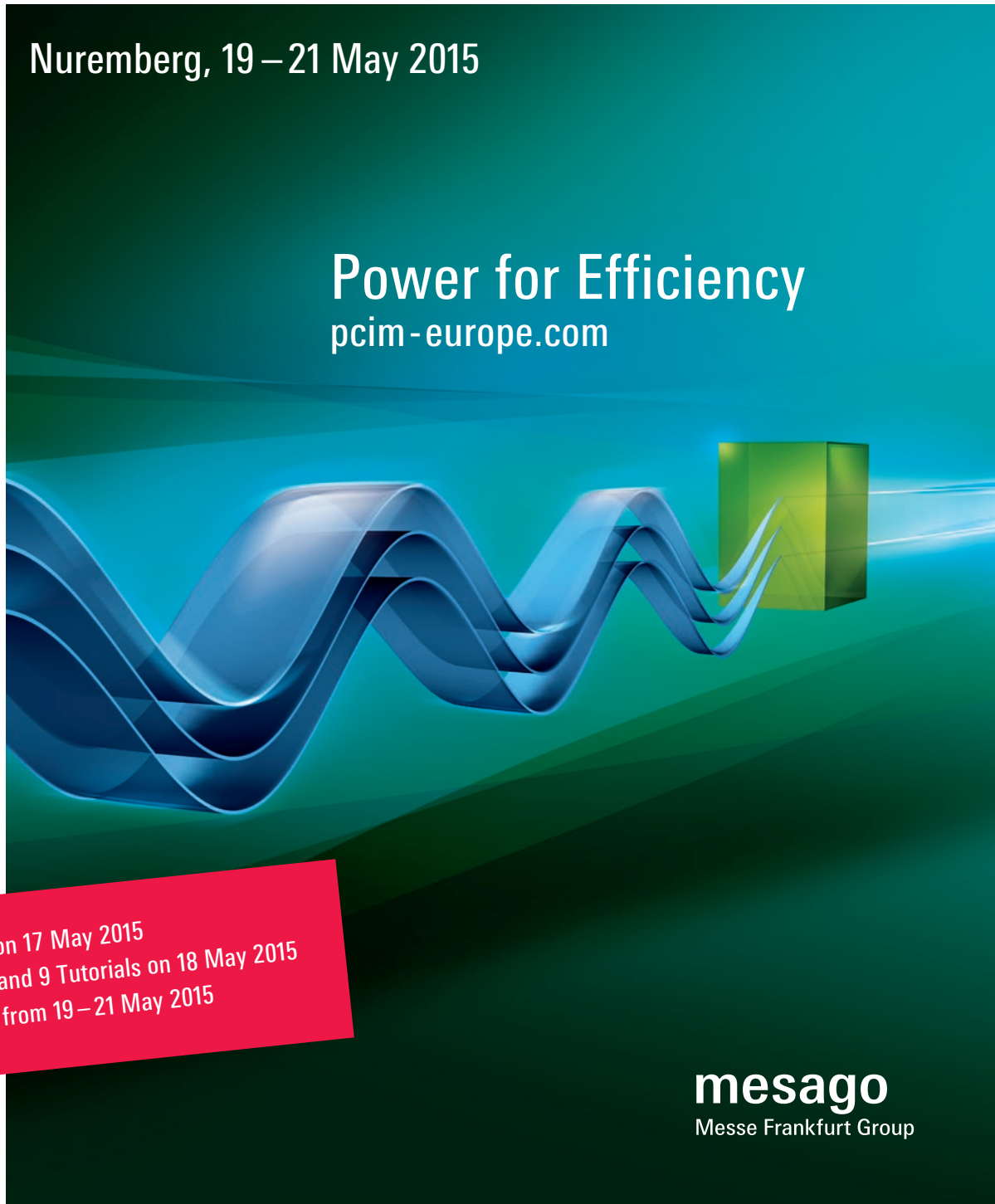
PCIM
EUROPE

International Exhibition and Conference
for Power Electronics, Intelligent Motion,
Renewable Energy and Energy Management

Conference Program



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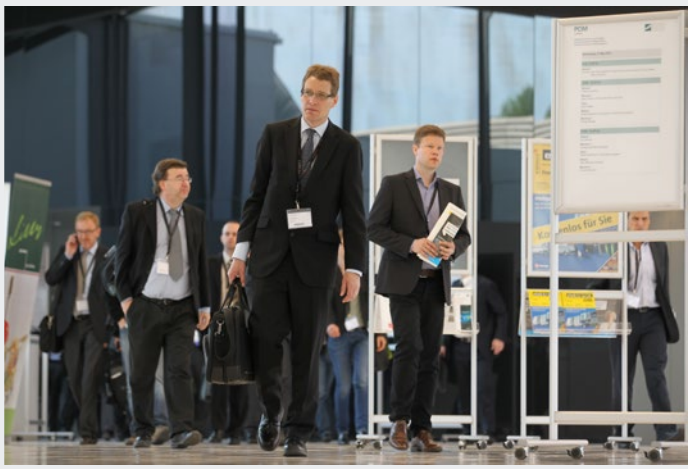

Welcome Address

Dear PCIM Europe participants,

We are very pleased to welcome you to the PCIM Europe 2015 Conference in Nuremberg. This important event serves as a technical and scientific forum for engineers and researchers engaged in all fields related to power conversion technologies. The topics of PCIM Conference and Exhibition are power electronics, intelligent motion, renewable energy and energy management.

Again this year we have seen a high quality of papers submitted and selected the best and most important to include it in the program of oral and poster presentations. Special attention has been paid on the research carried out by young engineers; the presentation of the Young Engineers and Best Paper Awards at the opening ceremony ranks amongst the conference highlights.

The technical program for this year's conference highlights advanced technologies for power semiconductor devices and passive components control and drive strategies for high efficient power converters, e-mobility and renewable energy technologies. New material for semiconductor devices, reliability issues on power module and system level as well as ideas on managing parasitic effects in the circuit set ups, forms the backbone of the PCIM Europe Conference.

The keynote papers cover the development trend for power semiconductor devices, including packaging and reliability issues for different fields of applications as well as future battery management solutions. This year the highlights of the conference include the special sessions on challenges in digital power control, PV-converters, e-mobility and the next generation of power devices.

I am convinced that with its high level technical program and discussion platform, this year's PCIM Europe Conference will provide you with an overview of the key technology development trends in power electronics and inspire you to pursue new business opportunities.

I wish you an enjoyable and successful conference, packed with new ideas for your future business.

Leo Lorenz,
General Conference Director, Germany

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Conference Program at a Glance

Sunday, 17 May 2015

14:00 – 17:30	Hotel Arvena Park Görlitzer Str. 51; D-90473 Nuremberg Seminars				

Monday, 18 May 2015

09:00 – 17:00	Hotel Arvena Park Görlitzer Str. 51; D-90473 Nuremberg Seminars and Tutorials				

Tuesday, 19 May 2015

09:00	Brüssel Conference Opening and Award Ceremony				
09:45	Brüssel KEYNOTE »The State-of-The-Art and Future Trend of Power Semiconductor Devices«				
10:30	Coffee Break				
11:00	Brüssel Materials	München 1 SiC High Power	Athen Control and Drive Strategies in Power Converters I	Mailand SPECIAL SESSION Solar Inverter Topologies	München 2 SPECIAL SESSION Passive Components
13:00	Lunch Break				
14:00	Brüssel High Power Low Inductive	München 1 Reliability Monitoring	Athen New and Renewable Energy Systems	Mailand Control Techniques in Intelligent Motion Systems	München 2 SPECIAL SESSION Digital Control Power – the Future of Power Electronics
15:30	Foyer Entrance NCC Mitte Poster/Dialogue Session				
17:15	Exhibition Party				

Wednesday, 20 May 2015

08:45	Brüssel KEYNOTE »Packaging and Reliability of Power Modules – Principles, Achievements and Future Challenges«				
09:30	Coffee Break				
10:00	Brüssel SPECIAL SESSION Power GaN for Automotive Applications	München 1 HV-IGBT	Athen DC/DC Converters	Mailand Advanced Packaging	München 2 Control and Drive Strategies in Power Converters II
12:00	Lunch Break				
14:00	Brüssel GaN	München 1 Robustness	Athen Power Electronics in Transmission Systems	Mailand Application for Drives & Motion Control	München 2 Passive Components and New Materials
15:30	Foyer Entrance NCC Mitte Poster/Dialogue Session				

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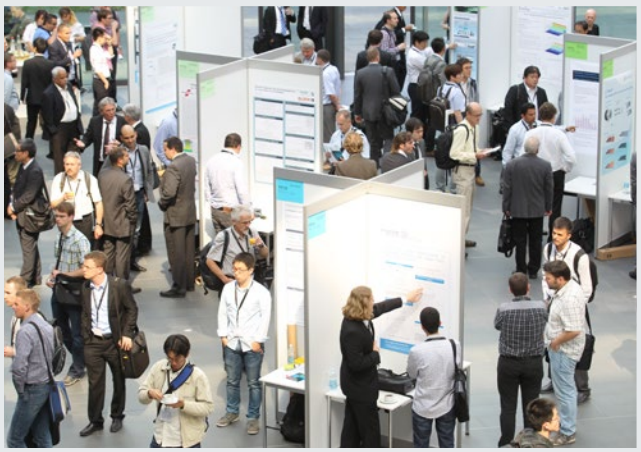
Thursday, 21 May 2015

08:45	Brüssel KEYNOTE »Electrochemical Battery Managements and Applications«				
09:30	Coffee Break				
10:00	Brüssel SiC Low Power	München 1 DC/AC Converters	Athen Power Quality Solutions	Mailand SPECIAL SESSION E-Mobility	München 2 Motors
12:00	Lunch Break				
14:00	Brüssel Power Modules	München 1 Low Power Converters	Athen Sensors	Mailand Power Electronics in Automotive, Traction and Aerospace	

as of February 2015/subject to change without notice



Seminars Sunday, 17 May 2015, 14:00 – 17:30

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Seminar 1

Basics of Electromagnetic Compatibility (EMC) of Power Systems

Jacques Laeuffer, Dtalents, France

About the instructor

Jacques Laeuffer has 30 years of experience in the field of Power Electronics, including high frequency resonant converters, automotive drive systems for hybrid vehicles, high power drives, from 10 W up to 10 MW. He has written over 80 technical papers, and is inventor of 27 patents. »Habilité à Diriger des Recherches« (H.D.R.) by University of Paris 6, he received also the »Grand Prix de l'Innovation 2004« from PSA Peugeot Citroen. Teacher at Supelec, Ensta, Aemc, Eurosae, he is also a consultant for design of switch mode power supplies and variable speed drives, EMC and control.

Contents

Seminar benefits include:

- → Avoid noisy oscillations in power systems
- → Calculate and optimize high frequency impedances and wiring
- → Calculate and optimize Differential Mode (DM) and Common Mode (CM) filters
- → Comply with Standards
- → Avoid expensive shielding and improve reliability

Main Seminar topics include:

- → Introduction
  - – Issues take source in power transistors and diodes sudden commutations
  - – Differential Mode interferences occurs when perturbation flows through active circuits
  - – Common Mode occurs when perturbation flows through parasitic capacitors, cases, grounds, etc.
- → Differential Mode management and filtering
  - – Switching supply operating sequence
  - – Input filtering capacitor resistance. Disturbance calculation
  - – Disturbance measurement according standards
  - – Line diodes recovery. Line inductance effect
  - – DM filter components calculation
- → Common Mode management and filtering
  - – Parasitic capacitance trough heat sinks. Disturbance calculation
  - – Disturbance measurement according standards
  - – Parasitic capacitance trough transformers; screens, electric machines windings
  - – CM filter components calculation
- → Power Semiconductors EMC Control
  - – Smoothing di/dt and dv/dt front edges by gate drives. Control for MOS and IGBTs

Who should attend?

This course is targeted towards engineers and project managers, who design, specify, integrate converters, inverters, and components, for power electronics and/or drive systems, optimized for E.M.C., global cost and reliability.

Seminar 2

Physical Limitations to Magnetics Power and Energy Densities, with Design approaches to Maximization

Bruce Carsten, Bruce Carsten Associates, USA

About the instructor

Bruce Carsten has 45 years of experience in all aspects of the design and development of switchmode power converters, at frequencies from 20 kHz to 1 MHz and power levels from 100 mW to 25 kW. He designed and built his first transformer in 1961, and by the early 70's began designing high frequency transformers and inductors for switchmode power converters, which he found an intriguing challenge. This became a speciality which he continues to research.

Contents

Nearly all design engineers do not understand why the dramatic »orders of magnitude« size reductions in many electronic devices have not been achieved in transformers and inductors (as well as capacitors), at least not to a remotely similar degree. A simple answer is that processors of information (bits and bytes) and storage in memory can be miniaturized with smaller devices, but that Joules and Watts cannot. Energy must be stored in, and transferred by, electric and magnetic fields, and the strength of these fields is limited by the non-ideal physical materials available. This seminar will focus largely on transformers, although inductors have very similar considerations. For a given frequency, size reductions require higher winding current and/or core flux densities, which increase losses in a smaller device. Some size reductions can be achieved at higher frequencies, but there are several practical limitations here. There are no »magical« approaches to high power (and energy) densities, but an understanding of the limitations and tradeoffs will allow a design to be optimized.

Topics include:

- → A basic analysis of transformer power capability
- → Frequency limitations in cores and windings
- → Scaling laws for geometrically similar transformers (size vs. loss tradeoffs)
- → The limited effect of shape on power density
- → Enhanced heat extraction methods for higher power densities
- → An extended analysis of the benefits of »fluid cooling passages«
- → Three classes of »integrated magnetics« for size reductions

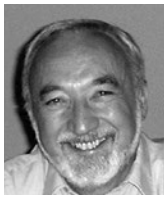
Who should attend?

This seminar is directed largely towards the design engineer who is either directly involved in magnetics design, or who needs to understand the limitations and tradeoffs involved.

Seminar 3

Ripple-Based Control of DC-DC Converters

Richard Redl, Redl Consulting, Switzerland



About the instructor

Dr. Redl is a power-electronics consultant in Switzerland, specializing in power supplies, UPSs, inverters, electronic ballasts, battery chargers and battery management systems, and integrated circuits for power management. He holds twenty-two patents, has written over hundred technical papers and three book chapters, and co-authored a book on the dynamic analysis of power converters. He is a regular seminar and tutorial instructor on many aspects of power electronics, including dc-dc and ac-dc converter topologies, control and modeling of dc-dc converters, EMC and power quality, and batteries and battery chargers. He was a member of the program committees of APEC, PESC, ECCE, and EPE, a paper reviewer for several technical journals, an associate editor of the IEEE Transactions on Industry Applications, and is now an associate editor of the IEEE Transactions on Power Electronics. Dr. Redl is a Fellow of the IEEE.

