented, supporting a practical discussion based on real drive. Possible fields of applications for sensorless drives will be discussed.

S.15 Connecting Theory with Design of Controllers in Switch-Mode Power Supplies, Power Factor Correction Circuits, and Motor Drives

Ned Mohan, University of Minnesota

Bayou II

Successful designs are based on solid theoretical foundation. This seminar presents a design-oriented theory of power electronics, hitherto overlooked. A general-purpose simulator is used as a bridge between theory and design, avoiding complicated analysis of no practical use and the associated confusion. The proposed approach is treated in-depth; the design examples provide an overview of its applications.

A generic building block underlies all commonly used switch-mode PWM converters in dc power

supplies, power factor correction circuits, dc and ac motor drives, and UPS. In a cycle-by-cycle averaged (CCA) representation, the building block is equivalent to an ideal transformer (augmented to include discontinuous conduction). The generic building block is analyzed only once and then used systematically for any application, leading to a clear understanding of PWM principles. It will be shown that averaged representation speeds up large disturbance simulations by two orders of magnitude. Bode plots for voltage- and current-mode (peak or average) controller designs (with continuous/discontinuous conduction) are generated using a SPICE-based simulator for linearization. This avoids complicated analysis and confusion. Applications of this theory illustrated by numerical design examples and simulations includes: flyback converters with voltage-mode and peak current-mode control; power factor correction circuit using average current-mode control; and torque, speed and position loops in motor drives.

EXPOSITION

EXPOSITION HOURS

The Exposition, located in the **Imperial Ballroom** of the Fairmont Hotel, will be open as follows:

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

Tuesday, February 8 ..... 12:00 Noon - 6:30 PM

Wednesday, February 9 .. 12:00 Noon - 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 Exposition Hall, details of the Exhibitor Seminars and other events in the Exposition Hall.

EXHIBITOR SEMINARS

On the afternoon of Tuesday, February 8, from 2:00 PM until 5:30 PM, several of the companies participating in the Exposition will offer technical seminars. Descriptions of the seminars will be listed in the Exposition Directory, available at the conference.

EXHIBITOR'S RECEPTIONS

A **Welcoming Reception** will be held in the Exposition Hall on Monday, February 7, from 5:30 PM until 8:00 PM. Join us for hors d'ouevres while visiting with the Exhibitors and other conference participants.

On Tuesday, light refreshments will be served during an **Exhibitors' Reception** from 5:00 PM until 6:30 PM.

Registered spouses and guests are welcome at these receptions.

EXPOSITION HALL LUNCHEONS

On Tuesday, February 8 and Wednesday, February 9, enjoy your lunch in the Exposition Hall. Tickets are $8.00 each and are available through Advance 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 Exposition Hall that you buy them with your

Advance Registration. Tickets will not be available at the luncheons.

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

EXHIBITORS

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

APEC 2000 Exhibitors

AAVID Thermal Systems
Allegro MicroSystems
Allied Signal
Allstar Magnetics
AMP Incorporated
Anderson Power Products
Ansoft Corporation
Artesyn Technologies
Ascom Energy Systems Inc.
AULT
Autotest
AVX Corporation
Bergquist Company, The
BTC Power Electronics Corp.
C.P. Clare Corporation
Cableco Technologies
Celestica Power Systems
Ceramic Magnetics
Cherry Semiconductor Corp.
Chomerics
Coilcraft
Coiltronics Inc.
Collmer Semiconductor
Cornell Dubilier Electronics, Inc.
Darnell Group
Eastern Components, Inc.
EBG, Inc.
ECI Electronics
ECN Magazine
Elcon Products International
Eldre Corporation
Electronic Concepts, Inc.
ELNA Ferrite Technologies
ELTEST
Ericsson Components
ERM
Fair-Rite Products
Filter Concepts Inc.
HV Components
International Rectifier
Intersil Corporation
IPD International
Isotek
ITW Paktron
IXYS Corporation
Kaschke USA, Inc.
LeCroy Corporation
LEM U.S.A.
Linfinity Microelectronics
Lodestone Pacific
Lucent Technologies
Magnetics
Magsoft Corporation
Mega-Power, Inc.
Methode Electronics
MH&W International
MicroMetals
Miles & Platts, Inc.
New England Electric Wire
OMNIREL
Onan Power Electronics
PCIM/Power Quality Magazine
Pearson Electronics
Philips Components
Positronic Industries, Inc.
Power Design Tools
Power Integrations
Powerex, Inc.
SanRex Corporation
Semikron
Shindengen America
Siemens Passive Electronics
Steward
STMicroelectronics
Texas Instruments
Thermacore
Tocos America
TSC Ferrite International
Venable Industries
Vogt Electronics
Voltage Multipliers

RAP SESSIONS

Tuesday, February 7, 6:30 – 8:00 PM

Rap Session #1 **Emerald Ballroom**

42V PowerNet: An Enabling Technology For Automotive Power Electronic Systems?

Moderator: Dr. John M. Miller,
Ford Research & Vehicle Technology

The next generation automotive electrical power system, 42V PowerNet, was introduced at the 1998 Convergence Conference on Transportation Electronics and was shown to have global acceptance within the automotive industry. Together, 42V PowerNet and power electronics developments are but two aspects of a global design for a vehicular electronics system. Communications is another important aspect. Taken together, these trends are converging into the electrification of electromechanical systems in the automobile. This mega-trend is growing at about 40%/year and will transform transportation during the near term. Effective implementation will require global standardization of power supply, power electronics, communications and strong supplier involvement. Will power electronics achieve the performance and cost targets necessary for automotive applications? Is the automobile ready for power electronics? This session will explore these concerns and what synergies exist between 42V PowerNet and modern power electronics for passenger vehicles early in the third millennium.

Rap Session #2 **University**

Are Mergers Good For The Power Supply Industry?

Moderator: Don Staffiere, Staffiere Consulting

There have been a number of mergers in the power supply industry in the past few years. Has that been good for the power industry or has it negatively influenced the industry? Does the mixing of different cultures come into play when two very different kinds of companies join forces? How does a merger impact the supply (vendor) base for the two separate companies? Is there strength in numbers? How are mergers going to affect the “little guy”? Does the merger result in

consolidation or in parallel organizations? Another question that we can ask is what is the rationale for a merger? The power supply industry is made up of many small companies and for many years there have predictions of an industry shake-out. Has it started to happen? This session will try to address this important topic.

Rap Session #3 **Explorer's**

Integration Of Motor Drives: How Much Is Too Much?

Moderator: Dr. Thomas M. Jahns, University of Wisconsin - Madison

Everyone seems to be in love with the concept of integrated motor drives these days. According to the buzz in both industry and academia, "integration" of motor drives is nearly synonymous with "low cost" and "high reliability". As we collectively seek this Holy Grail of integration, has the time come to ask ourselves whether we can ever get too much of a good thing? In other words, how real are the claimed cost and reliability advantages of increased levels of motor drive integration? And when does the darker underbelly of integration in the forms of reduced user flexibility and poorer reparability begin to overwhelm its widely trumpeted advantages? This panel will attempt to stake out realistic expectations for this important technology trend.

TECHNICAL SESSIONS

Session 1 **Monday, February 7**
Plenary Session **International Ballroom**
1:30 PM – 5:00 PM

Session Chair: R. Mark Nelms, Auburn University

1.1 Automotive Electrical Systems - The Power Electronics Market of the Future
John G. Kassakian, The Massachusetts Institute of Technology, Cambridge, MA

1.2 Where Are Power Supplies Headed?
Robert J. Huljak, V. Joseph Thottuvelil, Andrew J. Marsh and Bruce A. Miller, Lucent Technologies, Mesquite, TX

1.3 AC Adjustable-Speed Drives at the Millennium: How Did We Get Here?
Thomas M. Jahns, University of Wisconsin, Madison, WI and Edward L. Owen, General Electric Company, Schenectady, NY

1.4 Implementing the Whole Product Concept in Strategic Sector Marketing
Arnold N. Alderman, International Rectifier Corporation, El Segundo, CA

1.5 Optimally Selecting Packaging Technologies and Circuit Partitions Based on Cost and Performance
John B. Jacobsen, Grundof A/S, Bjerringbro, DENMARK and Douglas C. Hopkins, State University of New York, Buffalo, NY

1.6 Design Issues for 12-V/1.5-V, 50-A Voltage Regulation Modules
Yuri Panov and Milan M. Jovanovic, Delta Products Corporation, Research Triangle Park, NC

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Session 2 **Tuesday, February 8**
Marketing Strategies **Bayou II & IV**
For Today **8:30 AM – 12 Noon**

Session Chairs: Connie Heath Kubasti, Heath Resource Group and Larry Gilbert, The Powerhouse, Inc.