Contents

Switching regulators with ripple-based control (i.e., »ripple regulators«) are conceptually simple, have fast transient responses to both line and load perturbations, and some versions operate with a switching frequency that is proportional to the load current in discontinuous conduction mode. These characteristics make the ripple regulators especially well-suited for applications in portable electronic devices and computers. Ripple regulators also have some drawbacks, including (in some versions) a poorly defined switching frequency, noise-induced jitter, inadequate dc regulation, and a tendency for fast-scale instability.

This seminar presents an overview of the various ripple-based control techniques, discusses their merits and limitations, introduces techniques for reducing the jitter, improving the frequency stability and regulation, and addresses the modeling and stability issues.

The first part of the seminar discusses the basic ripple regulators (hysteretic, constant-off-time, constant-on-time, and constant-frequency versions), covering the schematics, waveforms, switching frequency and dc regulation. The second part presents techniques for reducing the noise sensitivity and jitter, and stabilizing the switching frequency. The third part focuses on improving the dc regulation by adding a high-dc-gain amplifier in the feedback loop and by improving the dynamic regulation with adaptive timing control. The fourth part discusses modeling and stability. The seminar concludes with a short review of miscellaneous topics (voltage positioning, multiphase operation, application of the ripple-regulator concept in topologies other than the buck converter). The detailed outline of the seminar is as follows.

- Basic ripple regulator types (topologies, waveforms, characteristics)
- Hysteretic
- Constant-off-time peak-voltage and constant-on-time valley-voltage regulators
- Constant-frequency peak-voltage and valley-voltage regulators
- Reducing noise sensitivity and jitter and stabilizing the frequency
- Increasing the effective ripple
- Adding artificial ramp to the ripple
- Stabilizing the frequency of with feedforward or feedback
- Synchronizing the frequency with PLL
- Improving the regulation
- Improving the dc regulation
- V2 control
- R3 control and its ramifications
- Combined inductor-voltage integrator and error amplifier
- Combined ripple and error amplifier
- Improving the dynamic regulation by adaptive on-time, off-time, or period control
- Modeling and stability
- Perturbation analysis for determining the subharmonic stability limits of the constant-on-time and constant-off-time regulators
- Small-signal modeling and equivalent circuits of V2 control
- Harmonic balance analysis for determining the subharmonic stability limits of the constant-on-time regulator with turn-on delay, feedback filter, and low-time-constant second output capacitor
- Miscellaneous
- Voltage positioning with ripple regulators
- Multiphase operation of ripple regulators
- Extending the ripple regulator concept to topologies other than the buck converter (Cuk, zeta, boost)

Who should attend?

The target audience of this seminar is power-supply design engineers, power-management IC designers, system designers, project managers, engineering students, and all other professionals interested in ripple-based control of dc-dc converters.

Seminars Sunday, 17 May 2015, 14:00 – 17:30

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Seminar 4

Magnetic Design for very High Efficiency Power Conversion

Ionel Dan Jitaru, Rompower,USA

About the instructor

Ionel »Dan« Jitaru is the founder of Rompower Inc. an internationally recognized engineering firm in the field of power conversion, later in 2001Ascom-Rompower Inc. and in 2003 Delta Energy Systems (Arizona) Inc. Presently he is the president of Rompower Energy Systems Inc. He has published 51 papers and held 45 professional seminars professional at different International Conferences in the power conversion field, wherein several of them have received the best paper award. Mr. Jitaru is one of the pioneers in several trends in power conversion technologies such as »Soft Switching«, »Full integrated multilayer PCB packaging concept«, »Synchronized rectification« and »Intelligent power processing«. Mr. Jitaru has 51 patents wherein 25 granted patents and 26 pending patents that have covered many areas in power conversion.

Contents

The tremendous progress in semiconductor technology moved the spotlight for efficiency quest towards the magnetics. The progress in magnet technologies has been limited, though the seminar will focus on the latest magnetic technologies capable of pushing the efficiency to very high level. A study of the loss mechanism in the magnetics and ways to improve it, together with Novel magnetic structures will be presented. Analyzing the power dissipation budgets in power converters made it clear that the progress in magnetics is imperative for reaching 99 % efficiency. The seminar will present in details all the parasitic elements in the magnetics, the loss mechanism associated with it and solutions in addressing them.

In this section will be analyzed the following:

- → Leakage Inductance and methods of control and reduction.
- → Stray Inductance and its effects.
- → Parasitic capacitances and method of reduction.
- → Gap effect and techniques to reduce it.
- → Loss due to the »end effect:« and methods of reduction.

This section will be also highlighter with design examples in application wherein the power conversion efficiency reached 99 %. Another section of the seminar will be dedicated to magnetic integration. It will start with Quasi-Integrated Magnetic wherein the main transformer becomes a partial energy storage reducing the size of the output filter. This concept can lead to great optimization of the power train efficiency. The presentation will continue with the »multi-legged« magnetic configuration, which is the latest magnetic technology today, referred also as »ultra-planar« magnetic. Other forms of distributed magnetic structures will be presented, some of them in power converters with the highest power density and lowest profile on the market. Another chapter is dedicated to wireless magnetic structures, with experimental data and example ranging from power level of 10 W to 1 KW wireless applications. In the last section of the seminar, there will be presented the latest magnetic technologies for very high frequency operation including the coreless transformers.

Seminar 5

Power Supply Workshop for non-isolated DC/DC converters

Ralf Regenhold, Würth Elektronik eiSos, Germany

About the instructor

Ralf Regenhold, born in 1967, worked since his graduation as master of electrical engineering at the University of Munich since 20 years in semiconductor industry. He held several positions in marketing, sales, field application and electrical design in major semiconductor companies.
He is a marketing expert, has strong technical know-how about power products and systems in industrial, automotive and the telecom segment. Within his career he fostered relationships with international customers and distributors. In 2014 Ralf joined Würth Elektronik eiSos and is now division manager of the MagI³C Power Module Division.

Contents

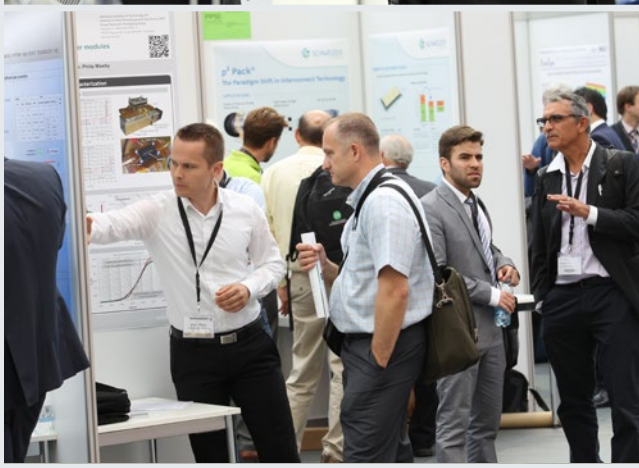
Hardware designers of power supplies which are based on non-isolated DC/DC converters have to calculate and choose electrical components for the power stage and to ensure the stability of its power supply. Electronic parts should be chosen as to ensure low temperature dissipation and to reach a higher efficiency of the power supply. Additionally these requirements should be ensured under all operation conditions without any oscillation at the converter's output and in all cases of perturbation.
How can the power stage be calculated? How can the electronic parts for the power stage be chosen? How can the control loop be compensated? How can a design engineer verify the performance of his power supply? These and more questions will be discussed in this workshop.
Within three hours, the attendees will learn to calculate and to choose the parts of the power stage of a non-isolated »Voltage mode« controlled DC/DC buck converter. Then they will learn how to compensate the control loop, to check their power supply and to verify the stability of the system.
In the first hour we plan to teach about the buck converters' power stage and the loop regulation using a presentation. The attendees will learn to understand how »Voltage« and »Current mode« DC/DC converters work, how to compensate the control loop and how to verify the system's stability. The next two hours are used to carry out practical tasks in small groups. The participants will calculate the power stage, choose components, compensate the control loop and perform various measurements to understand power stage, control loop and to verify the converter's loop for stability. The attendees will fully equip a board, a power supply and an oscilloscope for the duration of this workshop. It is not necessary to bring any equipment or tools with you.
All attendees will receive a full manuscript of this tutorial, a workshop instruction and the book »LTspice IV Simulator«, Application Handbook for LTspice IV simulation free of charge.

Content of the workshop:

- → DC/DC converter basics
- → Calculating power stage
- → Choosing passive components
- → »Voltage mode« and »Current mode« topologies
- → Type I, Type II, Type III compensation
- → Step by Step compensation
- → DC and AC analyses
- → Performing power supply tests
- → Simulation of control loops
- → Helpful tools for engineers
- → Tasks for calculating and choosing parts
- → Tasks for compensating control loops
- → Tasks for verifying converters stability

Who should attend?

This workshop is made for power supply designers, like students, beginners, as well as professionals who would like to refresh their know-how. All level design engineers and new designers will benefit from the knowledge presented in this workshop. Basic knowledge in buck topologies and working with oscilloscopes is helpful.



Seminars Sunday, 17 May 2015, 14:00 – 17:30

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Seminar 6

Practical Application of 600 V GaN HEMTs in Power Electronics

Eric Persson, International Rectifier, USA

About the instructor

Eric Persson is the Executive Director of GaN Applications and Marketing at International Rectifier, where he has been for the past 15 years. For 20 years before that, he was a hands-on power electronic design engineer developing many different converters, motor drives and inverters ranging in size from implantable medical devices to 75 kW power supplies.
Eric has presented more than 70 tutorials and papers at various international conferences. He is a regular lecturer, presenting short courses and tutorials at UW Madison, the University of Minnesota (his alma mater) and Purdue University. He is also Chairman, Board of Directors of the Power Source Manufacturers Association (PSMA). Mr. Persson holds 13 patents, and is a recipient of the IEEE Third Millennium Medal.

Contents

600 V GaN High Electron Mobility Transistors (HEMTs) are now becoming available from several major semiconductor manufacturers, and are moving from prototype to production in a variety of power electronic applications. This practical, application-oriented seminar begins with device characteristics, explaining similarities and differences compared to Silicon FETs and IGBTs. Gate drive and switching characteristics in both hard and soft-switching topologies are covered in detail. Several application examples cover power supply and motor drive real-world applications, comparing performance and EMI. The seminar concludes with some additional tips on thermal management and parallel operation recommendations for GaN devices.

Seminar Outline:

→ Device Characteristics
- Comparing normally-on and normally-off device characteristics
- Static and dynamic characteristics and temperature dependencies
- Output charge Qoss – why a single number doesn't tell the whole story
- Reverse conduction: cascode diode characteristics versus HEMT diode-like behavior
- Interpreting double-pulse test results – capacitive charge versus true reverse-recovery
- Voltage ratings: overvoltage, breakdown
- Safe Operating Area and short-circuit capability
- Thermal characteristics, models
- Packaging considerations and parasitic impedances

→ Gate Drive
- Parasitic impedance effects in fast-switching circuits
- How common source inductance affects switching behavior
- Inductively-limited switching and di/dt limits
- Using the Kelvin Source connection in gate drive circuits
- How much gate drive current and power is necessary?
- Temperature dependencies of GaN and Si gate threshold and leakage current
- Detailed Switching and Dynamic Characteristics [30 minutes]
- Hard-switched turn-on analysis, waveforms, losses, tradeoffs
- ZVS/Resonant turn-on analysis, waveforms, losses, tradeoffs
- Turn-off: ZVS on every edge is possible
- Controlling turn-on and turn-off dv/dt
- Spice models

→ Application Example: LLC Power Supply
- How does GaN benefit LLC topology?
- Deadtime requirements versus magnetizing current for Si, GaN
- Rms/ripple current reduction using GaN
- Gate drive losses
- Secondary-side synchronous rectification
- Performance comparison at 1 MHz

→ Application Example: Bridgeless PFC
- GaN applied to conventional PFC topologies
- Totem-Pole Bridgeless Boost topology using GaN + Coolmos
- Loss analysis in CCM operation at 60kHz
- Loss analysis in ZVS operation in the MHz region
- Modulation strategy and implementation
- Current and voltage measurement and control
- EMI characteristics, summary

→ Application Example: Motor Drive Inverter
- 250 W 3-phase inverter for PMAC compressor motor
- Full load and light load losses comparing FET, IGBT and GaN devices
- Switching loss associated with dv/dt control of GaN
- Comparing EMI characteristics of FET, IGBT and GaN

→ Practical Tips
- Parallel operation of GaN cascode switches
- PCB thermal management without heatsinks

→ Summary – Q&A

Seminar 7

Design of Magnetic Components for High Power Converters

Tomás Pagá, Woodwards IDS, Switzerland

About the instructor

Tomás Pagá born in Venezuela in 1969, he received his B.S and M.S. degrees from Simón Bolívar University in Caracas, Venezuela in 1994 and 1999 respectively. He was university professor and researcher until 2000. From 2001, during the last 14 years, has been Power Electronics Converter Designer for industry, railway and renewable energy applications. Currently he works as High Power Electronics Designer for ENERDRIVE GmbH in Zurich and for WOODWARD Kempen GmbH, Germany as technical lead for multi-megawatt power electronics converters design for wind energy applications. His research interests include high power electronics converters design, magnetic components modeling and design, modeling of power electronics components, thermal management and high frequency converters.

Contents

Filter chokes and transformers for high power converters, ranging from hundreds to thousands of kW, are commonly one of the most costly and difficult components to design.
Desired electrical performance and tight restrictions in weight, volume and cooling represent a challenging compromise for the designer.
In this seminar we address topics from how to specify the components for outsourcing to how to get deep inside the detailed design itself. References, test results and failure examples from real cases are presented.
The seminar starts with a revision of the basic concepts of magnetic design, then it goes deeply in the special case of operation with power electronics converters. Losses calculation and measuring are treated in detail, being the main topic on the seminar.
Losses produced by the switching high frequency components are often miscalculated resulting in poor thermal performance.
High frequency losses curves of laminated magnetic steel are commonly not available from the suppliers, so the designer faces with the need of high frequency losses measuring methods.
In this seminar, measurement error sources, low power factor and angle errors are explained in detail and methods to overcome those issues will be provided.
Additional sources of losses due to winding resistance, skin effect and fringe flux on the air-gaps will also be addressed.
Finally, cooling methods and mechanical design considerations for robustness and acoustic noise reduction are discussed.

Fields of application:

- → Grid Connected Converters
  - – Solar Inverters
  - – Wind Generators
  - – UPS systems
- → Electrical Drives
  - – Traction Drives
  - – Wind Generators
- → Isolated Grid Supplies
  - – Railway Auxiliary Converters
  - – UPS systems

- → Program:
  - – Field of application.
  - – Magnetic design basic concepts.
  - – Interaction with the PE converter.
  - – High frequency losses estimation and measurement.
  - – Additional losses sources.
  - – Cooling and mechanical design topics.

Who should attend?

Engineers and project managers involved on the design, specification and integration of transformers and inductors for high power electronics converters. High power electronics converters designers. Magnetic components, inductors and transformers, designers and manufacturers.