2.1 An Analysis of Dual-Source Strategies for Custom Power Supplies
F. Marshall Miles, Artesyn Technologies, Eden Prairie, MN

2.2 Critical Trends in Communications and Their Implications for Power Supply Makers
Linnea Brush, Darnell Group, Corona, CA

2.3 WITHDRAWN BY THE AUTHORS

2.4 US Merchant Markets & Applications for Internal AC/DC Switching Power Supplies & DC/DC Converters
Mark Gaboriault, Venture Development Corporation, Natick, MA

2.5 Are You Ready for Contract Manufacturing?
Terry Ulvinen, Celestica, Milwaukee, OR

2.6 Marketing Lessons Learned from a Complementary Power Industry
Barry Papermaster, Lucent Technologies Power Systems, Mesquite, TX

2.7 Marketing and Selling Through the Web
Mohan Mankikar, Micro-Tech Consultants, Santa Rosa, CA

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Session 3 — **Tuesday, February 8**
High Power DC-DC Converters I — **Grand Ballroom**
8:30 AM – 12 Noon

Session Chair: Anton Sommer, Ascom Energy Systems, Ltd.

3.1 A PWM Full-Bridge Converter with Load Independent Soft-Switching Capability
Gerry Moschopoulos and Praveen Jain, Concordia University, Montreal, Quebec, CANADA

3.2 A 3kW Soft Switching DC-DC Converter
Ionel Dan Jitaru, Rompower Inc., Tucson, AZ

3.3 A Novel Partial Series Resonant DC/DC Converter with Zero-Voltage/Zero-Current Switching
Eui-Sung Kim, Dong-Yun Lee and Dong-Seok Hyun, Hanyang University, Seoul, SOUTH KOREA

3.4 High Power High Frequency Half-Wave Mode ZCT-PWM Full Bridge DC/DC Converter
David M. Xu, J. H. Kong, J. M. Zhang and Z. Qian, Zhejiang University, Hang Zhou, PEOPLE'S REPUBLIC OF CHINA

3.5 Zero-Voltage and Zero-Current Hybrid Soft-Switching Phase-Shifted PWM DC-DC Power Converter for High Power Applications
Takeshi Morimoto, Shinya Shirakawa, Koudriavtse Oleg and Mutsuo Nakaoka, Yamaguchi University, Yamaguchi, JAPAN

3.6 Operation Principles of Bi-Directional Full-Bridge DC/DC Converter with Unified Soft-Switching Scheme and Soft-Starting Capability
Kunrong Wang, Fred C. Lee and Jason Lai, Virginia Polytechnic Institute and State University, Blacksburg, VA

3.7 An Improved ZVZCS PWM FB DC/DC Converter Using the Modified Energy Recovery Snubber
Eun-Soo Kim, Kee-Yeon Joe and Soon-Gu Park, Korea Electrotechnology Research Institute, Kyung Nam, SOUTH KOREA and Yoon-Ho Kim, Chung-Ang University, Seoul, SOUTH KOREA

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Session 4 — **Tuesday, February 8**
Induction Motor Drives I — **Bayou I & III**
8:30 AM – 12 Noon

Session Chair: Youqing Xiang, Ford Motor Company

4.1 Speed Adaptive Observer for Sensorless IM Drive using Combined Reference Frames
Feri Yusivar, Kenji Uchida, Hiroyuki Haratsu, Shinji Wakao and Takashi Onuki, Waseda University, Tokyo, JAPAN

4.2 Speed and Flux Sensorless Field Oriented Control of Induction Motors for Electric Vehicles
Fang Z. Peng, Oak Ridge National Laboratory, Oak Ridge, TN

4.3 Induction Motor Speed Detection by Applying Goertzel's Algorithm to Current Harmonics
Tong Zho, PrairieComm Inc., Arlington Heights, IL and Donald S. Zinger, Northern Illinois University, DeKalb, IL

4.4 Sensorless Vector Control of Induction Motor Based on a Flux Compensation with Application to Hoist Crane
Junha Kim and Kwanghee Nam, Postech University, Pohang, SOUTH KOREA

4.5 Speed Sensorless Control of Induction Motor Considering the Flux Saturation
Jung-Soo Choi, Wang-Moon Kim and Young-Seok Kim, Inha University, Incheon, SOUTH KOREA

4.6 Reduced Torque Ripple and a Constant Torque Switching Frequency for Direct Torque Control of Induction Machine
Nik Rumzi, Nik Idris and Abdul Halim Mohd Yatim, Universiti Teknologi Malaysia, UTM Skudai, Malaysia

4.7 A Novel Direct Torque Control (DTC) Method for Five-Phase Induction Machines
Hamid A. Toliyat, Huangsheng Xu and Ruhe Shi, Texas A&M University, College Station, TX

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Session 5A — **Tuesday, February 8**
Boost Converter Design & Analysis — **Emerald Ballroom**
8:30 AM – 10:15 AM

Session Chair: Arthur E. Brockschmidt, Boeing Information, Space and Defense Group

5A.1 A Comparative Study of Soft-Switched CCM Boost Rectifiers and an Interleaved Variable-Frequency DCM Boost Rectifier
Brian T. Irving, Yungtaek Jang and Milan Jovanovic, Delta Products Corporation, Research Triangle Park, NC

5A.2 Novel Boost PFC with Low Common Mode EMI: Modeling and Design
Wu Xn and Z.M. Qian, Zhejiang University, Hangzhou, PEOPLE'S REPUBLIC OF CHINA and M.H. Pong, Hong Kong University, Hong Kong, PEOPLE'S REPUBLIC OF CHINA

5A.3 A New Single Phase Power Factor Corrector Converter
Beatriz Vieira Borges and Victor Anunciada, Instituto Superior Tecnico, Lisboa, PORTUGAL

5A.4 A Step Down Converter with Low-Ripple Input Current for Power Factor Correction
Vlad Grigore and Jorma Kyyra, Helsinki University of Technology, Helsinki, FINLAND

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Session 5B — **Tuesday, February 8**
Three-Phase Design Techniques — **Emerald Ballroom**
10:45 AM – 12 Noon

Session Chair: Richard Redl, ELFI S.A.

5B.1 Analysis of Three-Phase/Three-Level Rectifiers at Low Load and Discontinuous Conduction Mode
P. Ide, N. Froehleke and H. Grotstollen, University of Paderborn, Paderborn, GERMANY and W. Korb and B. Margaritis, Ascom Energy Systems, Soest, GERMANY

5B.2 Three-Phase Voltage Source Soft-Switching Active Power Filter
Yoshihiro Konishi, Fuji Electric Co. Ltd., Tokyo, JAPAN and Manabu Kurokawa and Mutsuo Nakaoka, Yamaguchi University, Yamaguchi, JAPAN

5B.3 Analysis and Design of Passive and Active Harmonic Subtractors for Three Phase Rectifier Equipment to Meet Harmonic Compliance
Jae-ong Hahn, Moonshik Kang and Prasad N. Enjeti, Texas A&M University, College Station, TX and Ira J. Pitel, Magna Power Electronics, Boonton, NJ

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Session 6 — **Tuesday, February 8**
Modeling and Control I — **University Room**
8:30 AM – 12 Noon

Session Chair: Seshadri Sivakumar, KB Electronics Ltd.

6.1 Small Signal Model and Control of an Independently Regulated Multiple Output Forward Converter Topology
Youhao Xi and Praveen Jain, Concordia University, Montreal, Quebec, CANADA

6.2 Study of System Instability in Current-Mode Converter Power Systems Operating in Solar Array Voltage Regulation Mode
Kasemsan Siri, The Aerospace Corporation, El Segundo, CA

6.3 Analysis, Design and Performance Evaluation of Droop Current-Sharing Method
Brian T. Irving and Milan M. Jovanovic, Delta Products Corporation, Research Triangle Park, NC

6.4 Prediction of Switching Loss Variations by Averaged Switch Modeling
Osama Al-Naseem and Robert W. Erikson, University of Colorado, Boulder, CO and Palmer Carlin, National Wind Technology Center, Golden, CO

6.5 Unified Averaged Switch Models for Stability Analysis of Large Distributed Power Systems
Jian Sun, Rockwell Collins Inc., Cedar Rapids, IA

6.6 Modeling Average Current Mode Control
Philip Cooke, Texas Instruments, Merrimack, NH

6.7 A Novel Unified Average Model for Single Switch DC-DC Converter
Yuancheng Ren and Zhaoming Qian, Zhejiang University, Hangzhou, PEOPLE'S REPUBLIC OF CHINA and Ken Ruan, Analogy Company, Beaverton, OR

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Session 7 **Wednesday, February 9**
Power Electronics Packaging **Bayou II & IV**
8:30 AM – 12:00 Noon

Session Chair: Douglas C. Hopkins, State University of New York

PROGRAM NOTE: Because the authors withdrew Papers 7B.1 and 7B.3, the previously advertised Session 7B is being combined with Session 7A to form one five-paper session. The paper numbers have not been changed.