Seminar Monday, 18 May 2015, 09:00 – 12:30

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Seminar 8

Fundamentals and Multi-Objective Design of Inductive Power Transfer Systems

Johann Walter Kolar, Roman Bosshard, ETH Zürich, Switzerland

About the instructors

Johann W. Kolar (S'89-M'91-SM'04-F'10) is a full professor in Power Electronics at the Swiss Federal Institute of Technology (ETH) Zurich and Chair of the ETH Power Electronic Systems Laboratory. He has proposed numerous novel converter topologies and modulation/control concepts, e.g., the VIENNA Rectifier, the Swiss Rectifier, and the three-phase AC-AC Sparse Matrix Converter. In this context he has authored/co-authored over 450 scientific papers at main international conferences, over 180 papers in international journals, and 2 book chapters, and has filed more than 110 patents. The focus of his current research is on AC-AC and AC-DC converter topologies with low effects on the mains, Solid-State Transformers for Smart Microgrids, ultra-compact and ultra-efficient converter modules employing latest power semiconductor technology (SiC and GaN), Power Supply on Chip Systems, multi-objective optimization, and ultra-high speed and bearingless motors.
In the course of his research he has supervised over 50 Ph.D. students and PostDocs. Dr. Kolar is a Fellow of the IEEE and has received 20 IEEE Transactions or Conference Prize Paper Awards, the IEEE PELS Middlebrook Award 2014, and the SEMIKRON Innovation Award 2014. He initiated and/or is the founder/co-founder of 4 ETH Spin-off companies. He is a Member of the Steering Committees of several leading international conferences in the field and has been serving as an Associate Editor of the IEEE Transactions on Industrial Electronics and Power Electronics.

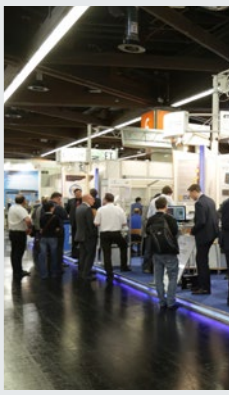
Roman Bosshard received the M.Sc. degree from the Swiss Federal Institute of Technology (ETH) Zurich, Switzerland, in 2011. During his studies, he focused on power electronics, electrical drive systems, and control of mechatronic systems. As part of his M.Sc. degree, he participated in a development project at ABB Switzerland as an intern, working on a motor controller for traction converters in urban transportation applications. In his Master Thesis, he developed a sensorless current and speed controller for an ultrahigh-speed electrical drive system with CELEROTON, an ETH Spin-off founded by former Ph.D. students of the Power Electronic Systems Laboratory at ETH Zurich. In 2011, he joined the Power Electronic Systems Laboratory at the Swiss Federal Institute of Technology (ETH) Zurich, where he is currently pursuing the Ph.D. degree. His main research area is inductive power transfer systems for electric vehicle battery charging, where he published five papers at international IEEE conferences and one paper in the IEEE Journal of Emerging and Selected Topics in Power Electronics.

Contents

The main aims of the seminar are to introduce the participants to the concepts and the multiobjective design challenges of Inductive Power Transfer (IPT) systems in a comprehensive, easy-to-follow fashion, to generate an understanding of the performance limits and to finally present experimental results of optimized industry-type demonstrator systems.
First, different application areas and IPT solutions existing in industry and academia are presented.
The main components of an Electric Vehicle (EV) battery charging IPT system with three-phase power factor corrected mains interface are explained. Furthermore, the design challenges of an IPT system are discussed in immediate comparison to the design of a conventional isolated DC/DC converter, in order to bridge the knowledge gap between both areas and to allow practicing engineers in industry and researchers in academia to seamlessly extend and complete their understanding of the subject area based on knowledge of general power converter design. Subsequently, a multi-objective design and optimization approach for IPT transmission coils along with the required calculation models for the high-frequency power losses in the main IPT system power components are presented in detail.
The method takes into account the required system performance (air gap, battery charging power), as well as the boundary conditions imposed by geometrical size limitations of the application, the electrical interface, the restrictions of the stray field as given by standards, and the thermal limitations of the components.
Experimental results obtained from a 96.5 % efficient 5 kW IPT system are presented to demonstrate the validity of the used calculation methods and the optimization process. In the last part of the seminar, the IPT system is discussed in the context of the complete power conversion chain from three phase mains via the IPT link to the vehicle battery. The feasibility of IPT systems for EV battery charging is discussed critically and requirements for implementation by industry are presented along with advantageous application areas.

Who should attend?

The intended audience are researchers and development engineers interested in an entry-level introduction into the concepts of IPT, and a thorough revision of the main operating principles and design challenges, as well as a critical discussion of the performance limits of this technology and the general potential in industry applications.



Seminar Monday, 18 May 2015, 13:30 – 17:00

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Seminar 9

Solid-State Transformer Concepts in Traction and Smart Grid Applications

Johann Walter Kolar, Jonas. E. Huber, ETH Zürich, Switzerland

About the instructors

Johann W. Kolar (S'89-M'91-SM'04-F'10) is a full professor in Power Electronics at the Swiss Federal Institute of Technology (ETH) Zurich and Chair of the ETH Power Electronic Systems Laboratory. He has proposed numerous novel converter topologies and modulation/control concepts, e.g., the VIENNA Rectifier, the Swiss Rectifier, and the three-phase AC-AC Sparse Matrix Converter. In this context he has authored/co-authored over 450 scientific papers at main international conferences, over 180 papers in international journals, and 2 book chapters, and has filed more than 110 patents. The focus of his current research is on AC-AC and AC-DC converter topologies with low effects on the mains, Solid-State Transformers for Smart Microgrids, ultra-compact and ultra-efficient converter modules employing latest power semiconductor technology (SiC and GaN), Power Supply on Chip Systems, multi-objective optimization, and ultra-high speed and bearingless motors.
In the course of his research he has supervised over 50 Ph.D. students and PostDocs. Dr. Kolar is a Fellow of the IEEE and has received 20 IEEE Transactions or Conference Prize Paper Awards, the IEEE PELS Middlebrook Award 2014, and the SEMIKRON Innovation Award 2014. He initiated and/or is the founder/co-founder of 4 ETH Spin-off companies. He is a Member of the Steering Committees of several leading international conferences in the field and has been serving as an Associate Editor of the IEEE Transactions on Industrial Electronics and Power Electronics.

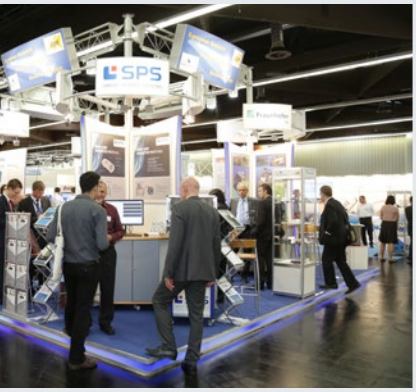
Jonas E. Huber received his M.Sc. (with distinction) degree from the Swiss Federal Institute of Technology (ETH) Zurich, Switzerland, in 2012, after studying electrical engineering with focus on power electronics, drive systems, and high voltage technology. He worked on a new modulation concept for the modular multilevel converter during an industry internship with ABB Switzerland as part of his master studies, before he designed and constructed a 100 kW/20 kHz back-to-back test bench for a medium frequency transformer in the scope of his master thesis, which was carried out at the Power Electronic Systems Laboratory, ETH Zurich. In 2012, he then joined the Power Electronic Systems Laboratory, ETH Zurich, as a PhD student, where his main research interests are in the area of solid-state transformers for smart grid applications, focusing on the analysis, optimization, and design of high-power multi-cell converter systems, reliability considerations, control strategies, and grid integration aspects, among others. He has authored five papers published at international IEEE conferences.

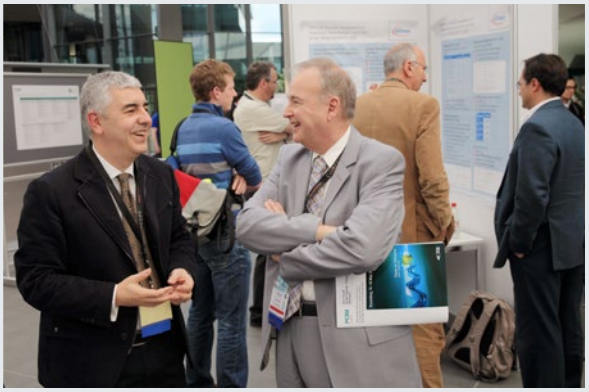
Contents

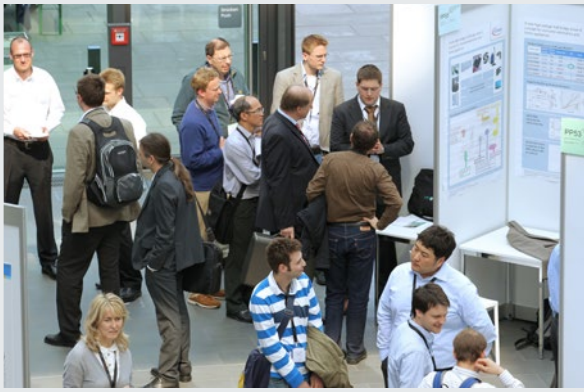
The main objective of this tutorial is to introduce participants to the Solid-State Transformer (SST) concept in a comprehensive but yet easy-to-follow fashion. After an introductory review of transformer basics and a brief history of SSTs, the motivation, requirements, and challenges associated with the two potential application areas, traction and smart grids, are discussed. Subsequently, the evolution of the SST concept from early basic structures to complex modern arrangements is shown by exploring the different degrees of freedom such as the partitioning of the power conversion, phase modularity, multi-cell solutions for interfacing medium-voltage systems, etc., leading to today's mainly considered three-stage SST approach featuring one or multiple isolated dc-dc converter stages. This is then illustrated by presenting state-of-the-art SST implementations from industry and research institutions with both, traction and smart grid backgrounds.
With the basic SST structures and operating principles introduced, the highly important aspect of system reliability is addressed by comparing reliability and redundancy concepts for multi-cell and single-cell SSTs.
In the following, based on an exemplary multi-cell SST system for distribution grid applications, various important design considerations such as the optimization of the number of cascaded converter cells, high-power dc-dc converter concepts, medium frequency transformer realization options, isolation coordination, and other application-oriented topics, are discussed. Furthermore, starting from general considerations on three-phase power flow control, suitable control strategies of multi-cell SSTs as well as the partitioning of the system control into local and global control units are addressed. Furthermore, the multi-cell SST concept for grid applications is critically evaluated and compared to a conventional low-frequency distribution transformer regarding efficiency, volume, costs, and functional aspects.
Finally, future trends such as unidirectional SST concepts or the importance and implications of the rapid development of SiC power semiconductor technology are presented along with an overall summary and conclusions.

Who should attend?

The intended audience is researchers and engineers interested in an introduction to the SST concept, including a thorough revision of main operating principles, an application-oriented discussion of key design challenges based on an exemplary SST design, and a critical review of the technology's potentials in traction and smart grid implementations.







Tutorials Monday, 18 May 2015, 09:00 – 17:00

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Tutorial 1

99 % Efficiency for AC-DC and DC-DC Converters

Ionel Dan Jitaru, Rompower, USA

About the instructor

Ionel »Dan« Jitaru is the founder of Rompower Inc. an internationally recognized engineering firm in the field of power conversion, later in 2001Ascom-Rompower Inc. and in 2003 Delta Energy Systems (Arizona) Inc. Presently he is the president of Rompower Energy Systems Inc.

He has published 51 papers and held 45 professional seminars professional at different International Conferences in the power conversion field, wherein several of them have received the best paper award. Mr. Jitaru is one of the pioneers in several trends in power conversion technologies such as »Soft Switching«, »Full integrated multilayer PCB packaging concept«, »Synchronized rectification« and »Intelligent power processing«. Mr. Jitaru has 51 patents wherein 25 granted patents and 26 pending patents that have covered many areas in power conversion.

Contents

The availability of very low impedance semiconductor devices and the new developments in the semiconductor technology such as SiC and GaN have allowed us to push the efficiency envelope towards 99 %. Reaching this milestone has proven to be very challenging. This goal requires reevaluation of the most suitable topologies which will be the best fit for very high efficiency power conversion using the existing components. Soft switching in primary and secondary is one of the main requirements, but also the minimization of the RMS current through the switching devices, magnetics and capacitors. Topologies such as LLC, which became very popular lately due to soft commutation and efficiency, may not be the most suitable candidate today when efficiencies around 99 % are targeted. The first section of the seminar concentrates on the latest soft switching topologies which are addressing the soft commutation both in the primary and the secondary side without adding complexity or penalties through an increased RMS current. Well known topologies are presented in the light of the latest improvements, as well as new topologies which were recently derived.

One of the main highlights of this seminar is the section dedicated to a Novel family of soft switching technologies which are derived from the conventional PWM topologies with minimum changes wherein the soft switching is accomplished through component sizing and the control mechanisms.

The second section of the seminar is dedicated to magnetics for high efficiency. The tremendous progress in semiconductor technology moved the spotlight for efficiency quest towards the magnetics. The progress in magnet technologies has been limited, though the seminar will focus on the latest magnetic technologies capable of pushing the efficiency to very high level.

A study of the loss mechanism in the magnetics and ways to improve it, together with Novel magnetic structures will be presented. Analyzing the power dissipation budgets in power converters made it clear that the progress in magnetics is imperative for reaching 99 % efficiency.

The third section of the seminar will present Intelligent Power Processing techniques, wherein the use of digital control allows us to obtain soft switching over the entire operating conditions and maximize the efficiency.

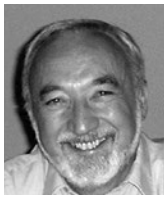
The presentation will be highlighted with design guidance, design example and experimental results for Power Factor Correction modules and isolated DC-DC Converters which reached 99 % efficiency and as a result very high power densities.