7A.1 Evaluation of the Metal Post Interconnected Parallel Plate Structure for Power Electronic Building Block
Kalyan Siddabattula, Zhou Chen and Dushan Boroyevich, Virginia Polytechnic Institute & State University, Blacksburg, VA

7A.2 High Power Density DC/DC Converter Using Thick Film Hybrid Technology
A.M. Pernia, M.J. Prieto and J.M. Lopera, Universidad de Oviedo, Gijón, SPAIN, J. Reilly and S. Linton, AVX Limited, Madrid, SPAIN and C. Quinones and R. Madsen, Alcatel Corporate Research Center, Madrid, SPAIN

7A.3 Current Handling and Thermal Considerations in a High Current Semiconductor Switch Package
Pamela Dugdale and Arthur Woodworth, International Rectifier GB, Surrey, UNITED KINGDOM

7A.4 Packaging of Integrated Power Electronics Modules Using Flip-Chip Technology
Xingsheng Liu, Shatil Haque, Jinggang Wang and Guo-Quan Lu, Virginia Polytechnic Institute & State University, Blacksburg, VA

7B.1 WITHDRAWN BY THE AUTHORS

7B.2 Thermal Management of Power Electronics Modules via Acoustic Micrography Imaging
Shatil Haque and Guo-Quan Lu, Virginia Polytechnic Institute and State University, Blacksburg, VA and John Goings and Joel Sigmund, Sonix Incorporated, Springfield, VA

7B.3 WITHDRAWN BY THE AUTHORS

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Session 8 **Wednesday, February 9**
High Power DC-DC Converters II **Grand Ballroom**
8:30 AM – 12 Noon

Session Chair: Gerry Moschopoulos, Concordia University

8.1 New Start-up Schemes for Active-Clamp Isolated Full-Bridge Boost Converters
Lizhi Zhu, Ecostar Electric Drive Systems, Dearborn, MI and Kunrong Wang, Jason Lai and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

8.2 A Zero Voltage and Zero Current Switching Three Level DC/DC Converter
Francisco Canales, Peter Barbosa and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

8.3 Modeling, Analysis and Design of 10kW Parallel Module Zero-Voltage Zero-Current Switched Full Bridge PWM Converter
Hangseok Choi, J.W. Kim, J.H. Lee and B.H. Cho, Seoul National University, Seoul, SOUTH KOREA

8.4 Leading-Edge Modulation Voltage-Mode Control with Flux Unbalance Correction for Push-Pull Converter
Xingsheng Zhou and Dan Chen, Virginia Polytechnic Institute & State University, Blacksburg, VA and Clifford Jamerson, Potant Technologies Inc. Research Lab, Blacksburg, VA

8.5 A Lossless Commutation PWM Two Level Forward Converter Operating Like a Full-Bridge
D.S. Oliveira, C.A. Bissochi Jr., J.B. Vieira Jr., V.J. Farias and L.C. de Freitas, Universidade Federal de Uberlândia, Uberlândia, BRAZIL

8.6 A Novel Full-Bridge DC-DC Converter for Battery Charging Using Secondary-Side Control Combines Soft-Switching over the Full Load Range and Low Magnetics Requirement
Rajapandian Ayyanar and Ned Mohan, University of Minnesota, Minneapolis, MN

8.7 Feedforward Ripple Cancellation for a Full-Bridge Converter
Deron K. Jackson and Steven B. Leeb, Massachusetts Institute of Technology, Cambridge, MA

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Session 9 **Wednesday, February 9**
Synchronous Motor Drives **Bayou I & III**
8:30 AM – 12 Noon

Session Chair: Peter Carruthers, Lockheed Martin Power & Drive Systems

9.1 A Bi-Directional Switched Reluctance Drive with High Power Quality
S. Y. R. Hui, J. Y. Zhu, Y. K. E. Ho and H. Chung, City University of Hong Kong, Hong Kong, PEOPLE'S REPUBLIC OF CHINA

9.2 Optimal Excitation of High Speed Switched Reluctance Generator
Erkan Mese, Yilmaz Sozer, James M. Kokernak and David A. Torrey, Rensselaer Polytechnic Institute, Troy, NY

9.3 Accurate Rotor Position Detection for Sensorless Control of SMR in Super-High Speed Operations
Longya Xu and Chuanyang Wang, The Ohio State University, Columbus, OH

9.4 Voltage Feedback Signal Conditioning in Switched Reluctance Generation Systems
David B. Wicklund, Sundstrand Aerospace, Rockford, IL and Donald S. Zinger, Northern Illinois University, DeKalb, IL

9.5 Sensorless Vector Control of Synchronous Reluctance Motors with Disturbance Torque Observer
Tomonobu Senjyu, Takeshi Shingaki and Katsumi Uezato, University of the Ryukyus, Okinawa, JAPAN

9.6 An Accurate Modeling for Permanent Magnet Synchronous Motor Drives
Naomitsu Urasaki, Tomonobu Senjyu and Katsumi Uezato, University of the Ryukyus, Okinawa, JAPAN

9.7 A Vector Control Scheme for a PMLSM Considering a Non-Uniform Flux Distribution
Bon-wang Gu and Kwanghee Nam, Postech University, Pohang, SOUTH KOREA

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Session 10 **Wednesday, February 9**
Digital and Analog Control of Harmonic Filters **University Room**
8:30 AM – 12 Noon

Session Chair: Jaime Arau, CENIDET

10.1 A Closed-Loop Selective Harmonic Control for Active Filters
P. Mattavelli and L. Malesani, University of Padova, Padova, ITALY

10.2 Unified Constant-Frequency Integration Control of Active Power Filters
Luowei Zhou and Keyue M. Smedley, University of California, Irvine, CA

10.3 A Novel Control Method for Input-Output Harmonic Elimination of the PWM Boost Type Rectifier Under Unbalanced Operating Conditions
A.V. Stankovic and T.A. Lipo, University of Wisconsin, Madison, WI

10.4 Control Strategies for Active Power Filter in Three-Phase Four-Wire Systems
S.S. Kim and P. Enjeti, Texas A&M University, College Station, TX

10.5 DSP Based Control Method of Active Filter: Elimination of Switching Ripples
B.N. Singh, Ambrish Chandra and Kamal Al-Haddad, Universite du Quebec, Montreal, Quebec, CANADA and Parviz Rastgouford, Tulane University, New Orleans, LA

10.6 A Novel DSP Controlled 2kW PFC Converter with a Simple Sampling Algorithm
Jinghai Zhou, Zhengyu Lu, Zhengyu Lin, Yuancheng Ren, Zhaoming Qian and Yousheng Wang, Zhejiang University, Hangzhou, PEOPLE'S REPUBLIC OF CHINA

10.7 Implementation of a DSP Based Active Power Filter for Electric Power Distribution Systems Supplying Nonlinear Loads
Wajiha Shireen and Li Tao, University of Houston, Houston, TX and M.S. Arefeen, Texas Instruments Inc., Stafford, TX

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Session 11 **Wednesday, February 9**
Single-Phase Power Factor Correction **Emerald Ballroom**
8:30 AM – 12 Noon

Session Chair: Laszlo Huber, Delta Products Corporation

11.1 A Novel Single-Stage Off-Line Converter with PFC and Fast Output Voltage Regulation
Dara O' Sullivan, M.G. Egan and M. Willers, University College, Cork, IRELAND

11.2 A Simplified Controller for a Half-Bridge Boost Rectifier
Doron Schmilovitz, Dariusz Czarkowski and Zivan Zabar, Polytechnic University, Brooklyn, NY and Shoubao Zou, Yunnan Polytechnic University, Kunming, PEOPLE'S REPUBLIC OF CHINA

11.3 A Novel Single-Phase Active-Clamped ZVT-PWM PFC Converter
David M. Xu, J. M. Zhang, Fy. C. Ren and Z. Qian, Zhejiang University, Hang Zhou, PEOPLE'S REPUBLIC OF CHINA

11.4 A Topology Survey of Single-Stage Power Factor Corrector with Boost Type Input-Current-Shaper Cell
Chongming Qiao and Keyue M. Smedley, University of California, Irvine, CA

11.5 A New Active Input Current Shaper for Converters with Symmetrically Driven Transformer
J. Sebastián, A. Fernández, P. Villegas and M. Hernando, Universidad de Oviedo, Gijón, SPAIN and S. Ollero, Chloride Power Protection, Viejo, SPAIN

11.6 Skynet Power Factor Correction Cell
Jim H. Liang, Wen-Sung Chien and C. Leu, Skynet Electronic Co. Ltd., Taipei, REPUBLIC OF CHINA

11.7 A Constant Power Battery Charger Circuit with Inherent Soft Switching and PFC
Frank N.K. Poon and M.H. Pong, The University of Hong Kong, Hong Kong, PEOPLE'S REPUBLIC OF CHINA

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Session 12
AC-DC Converters

Wednesday, February 9
Grand Ballroom
2:00 PM – 5:30 PM

Session Chair: Michael A.E. Andersen, Technical University of DENMARK

12.1 Simple AC/DC Converters to Meet IEC 1000-3-2
O Garcia, J.A. Cobos, R. Prieto, P. Alou and J. Uceda, Universidad Politécnica de Madrid, Madrid, SPAIN

12.2 Complementary Half Controlled Three Phase PWM Boost Rectifier for Multi-DC-Link Applications
Jun Kikuchi, Madhav D. Manjrekar and Thomas A Lipo, University of Wisconsin, Madison, WI

12.3 New Control Scheme for 3-Phase PWM AC/DC Converter without Phase Angle Detection under Unbalanced Input Voltage Conditions
Kyu-Seo Park, Sung-Chan Ahn and Dong-Seok Hyun, Hanyang University, Seoul, SOUTH KOREA and Song-Yul Choe, Hyundai Precision & Industry Co., Ltd., Seoul, SOUTH KOREA

12.4 Control of Circulating Current in Parallel Three-Phase Boost Rectifiers
Zhihong Ye, Dushan Boroyevich, Jae-Young Choi and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

12.5 Three-Phase AC/DC Regulated Power Supplies: A Comparative Evaluation of Different Topologies
B.N. Singh, Praveen Jain and Geza Joos, Concordia University, Montreal, Quebec, CANADA

12.6 A New Concept for Minimizing High-Frequency Common-Mode EMI of Three-Phase PWM Rectifier Systems Keeping High Utilization of the Output Voltage
Johann W. Kolar, Hans Ertl and Uwe Drofenik, Technical University Vienna, Vienna, AUSTRIA

12.7 An Improved Topology of Boost Converter with Ripple Free Input Current
Zhengyu Lu and Zhaoming Qian, Zhejiang University, Hangzhou, PEOPLE'S REPUBLIC OF CHINA and T.C. Green, Imperial College, London, UNITED KINGDOM

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Session 13
PWM Techniques

Wednesday, February 9
Bayou I & III
2:00 PM – 5:30 PM

Session Chair: Fang Zheng Peng, Oak Ridge National Lab

13.1 WITHDRAWN BY THE AUTHORS

13.2 Multilevel Space Vector PWM Technique Based on Phase-Shift Harmonic Suppression
Li Li, Pico Electronics, Pelham, NY, Dariusz Czarkowski, Polytechnic University, Brooklyn, NY, Yaguang Liu, API Controls Inc., Amherst, NY and Pragasen Pillay, Clarkson University, Potsdam, NY

13.3 An Improved SVPWM Method for Multilevel Inverters
Dae-Wook Kang, Yo-Han Lee and Dong-Seok Hyun, Hanyang University, Seoul, SOUTH KOREA, Bum-Seok Suh, Fairchild Semiconductor, Seoul, SOUTH KOREA and Chang-Ho Choi, POSCON Corporation, Seoul, SOUTH KOREA

13.4 A Space Vector PWM Method for Three-Level Voltage Source Inverters
P.F. Seixas, M.A.S. Mendes and P.D. Garcia, Universidade Federal de Minas Gerais, Belo Horizonte, BRAZIL and A.M.N. Lima, Universidade Federal da Paraiba, Campina Grande, BRAZIL

13.5 A Novel Wide Range Pulse Width Overmodulation Method
Andres Diaz and Elias Strangas, Michigan State University, East Lansing, MI

13.6 Four-Legged Converter 3D SVM Scheme Over-Modulation Study
Cangrong Liu, Dengming Peng, Richard Zhang, Jason Lai, Fred C. Lee and Dushan Borojevich, Virginia Polytechnic Institute & State University, Blacksburg, VA

13.7 Optimized Selection of the Random PWM Switching Frequencies in a Limited Pool
Khalid Ali Almarri, Dubai Police, Dubai, UNITED ARAB EMIRATES, Juan Carlos Balda, University of Arkansas, Fayetteville, AR and Ken Carr, Baldor Motors and Drives, Ft. Smith, AR

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Session 14
Lamp Ballasts

Wednesday, February 9
Bayou II & IV
2:00 PM – 5:30 PM

Session Chair: Dan Savage, Welch Allyn

14.1 An Electronic Ballast for Operating Fluorescent Lamps in Wide Temperature Range
Chin S. Moo, Tsai F. Lin and Zue T. Lin, National Sun Yat-Sen University, Kaohsiung, REPUBLIC OF CHINA and Ying C. Chuang, Kung-Shan Institute of Technology, Tainan, REPUBLIC OF CHINA

14.2 A New Family of One-Switch Topologies for Low Input Voltage Fluorescent Lamp Ballasts: Tapped-Inductor-Inverters Selection Criteria and Design Methodology
E.L. Corominas, J.M. Alonso, A.J. Calleja, J. Ribas and M. Rico-Secasdes, Universidad de Oviedo, Gijón, SPAIN

14.3 Analysis of the Class E Amplifier with Two Current Sources as a High-Power-Factor Electronic Ballast for Fluorescent Lamps
M. Ponce and J. Arau, Centro Nacional de Investigación y Desarrollo Tecnológico, Cuernavaca, MEXICO and J.M. Alonso, Universidad de Oviedo, Gijón, SPAIN

14.4 Low-Cost High-Power-Factor Electronic Ballast Based on the Self-Oscillating Buck-Boost Inverter
J. Ribas, J.M. Alonso, A.J. Calleja, E. Lopéz and M. Rico, Universidad de Oviedo, Gijón, SPAIN

14.5 A Critical-Conduction-Mode Single-Stage Power-Factor-Correction Electronic Ballast
Fengfeng Tao and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

14.6 Evaluation of a Novel Single-Stage High-Power-Factor Electronic Ballast Based on Integrated Buck Half-Bridge Resonant Inverter
J.M. Alonso, A.J. Calleja, J. Ribas, E. Lopéz and M. Rico-Secades, Universidad de Oviedo, Gijón, SPAIN

14.7 An Interleaved Single-Stage Power-Factor-Correction Electronic Ballast
Fengfeng Tao and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

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Session 15
Passive Components

Wednesday, February 9
University Ballroom
2:00 PM – 5:30 PM

Session Chair: Mark Wojcicki, Anderson Power Products

15.1 Planar Integrated Magnetics Assembly for High Voltage Converter
Boris Jacobson, Mark Barnett, Raymond DiPerna and John McGinty, Raytheon Company, Sudbury, MA

15.2 An Improved Calorimeter for Measuring the Core Loss of Magnetic Materials
Ralph Linkous and Arthur W. Kelley, North Carolina State University, Raleigh, NC and K.C. Armstrong, Powerware Cooperation, Raleigh, NC

15.3 Analysis of Buck-Boost Converter Inductor Loss Using a Simple Online B-H Curve Tracer
H.Y. Chung, Frank N.K. Poon, C.P. Liu and M.H. Pong, The University of Hong Kong, Hong Kong, PEOPLE'S REPUBLIC OF CHINA

15.4 Modeling and Accurate Determination of Winding Losses of High Frequency Transformers in Various Power Electronics Applications
Lothar Heinemann and Jens Helfrich, ABB Corporate Research Center, Heidelberg, GERMANY

15.5 High Frequency Behavior of Laminated Iron-Core Inductors for Filtering Applications
U. Reggiani, G. Grandi and G. Sancineto, University of Bologna, Bologna, ITALY, M.K. Kazimierczuk, Wright State University, Dayton, OH and A. Massarini, University of Modena, Modena, ITALY

15.6 Conductive Polymer Cathodes - The Latest Step in Declining ESR in Tantalum Capacitors
John D. Prynack, KEMET Electronics Corp., Greenville, SC