- → Loss Mechanisms in Power Converters
  - – Switching Losses
  - – Reverse Recovery Losses in rectifier means
  - – Conduction losses
  - – Losses in magnetics
- → A detailed evaluation of Soft Switching topologies
  - – Soft Switching Topologies through Current Shaping, LLC and others
  - – Soft Switching square waveforms topologies through magnetizing current steering
  - – Soft Switching square waveforms topologies through timed voltage injection
  - – Soft Switching square waveforms topologies through timed current injection
  - – Soft Switching square waveforms topologies through magnetizing current reversal
  - – A Novel method of converting a conventional hard switching topology into a soft switching through sizing and control
  - – Power dissipation budget analysis and comparisons for the previously described topologies
- → Magnetics for high Efficiency
  - – Brief analysis of the losses in magnetics
  - – Parasitic elements in the magnetics and methods to minimize them
  - – New magnetic structures for very high efficiency
  - – New magnetic structures for very low leakage inductance for very high current
  - – New Magnetic structures for very high frequency
- → Intelligent Power Processing
  - – Using Intelligent Power processing in efficiency optimization in PFC
  - – Using the Intelligent Power Processing in efficiency optimization for DC-DC Converters
- → Design examples for efficiency optimization (40 min)
  - – 99 % Efficiency for 1KW, 350W/inc3, Power Factor Correction Module
  - – 99 % Efficiency for 1KW isolated DC-DC Converter
- → Conclusion (20 min)
  - – Potential new trends in Power Conversion Technologies

Tutorial 2

Power-Factor Correction – from the Basics to the latest Developments

Richard Redl, Redl Consulting, Switzerland



About the instructor

Dr. Redl is a power-electronics consultant in Switzerland, specializing in power supplies, UPSs, inverters, electronic ballasts, battery chargers and battery management systems, and integrated circuits for power management. He holds twenty-two patents, has written over hundred technical papers and three book chapters, and co-authored a book on the dynamic analysis of power converters. He is a regular seminar and tutorial instructor on many aspects of power electronics, including dc-dc and ac-dc converter topologies, control and modeling of dc-dc converters, EMC and power quality, and batteries and battery chargers. He was a member of the program committees of APEC, PESC, ECCE, and EPE, a paper reviewer for several technical journals, an associate editor of the IEEE Transactions on Industry Applications, and is now an associate editor of the IEEE Transactions on Power Electronics. Dr. Redl is a Fellow of the IEEE.

Contents

The European norms EN61000-3-2 and EN61000-3-12 require that the current harmonics of all line-connected equipment stay below prescribed limits. Compliance with those norms is usually achieved by adding a harmonic-reduction/power-factor correction (PFC) circuit to the rectifier front-end of the equipment. This tutorial presents the fundamentals of PFC (harmonic regulations, passive and active circuit solutions, and control techniques), reviews and evaluates the latest developments, and provides guidelines for selecting the best solution for a particular application. The following topics will be covered.

→ Introduction
- – Power factor definitions
- – Causes and effects of line-current harmonics
- – Overview of the harmonic limits

→ Single-phase PFC
- – Passive solutions (choke, LC and LLC waveshaping, valley-fill rectifier)
- – Active solutions:
  - Fundamental considerations
  - Power-circuit topologies
    - Boost PFC and its derivatives (voltage-doubler, interleaved, multilevel)
    - Other nonisolated converters (buck, two-switch buck-boost, SEPIC, Cuk)
  - Isolated converters (flyback without or with high-efficiency postregulation, isolated boost, transformer-coupled higher-order converters, bridgeless isolated converters, nonisolated PFC and isolated downstream converter combination, isolated single-stage converters with energy storage on the input side, charge-pump PFC)
  - Control techniques
    - Standard average-current control
    - Boundary conduction control
    - Nonlinear carrier control
    - Inductor current control with modulated ramp
    - Voltage-follower control with distortion reduction
    - Control for fast transient response, high efficiency, or reduced component stress
- – PFC for lighting applications:
  - Fluorescent
  - LED

→ Three-phase PFC
- – Passive solutions:
  - Rectifier bridge with dc-side or ac-side inductors
  - Harmonic filter
  - Multi-pulse rectification
- – Active solutions:
  - Rectifier bridge and dc-side CCM boost converter combination
  - Boost PFC in DCM
    - Single-switch boost
      - Distortion reduction by harmonic injection
    - Two-switch zero-voltage-switching boost (»Taipei rectifier«)
    - Three-level Taipei rectifier
  - Boost PFC in CCM
    - Two-level Y and Δ converters
    - Two-level bidirectional PFC
    - Three-level PFC
      - Low-frequency (»slow-switching«) version
      - High-frequency version (»Vienna rectifier«)
        - Topologies
        - Control
  - Buck PFC
  - Four-switch buck-boost

Who should attend?

This seminar is offered to power-supply design engineers, system designers, managers, engineering students, PFC IC designers, and other professionals interested in power-factor correction and line-harmonics reduction.

Tutorials Monday, 18 May 2015, 09:00 – 17:00

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Tutorial 3

Electromagnetic Design of High Frequency Converters and Drives

Jacques Laeuffer, Dtalents, France

About the instructor

Jacques Laeuffer has 30 years of experience in the field of Power Electronics, including high frequency resonant converters, automotive drive systems for hybrid vehicles, high power drives, from 10 W up to 10 MW. He has written over 80 technical papers, and is inventor of 27 patents. »Habilité à Diriger des Recherches« (H.D.R.) by University of Paris 6, he received also the »Grand Prix de l'Innovation 2004« from PSA Peugeot Citroen. Teacher at Supelec, Ensta, Aemc, Eurosae, he is also a consultant for design of switch mode power supplies and variable speed drives, EMC and control.

Contents

- → Tutorial benefits include:
- → Design HF windings, lines, layouts to avoid noisy resonances, over voltages, extra losses
- → Discover some examples of correct and non correct designs with practical calculation
- → Choose and design E.M.C. optimized power converters (from 100 W up to 10 MW)
- → Design E.M.C. drive systems made of inverters, cables and electric machines together
- → Avoid expensive shielding and improve reliability

Main Tutorial topics include:

- → Introduction
  - – Examples of issues
  - – Electromagnetic fields actions: expected and non expected
  - – Differential mode (DM) and common mode (CM) from transistors and rectifiers
  - – Tests according standards and filters design
  - – HF oscillations inside converters; snubbers for EMC
- → Lines Design
  - – Propagation on lines. Poynting theorem
  - – Electric and magnetic energy storage
  - – Electromagnetic power flow
  - – Waves impedance and speed
  - – Design of bifilar, coaxial, and strip lines
- → Practical examples
  - – Winded Components Design
  - – Energy flow trough H.F. transformers, inductances
  - – Equivalent schematics and simulation
  - – Planar and multi-layer transformers
  - – Design for low EMI and low HF losses
- → Converters Design
  - – Global propagation in converters
  - – Semiconductors connection, SiC devices
  - – Topology choice according to requirements, electromagnetic and other constraints
  - – Design of flyback, forward, bridge, ZVS and ZCS converters
  - – Matching components and layout impedances
- → Drives Design
  - – Energy flow trough electric machines windings
  - – HF system made of inverter, cable and electric machine, as DM and CM
  - – Boundary conditions for EMC between inverters and motors windings
- → Radiations Reduction
  - – Neighbor field and far field identification
  - – Magnetic field measurement and reduction
  - – RF emissions from windings
  - – Electric field interference reduction

Who should attend?

This course is targeted towards engineers and project managers, who design, specify, integrate converters, inverters, and components, for power electronics and/or drive systems, optimized for E.M.C., global cost and reliability.

Tutorial 4

High Performance Control of Power Converters

Christian Peter Dick, Jens Onno Krah Cologne University of Applied Sciences, Germany

About the instructors

Christian P. Dick studied Electrical Engineering at RWTH Aachen University, Germany, where he also received his PhD degree. Beginning of 2011 he joined SMA Solar Technology AG as director for advance development of solar converters up to 20kW. Since end of 2011 he is professor for power electronics and electrical drives at Cologne University of Applied Science. Since years, Christian Dick is member of VDE and IEEE. His main research interests are resonant converters and the large-scale utilization of renewable energy, including automation and safety aspects.

Prof. Dr. Ing. Jens Onno Krah studied electrical engineering at the University Wuppertal and obtained his PhD 1993 by Prof. Holtz within electrical drives research. Until February 2004 he worked as technical director for Kollmorgen, formerly Seidel Servo Drives. He was responsible for the development of the Kollmorgen Servo Drives. Since March 2004 Prof. Krah teaches control engineering at the University of Applied Sciences Cologne.

Contents

Utilizing power electronic based converter technology is a key approach to build energy efficient solutions. Due to the innovation cycles of the semiconductor suppliers the size and the cost of the more and more complex inverter systems is not increasing. However, especially the new fast switching wide bandgap devices (SiC & GaN) are challenging the control hardware.
The advanced control architectures are covered by discussing algorithms and possible implementations using µC, DSP and FPGA technology. Robust controller designs with well-defined set up procedures or reliable self-tuning algorithms can help to use these innovations utilizing a reasonable set-up time.

1. Converter Design Basics
   - IGBT, MOSFET, SiC
   - 2-Quadrant Chopper
   - Buck, Flyback, resonant LLC
   - State machine based dead time generation
   - 2-Level/3-Level Inverter
   - Gate driver basics
2. Inverter Modulation Techniques
   - Single Phase Modulator
   - Pulse Width versus Pulse Frequency Modulation
   - 2-Level/3-Level SVM
3. Analog to Digital Conversion
   - Sigma-Delta DAC versus R-2R DAC and PWM
   - Sigma-Delta Modulation
   - Sinc^3 decimation filtering
   - Efficient FIR implementations
4. Current Sensing
   - Transducer versus shunt
   - Synchronous sampling
   - Aliasing, EMI suppression
5. Current Control
   - Hysteresis Control
   - Sampling Control
   - Synchronous Control (FOC): Clarke, Park, decoupling
   - Hybrid control
   - Buck, Flyback, resonant LLC
6. Model based Design
7. Current Prediction
   - Modeling the Plant
   - Smith Predictor
   - Current Observer
8. Parameter Tuning
   - Theoretical background
   - Parameter estimation
9. Conclusion and Future Trends

Who should attend?

R&D engineers and professionals, who are working in the area of IGBT and MOSFET based Inverter control who wish to learn about specific usage of digital control circuits. Basic knowledge in the area of control theory is helpful.

Tutorials Monday, 18 May 2015, 09:00 – 17:00

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Tutorial 5

Power Electronics in Renewable Energy Systems

Frede Blaabjerg, Aalborg University, Denmark

About the instructor

Professor Frede Blaabjerg, Aalborg University, Denmark was with ABB-Scandia, Randers, Denmark, from 1987 to 1988. From 1988 to 1992, he was a Ph.D. Student with Aalborg University, Aalborg, Denmark. He became an Assistant Professor in 1992, an Associate Professor in 1996, and a Full Professor of power electronics and drives in 1998. His current research interests include power electronics and its applications such as in wind turbines, PV systems, reliability, harmonics and adjustable speed drives. He has received 15 IEEE Prize Paper Awards, the IEEE PELS Distinguished Service Award in 2009, the EPE-PEMC Council Award in 2010, the IEEE William E. Newell Power Electronics Award 2014 and the Villum Kann Rasmussen Research Award 2014. He was an Editor-in-Chief of the IEEE TRANSACTIONS ON POWER ELECTRONICS from 2006 to 2012. He has been Distinguished Lecturer for the IEEE Power Electronics Society from 2005 to 2007 and for the IEEE Industry Applications Society from 2010 to 2011. He is nominated in 2014 by Thomson Reuters to be between the most 250 cited researchers in Engineering in the world.

Contents

The global electrical energy consumption is still rising and there is a steady demand to increase the power capacity. It is expected that it has to be doubled within 20 years. The production, distribution and use of the energy should be as technological efficient as possible and incentives to save energy at the end-user should also be set up. Two major technologies will play important roles to solve the future problems. One is to change the electrical power production sources from the conventional, fossil (and short term) based energy sources to renewable energy resources. Another is to use high efficient power electronics in power generation, power transmission/distribution and end-user application. This tutorial will discuss some of the most emerging renewable energy sources, wind energy and photovoltaics, which by means of power electronics are changing character from being a minor energy source to be acting as a major power source in the energy system.

Following issues will be covered:
Technology development, power converter technologies both for low power, medium power and high power, control of the different systems both single-phase and three phase, lcl-filter design, synchronization methods to the grid including PLL structures, anti-islanding detection and operation, grid codes and how to operate the different systems incl. low voltage ride through, system integration, mission profile based reliability assessment and finally discussion on future challenges.

Who should attend?

It is most for researchers and engineers who would like to learn about the basic operation and challenges of power electronic based renewable energy systems which either are connected to single-phase or three-phase systems.

Tutorial 6

Advanced Design with MOSFET and IGBT Power Modules

Tobias Reimann, ISLE Steuerungstechnik und Leistungselektronik, Germany
Thomas Basler, Infineon Technologies, Germany

About the instructors

Tobias Reimann received 1994 his PhD from the Technische Universität Ilmenau in the field of power semiconductor applications for hard and soft switching converters. In 1994 he was one of the founders of the ISLE company which is engaged in system development for power electronics and electrical drives. He is responsible for the operational business of this company. In addition, since July 2009 he is Professor for Industrial Electronics at Technische Universität Ilmenau. Prof. Reimann is a member of scientific board of »Thuringian Center of Excellence in Mobility (ThIMo)« at Technische Universität Ilmenau in the field of automotive electronics.

Thomas Basler received his Diploma in Electrical Engineering from Chemnitz University of Technology in 2009. His Diploma thesis was on the robustness of power diodes. Between 2009 and 2013 he was a member of the scientific staff at the Chair of Power Electronics and Electromagnetic Compatibility at Chemnitz University of Technology. At the beginning of 2014 he received his PhD. His thesis is about short-circuit and surge-current ruggedness of IGBTs and was supervised by Prof. Dr. Josef Lutz. 2014 he joined Infineon Technologies AG, Neubiberg, Germany, where he works on the development of IGBTs and diodes.

Contents

- → Power Devices/Modules/Reliability
  - – New Developments in MOSFETs, IGBTs, Freewheeling Diodes
  - – Module Layouts
  - – Thermal Mismatch, Thermal Stress
  - – Power Cycling Capability
  - – Design for Reliability
- → Drive and Protection
  - – Principles, Technical Realisations
  - – Failure Modes, Failure Detection
  - – Current, Voltage, Temperature Protection
- → Topology-dependent Power Losses
  - – DC/DC-Converters
  - – DC/AC-Converters
  - – Load Cycles
  - – Calculation of Heat Sink
- → Device Induced Electromagnetic Disturbance
  - – Parasitics
  - – Oscillations in Power Modules
- → Special Aspects of Application
  Consideration of Special Problems of Participants, for example:
  - – Paralleling and Series Connection, Special Effects in ZVS/ZCS Topologies
  - – Special Problems Related to New Device Technologies
  - – Short-Circuit Ruggedness of IGBTs.

Who should attend?

Engineers designing converters with IGBT- and MOSFET power modules having basic knowledge in power devices and power converters.

Tutorial 7

Switchmode Design and Layout Techniques for low EMI

Bruce Carsten, Bruce Carsten Associates, USA

About the instructor
Bruce Carsten has 45 years of experience in all aspects of the design and development of switchmode power converters, at frequencies from 20 kHz to 1 MHz and power levels from 100 mW to 25 kW. He designed and built his first transformer in 1961, and by the early 70's began designing high frequency transformers and inductors for switchmode power converters, which he found an intriguing challenge. This became a speciality which he continues to research.

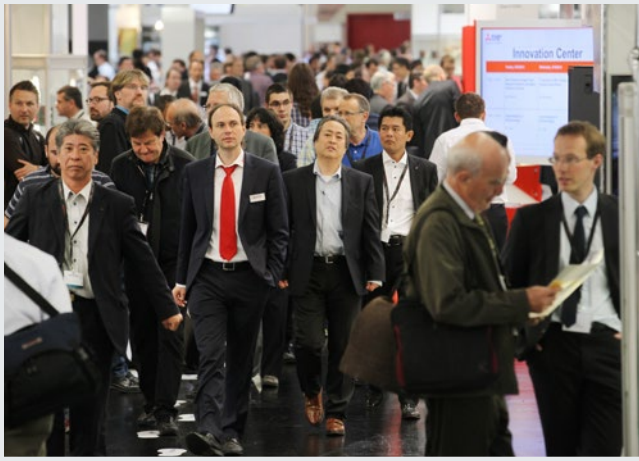
Contents

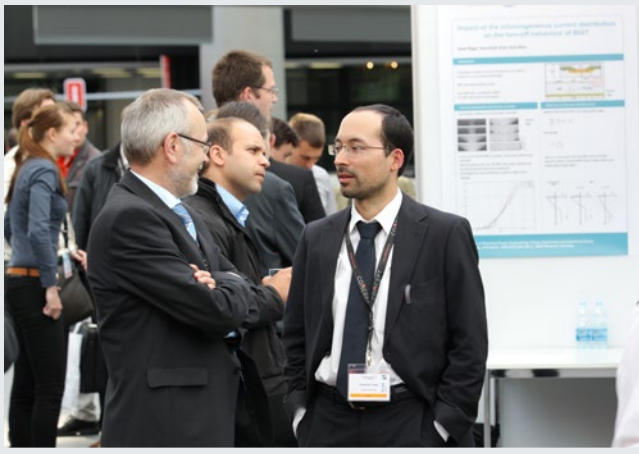
This newly revised tutorial combines much from my »classical« EMI tutorial (which has not been presented for some years) with newer material from my »PCB Layout for low EMI« seminar.
EMI is often considered to be a »black art«, but is actually simply energy coupling via changing currents and voltages. Unfortunately, parts per trillion or less of energy coupling can create EMI problems, and thus are easily overlooked as »trivial« effects by designers new to the field.
The focus of the tutorial is on developing an intuitive understanding of how EMI is generated in various parts of a switchmode converter, and how it can be minimized by design.

Topics include:

- → Introduction, and definition of terms
- → Types of EMI, and typical sources
- → Internal component parasitics affecting EMI
- → Magnetic and electric field shielding
- → Normal mode conducted noise and filtering
- → Common mode conducted noise, sources and filtering
- → Common mode currents are the principal source of radiated EMI
- → Transformer and Inductor stray fields
- → Switching waveforms and the EMI spectrum
- → PCB design and circuit layout
- → Locating EMI sources with H and E-field probes
- → Additional EMI diagnostic technique

Who should attend?
This tutorial is directed largely towards the switchmode design engineer. However, it will also be of value to engineers and technicians who need to diagnose and mitigate EMI sources in existing designs.





Tutorials Monday, 18 May 2015, 09:00 – 17:00

Venue: Arvena Park Hotel Nuremberg, Görlitzer Str. 51, 90473 Nuremberg

Tutorial 8

Reliability of IGBT Power Modules

Josef Lutz, Chemnitz University of Technology, Germany

About the instructor
Josef Lutz joined Semikron Electronics, Nuremberg, Germany in 1983. First he worked in the development of GTO Thyristors, then in the field of fast recovery diodes. He introduced the Controlled Axial Lifetime (CAL) diode. Since August 2001 he is Professor for Power Electronics and Electromagnetic Compatibility at the Chemnitz University of Technology, Germany. His main fields of research are ruggedness and reliability of power devices. He is involved in several national and international research projects regarding power cycling lifetime of IGBT modules and further reliability aspects. He is one of the authors of the book »Power Devices – Physics, Characteristics, Reliability«, published by Springer 2011.

Contents

1. Basic architecture of IGBT power modules
2. Substrates in power electronics
3. Interconnection technologies in power modules
4. Heat transport, thermal resistance, thermal impedance, cooling methods
5. Temperature determination
   – Thermocouples, IR-Cameras etc.
   – Virtual junction temperature: Definition, measurement
   – Thermal simulation
6. Fatigue processes in power modules, fatigue detection, related standardized tests
7. Power cycling as main method to determine the lifetime expectation
   – Experimental setup, test strategies
   – Standard measurements and failure criteria
   – New methods for online state-of-health analysis
8. Empirical models for lifetime prediction
   – LESIT model
   – CIPS 2008 model
   – Limits of available models
   – Special aspects with SiC devices
9. Mission profiles, superimposition of cycles, and open questions
10. Improved technologies and future trends in power module lifetime expectation
    – Diffusion sintering,
    – Diffusion soldering,
    – Cu bond wires,
    – Coated bond wires
    – Improved substrates

Who should attend?
Engineers in design of converters with IGBT modules with interest in reliability, beginners as well as experienced engineers are welcome. Focus is not on semiconductors, but on thermal problems.

Tutorial 9

IGBT Gate Drive Control- Principles, Optimization and Protection

Reinhard Herzer, Arendt Wintrich, Semikron Elektronik, Germany

About the instructors

Reinhard Herzer studied Electrical Engineering and received 1984 his PhD in the field of Microelectronics and 1992 his Habilitation in the field of Power Devices and Smart Power ICs from the Ilmenau Technical University. He joined Semikron Electronics Nuremberg, Germany in 1995 as head of the MOSFET, IGBT and IC research department. Currently he is working in the field of new power device application, the development of driver- and sensor- ICs and their implementation in new power modules and systems. Further he is Associated Professor at the Technical University of Ilmenau where he teaches and coaches students and PhD students.

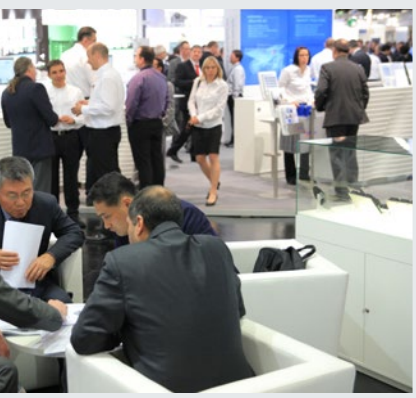
Dr. Arendt Wintrich, born in Schönebeck/Elbe, Germany, studied electrical engineering with focus on power electronics at the Technical University Chemnitz. He received his doctorate in electrical engineering with the subject »Modelling of power semiconductors«. He joined SEMIKRON in 1999 as Applications Manager focusing on customer consulting and system design. Further key activities are circuit simulation, loss and temperature calculation.

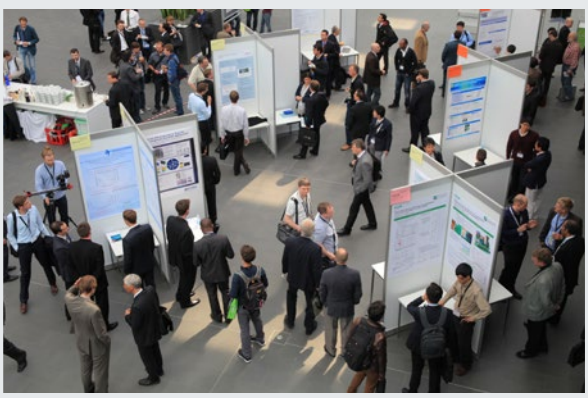
Contents

- Fundamentals
  - Power control system
  - Inverter principle, frequency inverter
  - Methods of potential separation
- Power devices
  - Physical basics, parameter and characteristics
  - Parasitics
  - Switching behaviour, switching times and losses
- Driver fundamentals
  - Gate driver topologies
  - Influence of different gate driver components on the switching behaviour
  - Transmission principles of control signal and driving energy
  - Galvanic isolation and level shift
  - Variants of power supply: DC/DC converter, bootstrap power supply, charge pump
  - Gate driving technologies and different gate driver circuits
- Protection techniques
  - Under voltage protection
  - Short pulse suppression and interlock
  - Different kinds of short circuit protection
  - Current and temperature sensing
  - Hard and soft turn-off
- Calculation and selection of drivers
  - Information and parameters, e.g. gate charge, frequency output voltage and current
  - Dimensioning of output stages
- Using IGBT drivers
  - Influence of supply voltage
  - Dimensioning and design of gate resistors
  - Gate- and Vce-Clamping
  - Connection between gate driver and IGBT module, paralleling of modules
  - Other environmental parameter with influence on switching behaviour (design parasitics)
  - Driver test
- New innovative gate driver concept- digital gate driver
  - Concept, solution, interfaces
  - Properties, advantages
- Gate driver for SiC- and GaN devices (normally-on devices)
  - Different devices, concepts and solutions
- Overview about available gate drivers
  - Hybrid drivers
  - IPMs
  - Integrated driver ICs, Single Chip Inverter

Who should attend?

Engineers using and designing drivers, converters and power electronic systems with IGBTs and MOSFETs.





Awards

Best Paper Award

The best paper of the conference will be honoured with this award presented by the conference directors. The award ceremony and speech will be part of the PCIM Europe Conference opening ceremony.

This award is sponsored by:

The nominees are:

Metastable NiSn4 in Sn-3.5Ag/ENIG joints
Sergey Belyakov, Christopher Gourlay, Imperial College London, Great Britain

End of Life Investigation on the .XT interconnect Technology
Karsten Guth, Nicolas Heuck, Christian Stahlhut, Daniel Bolowski, Christian Krasel, Sandra Krasel, Giudo Strotmann, Roland Speckels, Alexander Ciliox, Niels Oeschler, Lars Böwer, Stefan Tophinke, Infineon Technologies, Germany

Ultra Long Lifetime Energy Storage System using Flywheels and Matrix Converters
Koji Kato, Sanken Electric, Japan

Laser Cuts Increase the Reliability of Heavy-Wire Bonds and Enables On-line Process Control with Thermography
Andreas Middendorf, Technical University of Berlin, D

Cosmic Ray Failures in Power Modules – The Diode Makes the Difference
Uwe Scheuermann, Uwe Schilling, Semikron Elektronik, D

A 1000A 6.5 kV Power Module Enabled by Reverse-Conducting Trench IGBT-Technology
Dorothea Werber, Thomas Schütze, Thomas Hunger, Matthias Lassmann, Burkhard Stemmer, Frank Pfirsch, Matthias Wissen, Infineon Technologies, D; Volodymyr Komarnitskyy, Infineon Technologies, A

Young Engineer Award

Three outstanding contributions from authors not older than 35 years old will receive the »young engineer awards« which will be also honoured in the PCIM Europe Conference opening ceremony.

These awards are sponsored by:

The nominees are:

On the Five-Phase Open-End Winding drives Performance
Milan Darijevic, Liverpool John Moores University, Great Britain

DC Micro Grid Control System Based on Intelligent Power Units
Stefan Endres, Stefan Zeltner, Jens Schmenger, Fraunhofer-Institute IISB, Germany

New Approaches to Improve the Performance of Inductive Current Sensors
Stefan Hain, Mark-M. Bakran, University of Bayreuth, Germany

Investigation on Isolated Failure Mechanisms in Active Power Cycle Testing
Marion Junghänel, Jan Strobel, Uwe Scheuermann, Semikron Elektronik, Germany; Ralf Schmidt, Siemens, Germany

Circuit Mismatch and Current Coupling Effect Influence on Paralleling SiC MOSFETS in Multichip Power Modules
Helong Li, Szymon Beczkowski, Stig Munk-Nielsen, Aalborg University, Denmark

Parasitics in Power Electronic Modules – How parasitic Inductance influences Switching and how it can be minimized
Michael Meisser, Max Schmenger, Thomas Blank, Karlsruhe Institute of Technology, Germany

Design of a Highly Efficient Inductive Power Transfer (IPT) System for Low Voltage Applications
Marinus Petersen, Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, Germany

Mitigation of Current Harmonics in Inverter-Fed Permanent Magnet Synchronous Machines with Nonlinear Magnetics
Jan Richter, Thomas Lannert, Tobias Gemassmer, Martin Doppelbauer, Karlsruhe Institute of Technology, Germany

Comparison of the most efficient DC-DC Converters for Power Conversion in HVDC Grids
André Schön, Mark-M. Bakran, University of Bayreuth, Germany

Reliability Improvement of high Temperature sintered Ag Die-Attachment by adding Sub-micron SiC Particles
Hao Zhang, Katsuaki Suganuma, Shijo Nagao, Osaka University, Japan

Keynotes

Speaker: Tatsuhiko Fujihira, Fuji Electric, Japan
Chairman: Leo Lorenz, ECPE, Germany

Tuesday, 19 May 2015

The State-of-The-Art and Future Trend of Power Semiconductor Devices

Growing population and economy of this planet require us to build up a sustainable society system. In electric power conversion, more energy-saving and more resource-saving, efficient systems must be developed. Power devices are the key to develop more efficient power electronic systems. In this speech, state-of-the-art power devices, future trend, and some of their application examples to efficient power electronic systems are presented focused mainly on SiC devices and new types of Si IGBT.

Speaker: Uwe Scheuermann, Semikron Elektronik, Germany
Chairman: Josef Lutz, Chemnitz University of Technology, Germany

Wednesday, 20 May 2015

Packaging and Reliability of Power Modules – Principles, Achievements and Future Challenges

A review of fundamental design principles for power modules shows, that module design is always a compromise between conflicting requirements. Nevertheless has the progress in interconnection technologies resulted in a considerable enhancement of module lifetime, allowing to extend the maximum junction temperatures to 200°C. However, this achievement is restricted to degradation phenomena, while reliability also has to take into account early life failures and random failures. Besides other challenges from new semiconductor materials, the consideration of all failure modes by better lifetime models will be an important task for the future.

Speaker: Daniel Chatroux, CEA-LITEN, France
Chairman: Jean-Paul Beaudet, Schneider Electric, France

Thursday, 21 May 2015

Electrochemical Battery Managements and Applications

Due to nomad applications the electrochemical energy storage in batteries is an important research and development domain with rapid progress. This keynote presents the different batteries technologies, the main applications and markets, the important differences between Lithium ion batteries and the other technologies, and the impacts on battery design and management. A focus is done on the batteries requirements for electric vehicle and plug-in hybrid, the impact on the battery pack design, performances and cost of ownership, and the challenges in this domain.

Conference Tuesday, 19 May 2015, Morning und Afternoon Oral Sessions

Room Brüssel
09:00

Conference Opening/ Young Engineer Award/ Best Paper Award

Prof. Leo Lorenz warmly welcomes you to the PCIM Europe 2015 international exhibition and conference. The PCIM Europe conference is one of the most leading conferences, addressing the fields of power electronics and its applications in intelligent motion, renewable energy and energy management.

This years' conference program is more comprehensive than ever before and presents a high diversity on the latest technological trends and developments in power electronic components and systems.

The highlights include, amongst others, three keynote speeches, five special sessions and in addition 29 oral sessions as well as two poster sessions. During the conference opening the Young Engineer and Best Paper award ceremony takes place and the winners will be honoured.

More information about the awards on page 24.