15.7 Integrated Capacitor and Converter Package
Brett A. Jordan, University of Rio Grande, Rio Grande, OH and Russell L. Spyker, Air Force Research Laboratory, WPAFB, OH

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Session 16 **Wednesday, February 9**
Techniques For Improving Converter Performance **Emerald Ballroom**
2:00 PM – 5:30 PM

Session Chair: Andy Marsh, Lucent Technologies

16.1 Optimizing Transistor Performance in Synchronous Rectifier Buck Converters
Scott Deuty, ON Semiconductor, Phoenix, AZ

16.2 Efficiency Improvement of Synchronous Rectifier in a ZVS-PWM Controlled Series-Resonant Converter with Active Clamp
Hidekazu Tanaka and Tamotsu Ninomya, Kyushu University, Fukuoka, JAPAN

16.3 Low Output Voltage AC/DC Converter with a New Scheme of Synchronous Rectification that Complies with IEC 1000-3-2 Regulations
A. Fernández and J. Sebastián, Universidad de Oviedo, Gijón, SPAIN, P. Alou and J.A. Cobos, Universidad Politécnica de Madrid, Madrid, SPAIN and M. Rascón, Alcatel Corporate Research Center, Madrid, SPAIN

16.4 A Self-Driven Active Reset Converter for Low-Voltage High-Current Applications
Pavan Kumar, ASTEC Advanced Power Systems, Nepean, Ontario, CANADA

16.5 An Improved Lossless Passive Turn-on/Turn-off Boost Snubber with Peak Voltage Clamp for Telecom Power Systems
Jin He, Lucent Technologies, Mesquite, TX

16.6 Mixed-Mode EMI Noise and Its Implications to Filter Design in Offline Switching Power Supplies
Song Qu, Cherry Semiconductor Corporation, East Greenwich, RI and Dan Y. Chen, Virginia Polytechnic Institute & State University, Blacksburg, VA

16.7 High Frequency Resistance in Flyback Type Transformers
R. Preito, J.A. Cobos, O. Garcia, P. Alou and J. Uceda, Universidad Politécnica de Madrid, Madrid, SPAIN

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Session 17 **Thursday, February 10**
DC-DC Converters I **Grand Ballroom**
8:30 AM – 12 Noon

Session Chair: Ionel Dan Jitaru, Rompower, Inc.

17.1 An Improved Boost PWM Soft-Single-Switched Converter with Low Voltage and Current Stresses
Lucio dos Reis Barbosa, Joao Batista Vieira Jr., Luiz Carlos de Freitas and Valdier Jose Farias, Universidade Federal de Uberlândia, Uberlândia, BRAZIL

17.2 Application of the ZCS Auxiliary Commutation Circuits in Interleaved Boost Converters Operating in Critical Conduction Mode
C.M.O. Stein, J.R. Pinheiro and H.L. Hey, Universidade Federal de Santa Maria, Santa Maria, BRAZIL

17.3 A Novel Integrated Current Doubler Rectifier
Peng Xu, Qiaoqiao Wu, Pit-leong Wong and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

17.4 A Novel Zero-Voltage and Zero-Current Soft-Switching PWM DC-DC Converter with Reduced Conduction Losses
Satoshi Hamada, Sansha Electric Mfg. Co. Ltd., Osaka, JAPAN and Laknath Gamage, Takeshi Morimoto and Mutsuo Nakaoka, Yamaguchi University, Yamaguchi, JAPAN

17.5 PWM-PD Multiple Output DC/DC Converters Without Transformer
A. Barrado, E. Olias, A. Lazaro and J. Pleite, Universidad Carlos III de Madrid, Madrid, SPAIN

17.6 A Novel ZVT Circuit for Interleaving Two-Transistor Forward Converter
Feng Han and Xu Dehong, Zhejiang University, Hangzhou, PEOPLE'S REPUBLIC OF CHINA and Mikihiko Matsui, Tokyo Institute of Polytechnics, Kanagawa, JAPAN

17.7 A Modified ZVZCS Commutation Cell for All Active Switches in PWM Converters
Seung-Hee Ryu, Sang-Bong Yoo And Dong-Seok Hyun, Hanyang University, Seoul, SOUTH KOREA

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Session 18 **Thursday, February 10**
Components In Circuit Applications **University Room 8:30 AM – 12 Noon**

Session Chair: Carl Blake, International Rectifier

18.1 Design of a Contactless Battery Charger for Cellular Phone
Chang-Gyun Kim, J.S. You, J.H. Park and B.H. Cho, Seoul National University, Seoul, SOUTH KOREA and D.H. Seo, Samsung Electro-Mechanics Co. Ltd., Suwon, SOUTH KOREA

18.2 Loading Leveling Using EDLCs under PLL Control
Goichi Ariyoshi, Koosuke Harada and Kiyomi Yamasaki, Kyushu Electric Power Co., Inc., Fukuoka, JAPAN and Katsuaki Murata, Kumamoto Institute of Technology, Kumamoto, JAPAN

18.3 An Improved Method for Controlling an EDLC-Battery Hybrid Stand-alone Photovoltaic Power System
Yousuke Nozaki and Kazuya Akiyama, NTT Telecommunications Energy Laboratories, Tokyo JAPAN and Hiroshi Kawaguchi and Kosuke Kurokawa, Tokyo University of Agriculture and Technology, Tokyo, JAPAN

18.4 A Manufacturing Method for Multilayer Tubewinding with Interleaved Primary and Secondary Windings
Mika Sippola and Raimo Sepponen, Helsinki University of Technology, Helsinki, FINLAND

18.5 A PWM Controller for Extended Temperature Applications
Fong Shi, Boeing, Seattle, WA

18.6 Electric Vehicle Charger with Printed Circuit Board Magnetic Components
Christopher P. Henze, Analog Power Design, Inc., Lakeville, MN

18.7 Effects of Powering Low-Voltage, High-Current Load on Components from Power Design Perspective
Ning Dai, Celestica Power Systems, Fort Collins, CO

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Session 19 **Thursday, February 10**
Modeling and Control II **Emerald Ballroom 8:30 AM – 12 Noon**

Session Chair: Russ Spyker, U.S. Air Force

19.1 Envelope Simulation by Spice Compatible Models of Electric Circuits Driven by Modulated Signals
Sam Ben-Yaakov, Stanislav Glozman and Raul Rabinovici, Ben-Gurion University of the Negev, Beer-Sheva, ISRAEL

19.2 Ripple Effects on Small Signal Models in Average Current Mode Control
Chunxiao Sun and Brad Lehman, Northeastern University, Boston, MA and Jian Sun, Rockwell Collins, Cedar Rapids, IA

19.3 Charge Control of Three-Phase Buck PWM Rectifiers
Kunrong Wang, Dushan Boroyevich and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

19.4 Sensorless Control Strategies for PWM Rectifier
Steffan Hansen, Danfoss Drive A/S, Graasten, DENMARK, Frede Blaabjerg, Aalborg University, Aalborg, DENMARK and Mariusz Malinowski and Marian P. Kazmierkowski, Warsaw University of Technology, Warsaw, POLAND

19.5 Wideband Circuit Model for Bus Bar Impedance
Mark Jones and Arthur W. Kelley, North Carolina State University, Raleigh, NC

19.6 PSPICE-Compatible Electrical Equivalent Circuit for Busbar
M. Besacier, J.L. Schanen, J. Roudet and P. Suau, Laboratoire d'Electrotechnique de Grenoble, Grenoble, FRANCE

19.7 Design Verification and Testing of Power Supply System by using Virtual Prototype
Qioung Li, Philips Research, Briarcliff Manor, NY, Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA and Thomas G. Wilson Jr., Artesyn Technologies, Eden Prairie, MN

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Session 20A **Thursday, February 10**
AC-AC Converters **Bayou I & III**
8:30 AM – 10:15 AM

Session Chair: Bill Peterson, Electronic Power Conversion

20A.1 Application of Power Electronics to the Distribution Transformer
Edward R. Ronan, Jr., University of Missouri, Kansas City, MO, Scott D. Sudhoff and Steven F. Glover, Purdue University and Dudley L. Galloway, ABB Power T&D Co., Inc., Houston, TX

20A.2 Comparison of Two AC/AC Regulators: The Serial AC Link Regulator and the Boost/Inverter Converter
Joao Carlos de Oliveira, Evandro A. Soares da Silva, Valdeir Jose Farias, Luiz Carlos de Freitas and Joao Batista Vieira Jr., Universidade Federal de Uberlândia, Uberlândia, BRAZIL