Room Brüssel
09:45

KEYNOTE: The State-of-The-Art and Future Trend of Power Semiconductor Devices

Speaker: Speaker: Tatsuhiko Fujihira, Fuji Electric, Japan
Chairman: Leo Lorenz, ECPE, D

More information on page 25.

10:30 Coffee Break

Room Brüssel

Materials

Chairman: Stefan Linder, Alpiq, CH

11:00
Metastable NiSn4 in Sn-3.5Ag/ENIG joints
Sergey Belyakov, Christopher Gourlay, Imperial College London, GB

11:30
End of Life Investigation on the .XT interconnect Technology
Karsten Guth, Nicolas Heuck, Christian Stahlhut, Daniel Bolowski, Krasel Christian, Sandra Krasel, Giudo Strotmann, Roland Speckels, Alexander Ciliox, Niels Oeschler, Lars Böwer, Stefan Tophinke, Infineon Technologies, D

12:00
Reliability Improvement of high Temperature sintered Ag Die-Attachment by adding Sub-micron SiC Particles
Hao Zhang, Katsuaki Suganuma, Shijo Nagao, Osaka University, J

12:30
Development of direct bonded aluminum Substrates with sintered Ag Layer for SiC Power Modules
Shuji Nishimoto, Yoshiyuki Nagatomo, Toshiyuki Nagase, Mitsubishi Materials Corporation, J

Room München 1

SiC High Power

Chairman: Gourab Majumdar, Mitsubishi Electric Corporation, J

11:00
New Generation 10kV SiC Power MOSFET and Diodes for Industrial Applications
Jeffrey Casady, Cree, USA

11:30
Embedded very fast switching Module for SiC Power MOSEFTs
Eckart Hoene, Oleg Zeiter, Fraunhofer-Institute IZM, D; Gudrun Feix, Technical University of Berlin, D; Kristian Pedersen, Aalborg University, DK

12:00
Demonstration of a Medium Voltage Converter with High Voltage SiC Devices and Future Fields of Application
Jürgen Thoma, Dirk Kranzer, Fraunhofer-Institute for Solar Energy Systems ISE, D

12:30
Freewheeling Diode-Less SiC-Inverter with Fast Short-Circuit Protection for Industrial Applications
Takashi Ishigaki, Hiroshi Kageyama, Akio Shima, Digh Hisamoto, Hitachi, J; Kiyotaka Tomiyama, Yasushi Sasaki, Satoshi Ibori, Hitachi Industrial Equipment Systems, J

13:00 Ground Floor Lunch Break

Room Brüssel

High Power Low Inductive

Chairman: Josef Lutz, Technical University of Chemnitz, D

14:00
High voltage Module with low internal Inductance for next Chip Generation – next High Power Density Dual (nHPD2)
Daisuke Kawase, Masamitsu Inaba, Hitachi Power Semiconductor Device, J ; Keisuke Horiuchi, Hitachi Research Laboratory, J; Katsuaki Saito, Hitachi Europe Power Device Division, GB

14:30
LinPak, a new low inductive Phase-Leg IGBT Module with easy paralleling for high Power density Converter Designs
Raffael Schnell, Samuel Hartmann, Dominik Trüssel, Munaf Rahimo, ABB Switzerland, CH

15:00
New 4.5kV IGBT Module with Low Power Loss and High Current Ratings
Tatsuya Matsumoto, Ryoichi Suzuki, Takahiro Saiki, Yoshihiko Koike, Hitachi Power Semiconductor Device, J; Keisuke Horiuchi, Hitachi Laboratory, J

Room München 1

Reliability Monitoring

Chairman: Uwe Scheuermann, Semikron Elektronik, D

14:00
Indirect Measurement of Junction Temperature for Condition Monitoring of Power Semiconductor Devices during Operation
Bastian Strauß, Andreas Lindemann, Otto-von-Guericke-University of Magdeburg, D

14:30
Using the Zth(t) – Power Pulse Measurement to detect a Degradation in the Module Structure
Sebastian Hiller, Josef Lutz, Menia Beier-Möbius, Technical University of Chemnitz, D

15:00
Investigation on Isolated Failure Mechanisms in Active Power Cycle Testing
Marion Junghänel, Jan Strobel, Uwe Scheuermann, Semikron Elektronik, D; Ralf Schmidt, Siemens, D

15:30 Coffee Break

15:30 – 17:00 Foyer Ground Floor Entrance NCC Mitte **Poster/Dialogue Session** (More information on page 26/27)

17:15 NCC Ost Ebene 1 **Exhibition Party**

Room Athen

Control and Drive Strategies in Power Converters I

Chairman: Hubert Schierling, Siemens, D

11:00

DC Micro Grid Control System Based on Intelligent Power Units
Stefan Endres, Stefan Zeltner, Jens Schmenger, Fraunhofer-Institute IISB, D

11:30

Using the on-state-Vbe Sat-Voltage for Temperature Estimation of SiC-BJTs during normal Operation
Sophia Frankeser, Peter Steinhorst, Christian Herold, Sebastian Hiller, Josef Lutz, Technical University of Chemnitz, D

12:00

Robustness of Level Shifter Gate Driver ICs concerning Negative Voltages
Jinsheng Song, Wolfgang Frank, Infineon Technologies, D

12:30

Control Method for a Reverse Conducting IGBT
Daniel Domes, Infineon Technologies, D

Room Mailand

SPECIAL SESSION Solar Inverter Topologies

Chairman: Philippe Ladoux, University of Toulouse, F

11:00

Characterization of 1.2kV Silicon Carbide (SiC) semi-conductors in hard switching mode for three-phase Current Source Inverter (CSI) prototyping in solar applications
Catellani Stéphane, Anthony Bier, Martin Jérémy, Alves-Rodrigues Luis Gabriel, Barruel Franck, Commissariat of Atomic Energy and Alternative Energies, F

11:30

Future Challenges of Power Electronics for PV-Inverters
Jens Friebe, Mike Meinhardt, SMA Solar Technology, D

12:00

A Five-Level NPC Photovoltaic Inverter with Active Balanced Capacitive Voltage Divider
Alfred Rufer, Industrial Electronics Laboratory EPFL Lausanne, CH

12:30

Single-Phase MISO HF-link Isolated Grid-Connected Inverter for Renewable Energy Sources Applications
Alejandro Aganza Torres, Victor Cárdenas, University de San Luis Potosí, MX; Jose Mario Pacas, University of Siegen, D

Room München 2

SPECIAL SESSION Passive Components

Chairmen: Petar Grbovic, Huawei Technologies, D and Wolfram Teppan, LEM SA, CH

11:00

Simulating Saturation Behavior of Common Mode Chokes
Jörn Schliewe, Martin Neudecker, Stefan Weber, EPCOS, D

11:30

Reducing Inductor Size in High Frequency Grid Feeding Inverters
Stefan Hoffmann, Eckart Hoene, Oleg Zeiter, Gudrun Feix, Fraunhofer-Institute IZM, D; Klaus-Dieter Lang, Technical University of Berlin, D

12:00

Special Session: Advanced compact medium frequency Transformers
Dennis Kampen, BLOCK Transformatoren-Elektronik, D

12:30

Special Session: Actual and Future Developments of Nanocrystalline Magnetic Materials for Common Mode Chokes and Transformers
Holger Schwenk, Vacuumschmelze, D

Room Athen

New and Renewable Energy Systems

Chairman: Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, D

14:00

Three-Phase Three-level Novel AC Boost Rectifier dedicated to adjustable Speed Generation System PERFECTGEN
Tomasz Balkowiec, Wlodzimierz Koczara, Warsaw University of Technology, PL

14:30

Control and Modeling of a novel speed-variable Generator System for hydroelectric Power Plants
Mingjia Zhang, University of Applied Sciences Hannover, D

15:00

Smart Inverters for Utility and Industry Applications
Yaosuo Xue, Siemens, USA; Sebastian Nielebock, Johannes Nierwetberg, Siemens, D

Room Mailand

Control Techniques in Intelligent Motion Systems

Chairman : Jose Mario Pacas, University of Siegen, D

14:00

Evaluation of Multi-Axis Control Systems
Onno Martens, Jan Klöck, Walter Schumacher, Technical University of Braunschweig, D

14:30

Carrier Signal based Sensorless Control of Wound Field Synchronous Machines Using the Rotor Winding as the receiver: Rotating vs. Alternating Carrier Signal
Alexander Rambetius, Bernhard Piepenbreier, Friedrich-Alexander-University of Erlangen, D

15:00

A novel Concept for distributed Low-Power-Drives in multidirectional Conveyor Matrix
Matthias Thesseling, David Kimmerle, Heiko Stichweh, Lenze SE, D

Room München 2

SPECIAL SESSION Digital Control Power – the Future of Power Electronics

Chairman: Manfred Schlenk, Infineon, D

14:00

Software defined digital Power Conversion in medium to low Power AC/DC SMPS Applications
Marc Fahlenkamp, Infineon Technologies, D

14:30

Today's Relevance of Digital Control in Server- and Telecom Power Supplies
Frank Schafmeister, Heiko Figge, Tobias Grote, Delta Energy Systems, D

15:00

Digital Power Conversion: Easy, flexible and efficient Way to decrease BOM Complexity and Increase
Ales Loidl, STMicroelectronics, CZ

Conference Tuesday, 19 May 2015, Poster Dialogue Session

15:30 – 17:00, Foyer Ground Floor Entrance NCC Mitte

High Power Semiconductors

Chairman: Katsuaki Saito, Hitachi Europe, GB

PP001 **A New and Innovative Gate Charge Measurement Technique**
Hisao Kakitani, Atsushi Mikata, Ryo Takeda, Keysight Technologies International, J; Stewart Wilson, Keysight Technologies, GB

PP002 **New Low Loss Thyristor for HVDC Transmission**
Jan Vobecky, Virgiliu Botan, Karlheinz Stiegler, Urban Meier, ABB Switzerland Semiconductors, CH, Marco Bellini, ABB Corporate Research, D

PP003 **Dynamic Avalanche in High Voltage Diodes during Short Circuit III**
Jan Fuhrmann, University of Rostock, D

PP004 **Advantages of High Power Fast Thyristors and Diodes Produced by Means of Low Temperature Sintering of Silver Paste**
Dmitriy Titushkin, JSC Proton-Electrotex, RUS

PP005 **Impact of the dynamic Avalanche on the electrical Behavior of HV-IGBTs**
Patrick Münster, Hans-Guenter Eckel, Daniel Wigger, University of Rostock, D

PP006 **Evidence of Turn-off Gate Voltage Oscillations during Short Circuit of Commercial 1.7 kV/1 kA IGBT Power Modules**
Paula Diaz Reigosa, Frede Blaabjerg, Rui Wu, Francesco Iannuzzo, Aalborg University, DK

PP007 **On-Wafer high Voltage discrete Device Capacitance Characterization for Parameter Extraction of physically Scalable electro-thermal SPICE Models**
Mehrdad Baghaie Yazdi, James Victory, Thomas Neyer, Fairchild Semiconductor, D

PP008 **State of the Art of Bipolar Semiconductors for Very High Power Applications**
Mario Schenk, Jens Przybilla, Uwe Kellner-Werdehausen, Reiner Barthelmess, Infineon Technologies Bipolar, D; Jörg Dorn, Günter Sachs, Markus Uder, Stefan Völkel, Siemens, D

PP009 **Potential of RC-IGBTs in Three Phase Three Level Converters**
Sidney Gierschner, Hans-Günter Eckel, University of Rostock, D; Marc Hiller, Siemens, D

MOSFET and IGBTs

Chairman: Joel Turchi, On Semiconductor, F

PP010 **HV Power MOSFETs working in Linear Zone: Performances comparison between standard Planar and SJ devices**
Giuseppe Consentino, STMicroelectronics, I

PP011 **Theoretical Loss Analysis of Power Converters with 1200 V Class Si-IGBT and SiC-MOSFET**
Akira Nakajima, Shin-ichi Nishizawa, Hiromichi Ohashi, National Institute of Advanced Industrial Science and Technology, J; Wataru Saito, Toshiba Corporation, J

PP012 **Design Considerations to Increase Power Density in induction cooking Applications using the new Field stop II Technology IGBT**
Vittorio Crisafulli, Marco Antretter, ON Semiconductor, D

PP013 **A comprehensive Study of current Conduction during the Breakdown of Floating Field Ring terminations at arbitrary current Levels**
Paolo Mirone, Luca Maresca, Michele Riccio, Giuseppe De Falco, Gianpaolo Romano, Andrea Irace, Giovanni Breglio, University of Naples »Federico II«, I

PP014 **High Efficient Super Junction MOSFET Intelligent Power Module**
Yuji Ishimatsu, Motohiro Ando, Nobuhiro Hase, Kazuhide Ino, ROHM, J

GaN Devices

Chairman: Romeo Letor, STMicroelectronics, I

PP015 **Comparing Switching Performance of Gallium Nitrid HEMT and Silicon Power MOSFET**
Jennifer Lautner, Bernhard Piepenbreier, Friedrich-Alexander-University of Erlangen, D

PP016 **Monolithic GaN Integration for Higher DC-DC Efficiency and Power Density**
David Reusch, Efficient Power Conversion (EPC), USA

PP017 **Development of 650V Cascode GaN Technology**
Charlie Liu, ON Semiconductor, USA

PP018 **Switching Characteristics of Cascode GaN Switches**
Wenduo Liu, Haihua Zhou, Eric Persson, International Rectifier and Infineon Technologies Company, USA

PP019 **A new Method for Dynamic Ron Extraction of GaN Power HEMTs**
Nasser Badawi, Jan Böcker, Dieckerhoff, Sibylle, Technical University of Berlin, D

PP020 **1 kW LLC Resonant Converter with HV GaN Switches**
Adam Vasicek, ON Semiconductor, CZ

SiC Devices and Modules

Chairman: Andreas Lindemann, Otto-von-Guericke-University Magdeburg, D

PP021 **A New Analog Behavioral Spice Macro Model with thermal and self-heating Effects for Silicon Carbide Power MOSFETs**
Gaetano Bazzano, Daniela Cavallaro, Rosario Greco, Alessandra Raffa, Pier Paolo Veneziano, STMicroelectronics, I

PP022 **High Density and High Power Single-Stage LED Driver with 1200V Silicon Carbide MOSFET**
Jimmy Liu, Adam Barkley, Marcelo Schupbach, John Mookken, Cree, USA

PP023 **Analysis of SiC-MOSFETs Utilized in Hard Switching Inverter Topologies with Switching Frequencies up to 1 MHz**
Sebastian Fahlbusch, Ulf Müter, Klaus F. Hoffmann, Helmut Schmidt University, D

PP024 **Snubber circuit to suppress the voltage ringing for SiC device**
Motonobu Joko, Akiko Goto, Maki Hasegawa, Satoshi Miyahara, Haruk Murakami, Mitsubishi Electric Corporation, J

PP025 **Improving the Efficiency of a Class-D Audio Power Stage**
Verena Grifone Fuchs, Carsten Wegner, Dietmar Ehrhardt, University of Siegen, D

PP026 **Thermal Limits of the Blocking Stability of Silicon Carbide Schottky Diodes**
Christian Bödeker, Timo Vogt, Nando Kaminski, University of Bremen, D

PP027 **Towards high Power Ratings: Prospects and Challenges of SiC Technology**
Christian Nöding, Mehmet Kazanbas, Samuel Araujo, Peter Zacharias, University of Kassel, D

PP028 **Evaluation of the need for SiC SBD in parallel with SiC Mosfets in a Module Phase Leg Configuration**
Serge Bontemps, Pierre-Laurent Doumergue, Anthony Basler, Microsemi Power Module Products SAS, F

PP029 **Latest 1,700V SiC MOSFET vs. Advanced Silicon Technology in Auxiliary Power Supply**
Filippo Scrimizzi, Luigi Abbatelli, Michele Macauda, Giuseppe Catalisano, STMicroelectronics, I

PP030 **Circuit Mismatch and Current Coupling Effect Influence on Paralleling SiC MOSFETS in Multichip Power Modules**
Helong Li, Szymon Beczkowski, Stig Munk-Nielsen, Aalborg University, DK

PP031 **Comparison of drivers for SiC-BJTs, Si-IGBTs and SiC-MOSFETs**
Sophia Frankeser, Hani Muhsen, Josef Lutz, Technical University of Chemnitz, D

PP032 **An approach to lifetime Estimation of SiC MOSFETs subjected to thermal Stress induced by fast load Cycling**
Roel Ten Have, Prodrive Technologies, NL

PP033 **Analysis of Reverse-Recovery Behaviour of SiC MOSFET Body-Diode regarding Dead Time**
Roman Horff, Andreas März, Mark-M. Bakran, University of Bayreuth, D

PP034 **A bidirectional single-stage Three-Phase AC/DC Converter with High-Frequency Isolation and PFC**
Demercil Oliveira. Jr., Bruno R. de Almeida, Federal University of Ceara, BR

PP035 **High Frequency SiC Majority Carrier Modules**
John Waldron, Vic Temple, James Azotea, Silicon Power, USA

Power Modules

Chairman: Eric Carroll, EIC Consultancy, F

PP036 **New standard 800A/750V IGBT Module technology for Automotive Applications**
Keiichi Higuchi, Takahiro Koyama, Akio Kitamura, Fuji Electric, J

PP037 **A New IGBT Module with Insulated Metal Baseplate (IMB) and 7th Generation Chips**
Kota Ohara, Mitsubishi Electric Corporation Power Device Works, J

PP038 **New Transfer-Molded SLIMDIP for white goods using thin RC-IGBT with a CSTBT Structure**
Shogo Shibata, Masahiro Kato, Hongbo Zhang, Mitsubishi Electric Corporation, J

PP039 **Compact Power Module for Integrated Traction Inverters with Highest Power Density**
Ole Mühlfeld, Lars Paulsen, Klaus Olesen, Rüdiger Bredtmann, Danfoss Silicon Power, D

PP040 **1700V Hybrid Module with Si-IGBT and SiC-SBD for High Efficiency AC690V Application**
Taku Takaku, Seiki Igarashi, Takashi Nishimura, Shuji Miyashitai, Naoto Fujishima, Osamu Ikawa, Fuji Electric Corporation, J; Thomas Heinzel, Naoto Fujishima, Fuji Electric Europe, D

PP041 **Power Module Boasts highest Power Density in its Class**
Jan Baumann, Exar, D; Alan Elbanhawy, Exar Corporation, USA

PP042 **Aspects of increased power Density with the new 5th Generation IGBT demonstrated with Application relevant Measurements**
Raghavan Nagarajan, Dirk Brieke, Infineon Technologies, D

PP043 **Converter Power Density Increase using Low Inductive Integrated DC-Link Capacitor/Bus**
Ionut Trintis, Stig Munk-Nielsen, Aalborg University, DK; Bjørn Rannestad, KK Wind Solutions, DK; Toke Franke, Danfoss Silicon Power, D

PP044 **Analysis of a High Power Low Voltage NPC Converter for Wind Turbines – Influence of Mechanical Design on Performance**
Berthold Benkendorff, Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, D

Cooling

Chairman: Serge Bontemps, Microsemi PMP Europe, F

PP045 **Integrated Liquid Cooling Automotive IGBT Module for High Temperatures Coolant Application**
Yangang Wang, Dynex Semiconductor, GB

PP046 **Advanced Features in Sophisticated Inverter Design Supporting MW-Applications**
Stefan Schmies, Peter Lahl, Karsten Schoo, Martin Schulz, Infineon Technologies, D

PP047 **Dual-sided Cooling for Automotive Inverters – Practical Implementation with COOLiR2Bridge® Module**
Jacek Marcinkowski, International Rectifier and Infineon Technologies Company, USA

PP048 **Dual side cooling Package DSOP Advance: Thermal conductance innovation for Power-MOSFET**
Hajime Takagi, Toshiba, J

PP049 **New IGBT Power Module Concept for Wind Power Application in NPC Topology with Enhanced Reliability**
Kevin Lenz, Jacek Rudzki, Frank Osterwald, Danfoss Silicon Power, D; Max Poech, Fraunhofer-Institute ISIT, D; Martin Becker, University of Applied Sciences Kiel, D

PP050 **Ultra-compact SiC Power Module with sintered DCB on Micro-Channel Cooler**
Sebastian Liebig, Liebherr Elektronik, D; Kai Kriegel, Karl Weidner, Siemens, D

PP051 **A 50 kW SiC Three-Phase AC-DC Converter Design for High Temperature Operation**
Christina DiMarino, Yiying Yao, Milisav Danilovic, Wenli Zhang, Zhiyu Shen, Dushan Boroyevich, Rolando Burgos, Khai Ngo, Virginia Tech, USA; Zheng Chen, Halliburton Energy Systems, USA; Ruxi Wang, GE Global Research Center, USA; Paolo Mattavelli, University of Padova, I; Kaushik Rajashekara, University of Texas, USA

PP052 **Introduction of Short Circuit Protection Design for DIPIPM**
Hongguang Huang, Hongtao He, Gaosheng Song, Xiaoling Wang, Mitsubishi Electric & Electronics, CN

PP053 **Sn+ Heat-Spring® Solder TIMs for Superior Thermal Management in IGBT Power Modules**
Graham Wilson, Bob Jarrett, Indium Corporation, USA

PP054 **HydroSink™: a smart and more efficient Way to cool Power Electronics**
Andrea Meo, Andrea Sce, Aavid Thermalloy, I

Reliability

Chairman: Marco Liserre, Christian-Albrechts-University of Kiel, D

PP055 **Active Power Cycling Results using Copper Tin TLPB Joints as new Die-attach Technology**
Christian Ehrhardt, Matthias Hutter, Constanze Weber, Fraunhofer-Institute IZM, D; Klaus-Dieter Lang, Technical University of Berlin, D

PP056 **Thick Printed Copper as Highly Reliable Substrate Technology for Power Electronics**
Melanie Bawohl, Mark Challingsworth, Michael Choisi, Virginia Garcia, Matthias Gaul, Paul Gundel, Knuth Kersken, Christina Modes, Ilias Nikolaidis, Ryan Persons, Jessica Reitz, Caitlin Shahbazi, Heraeus Precious Metals, D

PP057 **Mission-specific Aging of Power Modules**
Markus Öttl, University of Applied Sciences Vorarlberg, A

PP058 **High Temperature Reliability of Power Module Substrates**
Dean Hamilton, University of Warwick, GB

PP059 **Characterization and Reliability of Paste based Thin-Film Sn-Cu TLPS Joints for High Temperature Power Electronics**
Aarief Syed, Friedrich-Alexander-University of Erlangen, D

PP060 **Correlating NTC-Reading and Chip-Temperature in Power Electronic Modules**
Martin Schulz, Infineon Technologies, D; Xin Ma, Infineon Technologies, CN

PP061 **Thermal Impedance: Computing the Necessary Number of Parameters for Rapid and Accurate Temperature Calculations**
Jimmy Alexander Butrón Ccoa, Gerhard Mitic, Siemens, D; Solutions and Services, Andreas Lindemann, Otto-von-Guericke-University of Magdeburg, D

PP062 **Correlation between Chip Metallization Properties and the Mechanical Stability of Heavy Cu Wire Bonds**
David Gross, Sabine Haag, Manfred Reinold, Robert Bosch, D; Martin Schneider-Ramelow, Klaus-Dieter Lang, Fraunhofer-Institute IZM, D

PP063 **Laser Impulse Metal Bonding with temporal Power Modulation**
Simon Britten, Stephan Wein, Benjamin Mehlmann, Alexander Olowinsky, Arnold Gillner, Fraunhofer-Institute ILT, D

PP064 **Laser Cuts Increase the Reliability of Heavy-Wire Bonds and Enables On-line Process Control with Thermography**
Andreas Middendorf, Technical University of Berlin, D

PP065 **InFORMS® vs Trimmed Wirebonds for Improved Reliability to Achieve Uniform Bondline Control between AlN Substrate & AlSiC Baseplate**
Karthik Vijay, Indium Corporation, GB; Liam Mills, Semelab, GB

PP066 **First Fault-Resilient High-Power 5-Level Flying Capacitor DC-DC Converter with Ideal Short-On Failure IGBT Modules**
Michael Gleißner, Mark-M. Bakran, University of Bayreuth, D; Jacek Marcinkowski, International Rectifier and Infineon Technologies Company, USA

Gate Drive Units

Chairman: Silvio Colombi, General Electric, CH

PP067 **Design and Evaluation of Gate Drivers of SiC MOSFET**
Hani Muhsen, Josef Lutz, Sebastian Hiller, Technical University of Chemnitz, D

PP068 **Gate Drive Optocoupler Provides Robust Insulation in IGBT Destructive Tests**
Vladan Mitov, Avago Technologies, D, Chun Keong Tee, Avago Technologies, SN

PP069 **EMI Reduction for Smart Power Switches by Iterative Tracking of a Gaussian-shape Switching Transition**
Mathias Blank, Tobias Glück, Andreas Kugi, Vienna University of Technology, A; Hans-Peter Kreuter, Infineon Technologies Austria, A

PP070 **Analysis of the Switching Behaviour of 650 V GaN Semiconductors and Design of a Two-Step Gate Voltage Driver**
Stephan Brüske, Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, D

PP071 **Slew Rate Control of discrete IGBT and CoolMOS reaches Targets far beyond the Gate Resistor Regime**
Wolfgang Frank, Infineon Technologies, D

PP072 **High-Side Driving under High-Switching Speed: Technical Challenges and Testing Methods**
Mehmet Kazanbas, Andressa Schittler, Samuel Araujo, Peter Zacharias, University of Kassel, D

PP073 **Operation and Control of a Three-Level Medium-Voltage NPC Inverter with TI F28M35 Microcontroller**
Wilfried Holzke, Johannes Adler, University of Bremen, D; Willi Paasch, Breuer-Motoren, D; Bernd Orlik, Institute for Electrical Drives, D

Conference Wednesday, 20 May 2015, Morning und Afternoon Oral Sessions

Room Brüssel 1

08:45

KEYNOTE:
Packaging and Reliability of Power Modules – Principles, Achievements and Future Challenges

Speaker: Uwe Scheuermann, Semikron Elektronik, D
Chairman: Josef Lutz, Technical University of Chemnitz, D

More information on page 25.

09:30 Coffee Break

Room Brüssel

SPECIAL SESSION
Power GaN for Automotive Applications

Chairman: Achim Scharf, Techmedia International, D

10:00
Enhancement-Mode Gallium Nitride Transistors in Automotive Applications
Alexander Lidow, Efficient Power Conversion Corporation, USA

10:30
Progress of GaN Transistors for Automotive Applications
Yifeng Wu, Transphorm, USA

11:00
The Automotive Market Opportunity for GaN
Girvan Patterson, GaN Systems, CA

11:30
GaN on Silicon Based Power Conversion for Automotive Applications: Progress and Potential
Tim McDonald, International Rectifier and Infineon Technologies Company, USA

Room München 1

HV-IGBT

Chairman: Yasukazu Seki, Fuji Electric, J

10:00
A 1000A 6.5 kV Power Module Enabled by Reverse-Conducting Trench-IGBT-Technology
Dorothea Werber, Thomas Schütze, Thomas Hunger, Matthias Lassmann, Burkhard Stemmer, Frank Pfirsch, Matthias Wissen, Infineon Technologies, D; Volodymyr Komarnitskyy, Infineon Technologies Austria, A

10:30
The new high Power Density 7th Generation IGBT Module for compact Power Conversion Systems
Thomas Heinzel, Fuji Electric Europe, D; Junya Kawabata, Yoshiyuki Kusunoki, Yuichi Onozawa, Yoshitaka Nishimura, Yasuyuki Kobayashi, Osamu Ikawa, Fuji Electric, J

11:00
The Automotive Market Opportunity for GRobust HVIGBT Module Design against high Humidity
Nobuhiko Tanaka, Yasuhiro Sakai, Kenji Ota, Shinichi Iura, Yasutaka Kusakabe, Keiichi Nakamura, Mitsubishi Electric Corporation, J; Eugen Wiesner, Eckhard Thal, Mitsubishi Electric Europe, D

11:30
Electrical performance of a low inductive 3.3kV half-bridge IGBT Module
Sven S. Buchholz, Thomas Schütze, Infineon Technologies, D

12:00
The Cross Switch "XS" Silicon and Silicon Carbide Hybrid Concept
Munaf Rahimo, ABB Switzerland – Semiconductors, CH

12:00 Ground Floor Lunch Break

Room Brüssel

GaN

Chairman: Werner Berns, Texas Instruments, D

14:00
Large Area Embedded GaN Power Transistors
Girvan Patterson, John Roberts, Lyubov Yushyna, Larry Spaziani, GaN Systems, CA

14:30
Design and Implementation of a High-efficiency Three-level Inverter Using GaN HEMTs
Jim Honea, Zhan Wang, Yifeng Wu, Transphorm, USA

15:00
Controllability and Optimization of Reverse Recovery for GaN Devices in Hard Switching Applications
David Sheridan, Dong Young Lee, Charles Coleman, Jian Yang, RFMD, USA

Room München 1

Robustness

Chairman: Nando Kaminski, University of Bremen, D

14:00
Cosmic Ray Failures in Power Modules – The Diode Makes the Difference
Uwe Scheuermann, Uwe Schilling, Semikron Elektronik, D

14:30
Surge Current Behaviour of Different IGBT Designs
Jens Kowalsky, Josef Lutz, Thomas Basler, Riteshkumar Bhojani, Technical University of Chemnitz, D

15:00
Are Sic Power Mosfets more robust of standard silicon Devices when subjected to tertrestrial Neutrons?
Giuseppe Consentino, Marc Laudani, Giovanni Privitera, STMicroelectronics, I; Calogero Pace, Carlo Giordano, Jorge Hernandez, University of Calabria, I