20A.3 A New AC/AC Serial Regulator Using a Capacitor as the Serial Component
Joao Carlos de Oliveira, Carlos Augusto Bissochi Jr., Fabio Vincenzi R.S., Valdier Jose Farias, Luiz Carlos de Freitas and Joao Batista Vieira Jr., Universidade Federal de Uberlândia, Uberlândia, BRAZIL

20A.4 Transformerless 4-Leg Current Conditioner with Voltage Restoring Capability
F. Carocci and H. Stemmler, The Swiss Federal Institute of Technology, Zurich, SWITZERLAND

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Session 20B **Thursday, February 10**
Inverter Control **Bayou I & III**
10:45 AM – 12:00 Noon

Session Chair: Bill Peterson, Electronic Power Conversion

20B.1 A New Distributed Digital Controller for Next Generation Power Electronics Building Blocks
Ivan Celanovic, Dushan Boroyevich and Jinhong Guo, Virginia Polytechnic Institute & State University, Blacksburg, VA, Ivana Milosavljevic, Visteon Automotive Systems, Dearborn, MI and Roger Cooley, Naval Surface Warfare Center, Annapolis, MD

20B.2 A New Space Vector Based Control Method for UPS Systems Powering Nonlinear and Unbalanced Loads
Uffe Borup Jensen, AXA Power A/S, Smedebakken, DENMARK, Prasad Enjeti, Texas A&M University, College Station TX and Frede Blaabjerg, Aalborg University, Aalborg, DENMARK

20B.3 A New Unified Controller Based 100kVA Mobile Engine Generator for Single or Three Phase Distribution Line Backup
C.Y. Jeong, J.G. Cho, W. Baek and D.W. Yoo, Korea Electrotechnology Research Institute, Kyungnam, SOUTH KOREA

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Session 21 **Thursday, February 10**
Induction Motor **Bayou II & IV**
Drives II **8:30 AM – 12 Noon**

Session Chair: James M. Kokernak, Rensselaer Polytechnic Institute

21.1 New Inverter Output Filter Topology for PWM Motor Drives
Yilmaz Sozer, David A. Torrey and Suhan Reva, Rensselaer Polytechnic Institute, Troy, NY

21.2 A New Space Vector Pulsewidth Modulation Strategy for Reducing Ground to Stator-Neutral Voltage in Inverter-Fed AC Motor Drives
Hyeoun-Dong Lee, Yo-Chan Son and Seung-Ki Sul, Seoul National University, Seoul, SOUTH KOREA

21.3 Field-Oriented Control of an Induction Motor using Random Pulse Width Modulation
Michael M. Bech, John K. Pedersen and Frede Blaabjerg, Aalborg University, Aalborg, DENMARK

21.4 A New Hybrid Random Pulse Width Modulator for Industrial Drives
Vladmir Blasko, Rockwell Automation, Mequon, WI and Michael M. Bech, Frede Blaabjerg and John K. Pedersen, Aalborg University, Aalborg, DENMARK

21.5 A Flexible High Performance Advanced Controller for Electric Machines
Habib-ur Rehman and Richard J. Hampo, Ecostar Electric Drives, Dearborn, MI

21.6 Analysis of Current Control Performance for a Parallel IGBT Inverter System in a Ultra-Speed Elevator
Toshifumi Yoshikawa, Inaba Hiromi and Toshisuke Mine, Hitachi Ltd., Ibaraki, JAPAN

21.7 Hybrid Rectifier Using Thyristors and IGBTs for Low Cost Regenerative Drives
Giovanna Oriti and Alexander L. Julian, United Technologies Research Center, East Hartford, CT

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Session 22 **Thursday, February 10**
DC-DC Converters II **Grand Ballroom**
2:00 PM – 5:30 PM

Session Chair: John Bassett, Artesyn Technologies

22.1 Clamp Voltage Analysis for RCD Forward Converters
Christopher O. Bridge, Texas Instruments, Merrimack, NH

22.2 Design Consideration of the Active-Clamp Forward Converter with Current Mode Control during Large-Signal Transient
Qioung Li, Philips Research, Briarcliff Manor, NY and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

22.3 Investigating Coupling Inductor in Interleaving QSW VRM
Pit-Leong Wong, Qiaoqiao Wu, Peng Xu, Bo Yang and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

22.4 A ZCS Bi-Directional Flyback DC/DC Converter Using the Leakage Inductance of the Coupled Inductor
Henry S.H. Chung, S.Y.R. Hui and K.M. Chan, City University of Hong Kong, Hong Kong, PEOPLE'S REPUBLIC OF CHINA

22.5 A Precisely Regulated Multiple Output Forward Converter Topology
Youhao Xi and Praveen Jain, Concordia University, Montreal, Quebec, CANADA

22.6 Two Methods to Drive Synchronous Rectifiers During Dead Time in Forward Converters
Joe C.P. Liu, Frank N.K. Poon, Xie Xuefei and Bryan M.H. Pong, The University of Hong Kong, Hong Kong, PEOPLE'S REPUBLIC OF CHINA

22.7 Influence of Windings Coupling in Low-Voltage DC/DC Converters with Single Winding Self-Driven Synchronous Rectification
P. Alou, J.A. Cobos, R. Prieto and J. Uceda, Universidad Politécnica de Madrid, Madrid, SPAIN and M. Rascón, Alcatel Corporate Research Center, Madrid, SPAIN

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Session 23 **Thursday, February 10**
Soft-Switched Inverters **Bayou I & III**
2:00 PM – 5:30 PM

Session Chair: David Torrey, Rensselaer Polytechnic Institute

PROGRAM NOTE: The presentation order of Papers 23.5 and 23.7 has been changed from previously published information.

23.1 Characterization of EMI Performance for Hard and Soft-Switched Inverters
Jianwen Shao, Ray L. Lin, Fred C. Lee and Dan Y. Chen, Virginia Polytechnic Institute & State University, Blacksburg, VA

23.2 Investigation of a High Power Three-Level Quasi-Resonant DC-Link Voltage Source Inverter
Thomas Bruckner, Dresden University of Technology, Dresden, GERMANY and Steffan Bernet, ABB Corporate Research, Heidelberg, GERMANY

23.3 Improved ZVT Three-Phase Inverter with Two Auxiliary Switches
Jae-Young Choi, Dushan Boroyevich and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

23.4 A Novel Three-Phase Zero-Count-Transition and Quasi-Zero-Voltage-Transition (ZCT-QZVT) Inverter/Rectifier with Reduced Stresses on Devices and Components
Yong Li, Fred C. Lee, Jason Lai and Dusan Boroyevich, Virginia Polytechnic Institute & State University, Blacksburg, VA

23.7 Efficiency Considerations of Load Side Soft-Switching Inverters for Electric Vehicle Applications
Wei Dong, Jae-Young Choi, Yong Li, Huijie Yu, Jason Lai, Dusan Boroyevich and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

23.6 Comparison Between a Novel Zero-Switching-Loss Topology and Two Existing Zero-Current-Transition Topologies
X. Jing and D. Borojevich, Virginia Polytechnic Institute & State University, Blacksburg, VA

23.5 A Resonant Driver for a Piezoelectric Motor with Single Transistor Direction Switches
Sam Ben-Yaakov, Evgeny Rozanov and Gregory Ivensky, Ben-Gurion University of the Negev, Beer-Sheeva, ISRAEL and Tomer Wasserman, Tzachi Rafaeli and Lior Shiv, Nanomotion Ltd., Yokneam, ISRAEL

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Session 24A **Thursday, February 10**
Unique Utility Interfaces **Emerald Ballroom**
2:00 PM – 3:45 PM

Session Chair: Herb Hess, University of Idaho

24A.1 An Improved Approach to Reduce Harmonics in the Utility Interface of Wind, Photovoltaic and Fuel Cell Power Systems
P.N. Enjeti and Ali M. El-Tamaly, Texas A&M University, College Station, TX and H.H. El-Tamaly, Elminia University, Elminia, EGYPT

24A.2 Thyristor Controlled Two-Stage Magnetic-Valve Reactor for Dynamic VAR-Compensation in Electric Railway Power Supply Systems
Baichao Chen, Wuhan University of Hydraulic and Electric Engineering, Wuhan, PEOPLE'S REPUBLIC OF CHINA and James M. Kokernak, Rensselear Polytechnic Institute, Troy, NY

24A.3 WITHDRAWN BY THE AUTHORS

24A.4 A Harmonic Reference Frame Based Current Controller for Active Filter
Sang-Joon Lee and Seung-Ki Sul, Seoul National University, Seoul, SOUTH KOREA

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Session 24B **Thursday, February 10**
Modeling and Control III **Emerald Ballroom**
4:15 PM – 5:30 PM

Session Chair: Jian Sun, Rockwell Collins, Inc.

24B.1 Analysis and Modeling of a Piezoelectric Transformer in High Output Voltage Applications
Gregory Ivensky, Moshe Shvartsas and Sam Ben-Yaakov, Ben Gurion University of the Negev, Beer-Sheva, ISRAEL

24B.2 A Novel Power PIN Diode Behavioral SPICE Macromodel Including the Forward and Reverse Recoveries and the Self-Heating Process
Adrian Maxim and Gheorghe Maxim, Technical University "Gh. Asachi" Iasi, Iasi, ROMANIA

24B.3 Analysis of the Class AD Audio Amplifier Including Hysteresis Effects
A. Ginart, W.M. Leach Jr., R.M. Bass and T. Habetler, Georgia Institute of Technology, Atlanta, GA and Kim Gray, Aureal Semiconductor, Fremont, CA

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Session 25 **Thursday, February 10**
Power Semiconductors **Bayou II & IV**
2:00 PM – 5:30 PM

Session Chair: Alexander H. Craig, Intersil

25.1 IGBT Ghost Failures in Boost Topology Circuits Explained through Third Quadrant Operation
Alexander H. Craig and Joe Yedinak, Intersil, Mountaintop, PA and Ronald Randall, ACME Electric Corp., Cuba, NY

25.2 Impact of Switching Sequence on Zero Current Switching Performance of Power Bipolar Semiconductor Devices
R. Vijayalakshmi, M. Trivedi and K. Shenai, University of Illinois at Chicago, Chicago, IL

25.3 Analysis by Measurements and Circuit Simulations of the PT and NPT-IGBT under Different Short-Circuit Conditions
M. Cotorogea, A. Claudio, J. Aguayo and H. Muller, Centro Nacional de Investigación y Desarrollo Tecnológico, Cuernavaca, MEXICO

25.4 Parastic Extraction Methodology for Insulated Gate Bipolar Transistors
Malay Trivedi and Krishna Shenai, University of Illinois at Chicago, Chicago, IL

25.5 Comparison of the State-of-the Art High Power IGBTs, GCTs and ETOs
Kevin Motto, Yuxin Li and Alex Q. Huang, Virginia Polytechnic Institute and State University, Blacksburg, VA

25.6 Resonant Gate Commutated Thyristor (RGCT) -- A New Snubberless Turn-Off GTO
Yuxin Li, Alex Q. Huang and Kevin Motto, Virginia Polytechnic Institute and State University, Blacksburg, VA

25.7 Experimental Demonstration of the MOS Controlled Diode (MCD)
Zhenxue XU, Bo Zhang and Alex Q. Huang, Virginia Polytechnic Institute and State University, Blacksburg, VA

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Session 26 **Thursday, February 10**
Power Electronics **University Room**
Gumbo **2:00 PM – 5:30 PM**

Session Chair: Lars Thorsell, Ericsson Components AB

26.1 A RISC-Microcontroller Based Photovoltaic System for Illumination Application
M. Godoy Simoes and N.N. Franceschetti, University of Sao Paulo, Sao Paulo, BRAZIL

26.2 A Non-Contact Power-Supply Card Powered by Solar Cells for Mobile Communication
Yasuyuki Kanai, Masato Mino, Tatsuo Sakai and Toshiaki Yachi, NTT Telecommunications Energy Laboratories, Tokyo, JAPAN

26.3 A Design Approach for Server Power Supplies for Networking Applications
Laszlo Huber and Milan M. Jovanovic, Delta Products Corporation, Research Triangle Park, NC

26.4 Characterizing the Generation & Coupling Mechanisms of Electromagnetic Interference Noise from an Electric Vehicle Traction Drive up to Microwave Frequencies
Chingchi Chen, Ford Research Laboratories, Dearborn, MI

26.5 Low Power AC/DC On-Board Converters for Rectified AC Power Distribution Demonstrator for Telecommunication
L. Alvarez Barcia, A. Fontan, A. Huertas, J. González and J. Ara, Alacatel Corporate Research Center, Madrid, SPAIN and A. Fernández, Universidad de Oviedo, Gijón, SPAIN

26.6 Processor Power Subsystem Architectures
Robert Kollman and Dan Chamberlin, Raytheon Systems Company, Dallas, TX

26.7 On-Line Measurement on Stability Margin of DC Distributed Power System
Xiaogang Feng and Fred C. Lee, Virginia Polytechnic Institute & State University, Blacksburg, VA

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APEC 2000 At A Glance

Saturday, February 5

Registration Desk Open		3:00 PM – 6:00 PM	Imperial Ballroom Foyer

Sunday, February 6

Seminar 1	**Design and Analysis of Magnetic Devices**	**9:30 AM – 1:00 PM**	**Emerald Room**
Seminar 2	**Intellectual Property, Patents and Ethical Issues for Engineers**	**9:30 AM – 1:00 PM**	**Grand Ballroom**
Seminar 3	**Switching Power Supply Design Basics**	**9:30 AM – 1:00 PM**	**University Room**
Seminar 4	**Introduction to High Efficiency Electronically Commutated Motor Drives**	**9:30 AM – 1:00 PM**	**Bayou I**
Seminar 5	**Introduction to Small-Signal Modeling and Measurement of Switching Converters**	**9:30 AM – 1:00 PM**	**Bayou II**
Seminar 6	**Planar Magnetics Technologies**	**2:30 PM – 6:00 PM**	**Grand Ballroom**
Seminar 7	**Telecomm Power System Specification**	**2:30 PM – 6:00 PM**	**Emerald Room**
Seminar 8	**Selecting Switchmode Topologies for Various Applications**	**2:30 PM – 6:00 PM**	**University Room**
Seminar 9	**Switched Reluctance Motor Drives: Recent Advances and State of the Art**	**2:30 PM – 6:00 PM**	**Bayou I**
Seminar 10	**Feedback Control Design**	**2:30 PM – 6:00 PM**	**Bayou II**
Registration Desk Open		8:00 AM – 6:00 PM	Imperial Ballroom Foyer
Conference Breakfast (Ticket Required)		8:00 AM – 9:30 AM	Blue
Spouse & Guest Hospitality Room Open		12:00 Noon – 5:00 PM	Orleans

Monday, February 7

Seminar 11	**Compact Models of Power Devices and Power ICs for Circuit Simulation**	**8:30 AM – 12:00 Noon**	**Emerald Room**
Seminar 12	**State of Power Electronics Packaging**	**8:30 AM – 12:00 Noon**	**University Room**
Seminar 13	**Latest Developments in Power-Factor Correction**	**8:30 AM – 12:00 Noon**	**Grand Ballroom**
Seminar 14	**Sensorless Control of Induction Motors and Permanent Magnet Synchronous Motors**	**8:30 AM – 12:00 Noon**	**Bayou I**
Seminar 15	**Connecting Theory with Design of Controllers in Switch-Mode Power Supplies, Power Factor Correction Circuits and Motor Drives**	**8:30 AM – 12:00 Noon**	**Bayou II**
Session 1	**Plenary Session**	**1:30 PM – 5:00 PM**	**International Ballroom**
Conference Breakfast (Ticket Required)		7:00 AM – 8:30 AM	Blue
Registration Desk Open		7:30 AM – 5:00 PM	Imperial Ballroom Foyer
Spouse & Guest Hospitality Room Open		8:30 AM – 5:00 PM	Orleans
Spouse & Guest Welcoming Breakfast & City Orientation		9:00 AM – 11:00 AM	Orleans
Spouse & Guest City Bus Tour (Reservation Required)		1:15 PM – 4:30 PM	Orleans
Exposition Hall Open		5:30 PM – 8:00 PM	Imperial Ballroom
Welcoming Reception		5:30 PM – 8:00 PM	Imperial Ballroom
MicroMouse Contest		8:00 PM – 10:00 PM	Grand Ballroom
Sack Sitters		To Be Announced	To Be Announced

Tuesday, February 8

Session 2	**Marketing Strategies for Today**	**8:30 AM – 12:00 Noon**	**Bayou II & IV**
Session 3	**High Power DC-DC Converters I**	**8:30 AM – 12:00 Noon**	**Grand Ballroom**
Session 4	**Induction Motor Drives I**	**8:30 AM – 12:00 Noon**	**Bayou I & III**
Session 5A	**Boost Converter Design & Analysis**	**8:30 AM – 10:15 AM**	**Emerald Ballroom**
Session 5B	**Three-Phase Design Techniques**	**10:45 AM – 12:00 Noon**	**Emerald Ballroom**
Session 6	**Modeling and Control I**	**8:30 AM – 12:00 Noon**	**University Room**
Exhibitor Seminars 1 - 4	**See Exposition Directory For Seminar Descriptions**	**2:00 PM – 3:00 PM**	**See Exposition**
Exhibitor Seminars 5 - 8	**See Exposition Directory For Seminar Descriptions**	**3:15 PM – 4:15 PM**	**Directory For**
Exhibitor Seminars 9 - 12	**See Exposition Directory For Seminar Descriptions**	**4:30 PM – 5:30 PM**	**Room Assignments**
Rap Session 1	**42V PowerNet: An Enabling Technology For Automotive Power Electronic Systems?**	**6:30 PM – 8:00 PM**	**Emerald Ballroom**
Rap Session 2	**Are Mergers Good For The Power Supply Industry?**	**6:30 PM – 8:00 PM**	**University**
Rap Session 3	**Integration Of Motor Drives: How Much Is Too Much?**	**6:30 PM – 8:00 PM**	**Explorer's**
Conference Breakfast (Ticket Required)		7:00 AM – 8:30 AM	Blue
Registration Desk Open		7:30 AM – 5:00 PM	Imperial Ballroom Foyer
Spouse & Guest Hospitality Room Open		8:30 AM – 5:00 PM	Orleans
Spouse & Guest Walking Tour Of The French Quarter (Reservation Required)		8:45 AM – 12:00 Noon	Orleans
Exposition Hall Open		12:00 Noon – 6:30 PM	Imperial Ballroom
Lunch In The Exposition Hall (Ticket Required)		12:00 Noon – 1:30 PM	Imperial Ballroom
Exhibitor's Reception		5:00 PM – 6:30 PM	Imperial Ballroom
Exposition Raffle Drawing (Must Be Present To Win)		6:15 PM	Imperial Ballroom
Sack Sitters		To Be Announced	To Be Announced

APEC 2000 At A Glance

Wednesday, February 9

Session 7	**Power Electronics Packaging**	**8:30 AM – 12:00 Noon**	**Bayou II & IV**
Session 8	**High Power DC-DC Converters II**	**8:30 AM – 12:00 Noon**	**Grand Ballroom**
Session 9	**Synchronous Motor Drives**	**8:30 AM – 12:00**	**Bayou I & III**
Session 10	**Digital and Analog Control of Harmonic Filters**	**8:30 AM – 12:00 Noon**	**University Room**
Session 11	**Single-Phase Power Factor Correction**	**8:30 AM – 12:00 Noon**	**Emerald Ballroom**
Session 12	**AC-DC Converters**	**2:00 PM – 5:30 PM**	**Grand Ballroom**
Session 13	**PWM Techniques**	**2:00 PM – 5:30 PM**	**Bayou I & III**
Session 14	**Lamp Ballasts**	**2:00 PM – 5:30 PM**	**Bayou II & IV**
Session 15	**Passive Components**	**2:00 PM – 5:30 PM**	**University Ballroom**
Session 16	**Techniques for Improving Converter Performance**	**2:00 PM – 5:30 PM**	**Emerald Ballroom**
Conference Breakfast (Ticket Required)		7:00 AM – 8:30 AM	Blue
Registration Desk Open		7:30 AM – 2:00 PM	Imperial Ballroom Foyer
Spouse & Guest Hospitality Room Open		8:30 AM – 5:00 PM	Orleans
Spouse & Guest New Orleans Shopping Safari		9:30 AM – ???	Orleans
Exposition Hall Open		12:00 Noon – 2:00 PM	Imperial Ballroom
Lunch In The Exposition Hall (Ticket Required)		12:00 Noon – 1:30 PM	Imperial Ballroom
Conference Banquet: Blaine Kern's Mardi Gras World		6:00 PM – 10:00 PM	
Sack Sitters		To Be Announced	To Be Announced

Thursday, February 10

Session 17	**DC-DC Converters I**	**8:30 AM – 12:00 Noon**	**Grand Ballroom**
Session 18	**Components in Circuit Applications**	**8:30 AM – 12:00 Noon**	**University Room**
Session 19	**Modeling and Control II**	**8:30 AM – 12:00 Noon**	**Emerald Ballroom**
Session 20A	**AC-AC Converters**	**8:30 AM – 10:15 AM**	**Bayou I & III**
Session 20B	**Inverter Control**	**10:45 AM – 12:00 Noon**	**Bayou I & III**
Session 21	**Induction Motor Drives II**	**8:30 AM – 12:00 Noon**	**Bayou II & IV**
Session 22	**DC-DC Converters II**	**2:00 PM – 5:30 PM**	**Grand Ballroom**
Session 23	**Soft-Switched Inverters**	**2:00 PM – 5:30 PM**	**Bayou I & III**
Session 24A	**Unique Utility Interfaces**	**2:00 PM – 3:45 PM**	**Emerald Ballroom**
Session 24B	**Modeling and Control III**	**4:15 PM – 5:30 PM**	**Emerald Ballroom**
Session 25	**Power Semiconductors**	**2:00 PM – 5:30 PM**	**Bayou II & IV**
Session 26	**Power Electronics Gumbo**	**2:00 PM – 5:30 PM**	**University Room**
Conference Breakfast (Ticket Required)		7:00 AM – 8:30 AM	Blue
Registration Desk Open		7:30 AM – 12:00 Noon	Imperial Ballroom Foyer
Spouse & Guest Hospitality Room Open		8:30 AM – 12:00 Noon	Orleans
Sack Sitters		To Be Announced	To Be Announced

APEC 2000 Conference Registration Form

IEEE Applied Power Electronics Conference And Exposition

February 6 – 10, 2000, Fairmont Hotel, New Orleans, Louisiana

Last Name, First Name

Affiliation/Organization

Address Line 1

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Please check the appropriate box to register in advance or late/on-site, as a member or non-member or as an IEEE Life Member or Student.	**Advance Registration (Received By January 7, 2000)**		**Late Or On-Site Registration (Received After January 7, 2000)**		**IEEE Life Members And Students**	**Amount Due**
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Professional Education Seminars	❑ $250.00	❑ $300.00	❑ $300.00	❑ $350.00	❑ $50.00	
Technical Sessions	❑ $350.00	❑ $425.00	❑ $425.00	❑ $500.00	❑ $100.00	

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Qty	**Item Description**	**Price Each With Conference Registration**	**Price Each Without Conference Registration**	**Item Total**
	APEC 2000 Proceedings (Hardcopy & CD-ROM)	$70.00	$95.00	
	Seminar Workbook (Hardcopy Only)	$60.00	$85.00	
	Proceedings & Workbook Combination	$120.00	$165.00	

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	Conference Breakfast Tickets @ $4.00 Each	
	Tuesday Lunch Tickets @ $8.00 Each	
	Wednesday Lunch Tickets @ $8.00 Each	
	Additional Conference Banquet Tickets @ $40.00 Each (1 Included With Technical Session Registration)	

APEC REGISTRATION TOTAL AMOUNT DUE:

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If a spouse or guest will accompany you, please provide their name:

Please register my spouse/guest for the events checked below. We understand space is limited and available on a first-come, first served basis.

❑ Welcoming Breakfast & City Orientation (Monday AM) ❑ City Bus Tour (Monday PM) ❑ French Quarter Walking Tour (Tuesday AM)

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APEC 2000 Hotel Registration Form

IEEE Applied Power Electronics Conference And Exposition

February 6 – 10, 2000, Fairmont Hotel, New Orleans, Louisiana

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When will you be arriving and departing the Fairmont Hotel?

Arrival Date Departure Date

Room Type (Check One) ❑ Single (APEC Rate $169.00 Per Night) ❑ Double (APEC Rate $189.00 Per Night)

The APEC rates are a preferred rate for APEC attendees. To receive the APEC rate the reservation must be made by Thursday, January 6, 2000. The hotel rates quoted here do not include city and state taxes.

Room Requests

Bed Type (Check One): ❑ Two Double Beds ❑ One King Size

Smoking Preference (Check One): ❑ Non-Smoking Room ❑ Smoking Room

Room requests are granted on a space available basis and cannot be guaranteed. Thank you for your understanding.

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A deposit equal to one night's lodging is required with the reservation. The deposit can be paid either with a check or a money order or the reservation can be guaranteed with a credit card. Checks and money orders must be in U.S. dollars, drawn on an U.S. bank and should be made payable to The Fairmont Hotel.

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