15:30 Coffee Break

15:30 – 17:00 Foyer Ground Floor Entrance NCC Mitte **Poster/Dialogue Session** (More information on page 30/31)

Room Athen

DC/DC Converters

Chairman: Stéphane Lefebvre, Satie, F

10:00
Constraints replacing IGBTs with SiC MOSEFTs in an on-board Railway Power Supply
Andreas März, Roman Horff, Mark-M. Bakran, University of Bayreuth, D; Martin Helsper, Niklas Rüger, Siemens, D

10:30
High Efficiency Bidirectional DC-DC Converter with Wide Input and Output Voltage Ranges for Battery Systems
Zhe Yu, Holger Kapels, Fraunhofer-Institute ISIT, D; Klaus F. Hoffmann, Helmut Schmidt University, D

11:00
1 High Power Fully Regulated Eighth-brick DC-DC Converter with GaN FETs
John Glaser, Johan Strydom, David Reusch, Efficient Power Conversion Corporation, USA

11:30
An Experimental Study of a Zero Voltage Switching SiC Boost Converter with an Active Snubber Network
Michael Ebli, Michael Engel, Martin Pfost, University of Reutlingen, D

12:00
A 3.6kW Efficiency and Switching Frequency Improved DC- DC-Converter Design with Optimized Mounting and Interconnect Technology
Martin Kilian, Joachim Joos, Bernhard Wicht, Robert Bosch, D

Room Mailand

Advanced Packaging

Chairman: Reinhold Bayerer, Infineon Technologies, D

10:00
Anti-crack of multichip Module Package on mounting by improved Properties of EMC (Epoxy molding compound) and DCB (Direct copper bonding)
Dongwook Kang, Jun-hee Park, KCC Corporation, ROK

10:30
Bonding technology for High Operation Temperature Power Semiconductor Module
Tatsunori Yanagimoto, Yasunari Hino, Daisuke Kawabata, Koichi Tokubo, Kenta Nakahara, Shingo Sudo, Takeshi Araki, Mitsubishi Electric Corporation, J

11:00
Power-Module Optimizations for fast Switching – a comprehensive Study
Christian Müller, Stefan Buschhorn, Infineon Technologies, D

11:30
Double Sided Cooled Module Concept for High Power Density in HEV Applications
Andreas Grassmann, Infineon Technologies, D

Room München 2

Control and Drive Strategies in Power Converters II

Chairman: Klaus Marahrens, Sew-Eurodrive, D

10:00
Hybrid Control System for large Arrays of Transformer-Coupled Zero Voltage Switching Buck-Boost DC-DC Converters
Joseph Aguilar, Xiaoyan Yu, Vicor Corporation, USA

10:30
A novel 1200 V High Voltage Integrated Circuit with High-side fault Protection and reverse Level Shifter
Yo Habu, Manabu Yoshino, Takanobu Takeuchi, Masahiro Yamamoto, Mitsutaka Hano, Mitsubishi Electric Corporation, J; Marco Honsberg, Mitsubishi Electric, D; John Donlon, Powerex, USA

11:00
Sigma-Delta-Conversion Used for Motor Control
Jens Sorensen, Analog Devices, USA

11:30
A New Simplified Space Vector PWM Scheme for Two-Level Voltage Source Inverter
Hani Muhsen, Sebastian Hiller, Technical University of Chemnitz, D

Room Athen

Power Electronics in Transmission Systems

Chairman: Peter Steimer, ABB Schweiz, CH

14:00
Comparison of the most efficient DC-DC Converters for Power Conversion in HVDC Grids
André Schön, Mark-M. Bakran, University of Bayreuth, D

14:30
A Novel Current-Injection Based Design for HVDC Circuit Breakers
Rene Sander, Michael Suriyah-Jaya, Thomas Leibfried, Karlsruhe Institute of Technology, D

15:00
Optimized Power Semiconductors for the Power Electronics Based HVDC Breaker Application
Liutauras Storasta, ABB Switzerland – Semiconductors, CH

Room Mailand

Applications for Drives & Motion Control

Chairman: Manfred Schrödl, Vienna University of Technology, A

14:00
Measurement Results of a 22 kW Bidirectional Inductive Charger
Benriah Goeldi, Johannes Tritschler, Stefan Reichert, Fraunhofer-Institute ISE, D

14:30
Operating Performance of the Modular Multilevel Matrix Converter in Drive Applications
Felix Kammerer, Dennis Bräckle, Mario Gommeringer, Mathias Schnarrenberger, Michael Braun, Karlsruhe Institute of Technology, D

15:00
On the Five-Phase Open-End Winding drives Performance
Milan Darijevic, Liverpool John Moores University, GB

Room München 2

Passive Components and New Materials

Chairman: Enrique J. Dede, University of Valencia, E

14:00
Design and Simulation of Thermally Optimized Filter Inductors for a 1MW Windmill Demonstrator
Alexander Stadler, Tobias Stolzke, Christof Gulden, STS, D

14:30
Development of High Power, High Frequency Magnetics for the Future Power Electronics Applications
Kapila Warnakulasuriya, Carroll & Meynell Transformers, GB

15:00
3D Virtual Identification of a Power Inter Cell Transformer
Léon Havez, Emmanuel Sarraute, Didier Flumian, University of Toulouse, F

Conference Wednesday, 20 May 2015, Poster Dialogue Sessions

15:30 – 17:00, Foyer Ground Floor Entrance NCC Mitte

Control of Power Converters

Chairman: Volker Pickert, University of Newcastle, GB

PP074 **Dynamic Two Stage Bus Architecture**
Jan Baumann, Exar, D; Alan Elbanhawy, Exar Corporation, USA

PP075 **Active thermal Management for a single-phase H-Bridge Inverter employing switching frequency Control**
Markus Andresen, Giampaolo Buticchi, Marco Liserre, Christian-Albrechts-University of Kiel, D; Ole Mühlfeld, Danfoss Silicon Power, DK

PP076 **Overview of the six Phase VSI control Techniques for the dual three Phase induction Machine Drive**
Dragan Milicevic, Boris Dumnic, Bane Popadic, Vladimir Katic, Djura Oros, Faculty of Technical Sciences, RS

PP077 **A fault tolerant Communication Interface for modular and distributed Power Electronics**
Marek Galek, Manuel Blum, Hamza Mlayeh, Siemens, D

PP078 **Performance Improvement of Dynamic Voltage Restorer using Proportional – Resonant Controller**
Sajitha Andrews, Subash Joshi, CDAC, IN

PP079 **Autonomous Method of maximum Power Efficiency tracking for PFC- and DC/DC-Converter System**
Bernhard Strzalkowski, Analog Devices, D

PP080 **Bidirectional Current-sensorless High Power Factor Corrector**
Felipe López, Francisco J. Azcondo, University of Cantabria, ES

PP081 **Investigation of Interactions among Inverters for renewable Energies due to Coupling Impedances and PLL dynamics in weak Power Systems**
Lars Jessen, Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, D

Power Converters AC-DC, DC-DC

Chairman: Mark M. Bakran, University of Bayreuth, D

PP082 **High Efficient Digital Controlled Bridgeless Boost PFC without Direct Current Sensing**
Daniel Miller, Manfred Reddig, University of Applied Sciences Augsburg, D; Ralph Kennel, Technical University of Munich, D; Manfred Schlenk, Infineon, D

PP083 **Topology Survey of DC-Side-Enhanced Passive Rectifier Circuits for Low-Harmonic Input Currents and Improved Power Factor**
Markus Makoschitz, Hans Ertl, Technical University of Wien, A; Michael Hartmann, Schneider Electric Power Drives, A

PP084 **A Soft Switching Bidirectional DC-DC Converter with High Frequency Isolation Feasible to Photovoltaic System Applications**
Fernando L. M. Antunes, Luan Carlos Mazza, Demercil de S. Oliveira Jr., Diego B. S. Alves, Paulo C. M. Campelo, Fábio J. L. Freire, Federal Institute of Ceará, BR

PP085 **High-efficiency True Bridgeless Totem Pole PFC based on GaN HEMT: Design Challenges and Cost-effective Solution**
Yifeng Wu, Liang Zhou, Transphorm; USA, Jim Honea, Zhan Wang, Goleta, USA

PP086 **Design of a Series Resonant Converter with Inductive Output Filter for 130 W Street Lighting Application**
Erika Stenglein, Christian Oeder, Thomas Dürbaum, University of Erlangen, D

PP087 **A Method To Achieve ZVS With A DC/DC Half-Bridge Converter Working With Constant Frequency In A Wide Output Power Range**
Tammo Winkler, Henrik Ehlers, Scansonic, D; Sibylle Dieckerhoff, Technical University of Berlin, D

PP088 **A More Accurate MOSFET RDS(on) Current Sensing Scheme in Synchronous Buck Converters**
Wengkang Huang, Infineon Technologies, USA

PP089 **Modular, parallel Array of single super Capacitor Cells enabled by a distributed DC-DC Converter Architecture**
David Bourner, Maurizio Salato, Peter Makrum, Vicor Corporation, USA

Power Converters DC-AC

Chairman: Hans Ertl, Vienna University of Technology, A

PP090 **Compact and Cost-efficient Power Regeneration System for Voltage Source Converters**
Johann Austermann, Simon Cepin, Holger Borcherding, University Ostwestfalen Lippe, D

PP091 **Multi-Cell Switch-Mode Power Amplifier with Closed-Loop Hybrid Output Voltage Filter**
Helmut Votzi, Hans Ertl, University of Technology Vienna, A

PP092 **Minibloc SiC-MOSFET in a resonant Half-Bridge Inverter operating in the MHz-Range**
Fabian Denk, Karsten Hähre, Wolfgang Heering, Rainer Kling, Karlsruhe Institute of Technology, D

PP093 **Bi-directional two level 6-phase DC-DC Converter for Energy Storage Application**
Kaspars Kroics, Institute of Physical Energetics, LV

PP094 **A Single-Stage AC-DC Modular Cascaded Multi-level Converter Feasible to SST Applications**
Demercil Oliveira, Dalton Honório, Luiz Henrique Barreto, Paulo Praça, Federal University of Ceará, BR

PP095 **Three-Level Active Neutral Point Clamped Inverter with Current Splitting in Neutral Voltage Level for Low Fundamental Frequency Currents in Grid Impedance Measurement Application**
Sandro Günter, Friedrich W. Fuchs, University of Kiel, D

PP096 **Cascaded Multilevel Converter Applied to Fault Ride-Through Tests of Wind Turbines**
Fernanda de Morais Carnielutti, Jorge Massing, Benhur Tessele, Humberto Pinheiro, Federal University of Santa Maria, BR

PP097 **Right Power MOSFET selection for Bridge Motor Control**
Filippo Scrimizzi, Giuseppe Longo, Giusy Gambino, STMicroelectronics, I

PP098 **A Comparison of Quasi-Z-Source Inverter and Traditional Two-Stage Inverter for Photovoltaic Application**
Ayman Ayad, Stefan Hanafiah, Ralph Kennel, Technical University of Munich, D

PP099 **Kelvin Source Connection for High Current IGBTs. A way to get high Energy Efficiency**
Vittorio Crisafulli, Marco Antretter, ON Semiconductor, D

Power Electronics in Automotive

Chairman: Martin März, FhG-IISB, D

PP100 **About the Heating of foreign Metallic Objects in the magnetic Field of wireless Power Transfer by Cars**
Ralf Wiengarten, Paul Vahle, D

PP101 **Using a multiphase interleaved-switched Inverter as Power-Hardware-in-the-loop Machine Emulator to test sensorless control Techniques**
Oliver Lehmann, Martin Heintze, Christian Nemec, Jörg Roth-Stielow, University of Stuttgart, D

PP102 **Topology Comparison and System Optimisation for a modular 25 kW Motor–Inverter Drive Train System**
Ulf Schwalbe, Marco Schilling, Technical University Ilmenau, D

PP103 **Thermal Optimization within Power Packages for Automotive Applications**
Liu Chen, Infineon Technologies, D

PP104 **Electric Water Pump operation plan to increase fuel efficiency of Hybrid and Electric Vehicle**
JeHwan Lee, HangGeun Jang, Hyundai Motors, ROK

PP105 **Value creation developing efficient 750V IGBT and Emitter controlled Diode for automotive Applications**
Thomas Geinzer, Heike Boeving, Tomas Reiter, Martina Seider-Schmidt, Frank Wolter, Infineon Technologies, D

PP106 **High Performance 7th Generation Chip Installed Power Module for EV/HEV Inverters**
Yosuke Nakata, Mikio Ishihara, Khalid Hussein, Mitsubishi Electric Corporation, J; Thomas Radke, Mitsubishi Electric Europe, D

Renewable Energy Systems I

Chairman: Peter Wallmeier, Delta Energy Systems, D

PP107 **Use of a DC-DC step up Converter in photovoltaic Plants for increased electrical Energy Production and better Utilization of covered surface Area**
Gina Steinke, Alfred Rufer, Industrial Electronics Laboratory EPFL Lausanne, CH

PP108 **Effects of Turbulence Frequency on MPPT of Wind Turbine**
Lianjun Zhou, Minghui Yin, Liudong Zhang, Baozhu Du, Yun Zou, Nanjing University of Science and Technology, CN

PP109 **Development and Validation of a simulation Model of a Hybrid Power Generation System**
Yavor Stefanov, Hartmut Hinz, University of Applied Sciences Frankfurt, D

PP110 **Single-phase Inverter for an autonomous small Photovoltaic System with SPWM Voltage Regulation**
Francisco-Javier Valdez-Cruz, Ana Mariel Armendaiz Rocha, Instituto Tecnologico de Estudios Superiores de Monterrey, MX; Nahúm Núñez-Loredo, Instituto de Ciencias y Estudios Superiores de Tamaulipas, MX

PP111 **Photovoltaic – Wind Energy – Hybrid System with Battery and Heat-Storage Path**
Thilo Bocklisch, Johannes Lindner, Technical University of Chemnitz, D

PP112 **Nanoconfinement of hydride Materials into Carbon hosts for reversible hydrogen Storages**
Rapee Gosalawit-Utke, Suranaree University of Technology, TH

PP113 **Autonomous Control of Combined PV and Battery Sources for Reliable Power Systems**
Ali Elrayyah, Abdelkader Bousselham, Qatar Environment and Energy Research Institute, Q

Renewable Energy Systems II

Chairman: Daniel Chatroux, CEA-LITEN, F

PP114 **Power Losses of Three Phase Rectifier Topologies in Small Wind Turbines**
Kristina Buchert, Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, D

PP115 **Single Phase Solar PV Inverter without Electrolytic Capacitors**
Alfons Klönne, Rainer Merz, University of Applied Sciences Karlsruhe, D

PP116 **Control Method for One Frequency Converter Driving Two Induction Generators**
Sergej Frank, Ulf Schümann, University of Applied Sciences Kiel, D; Olaf Goll, SkyWind, D

PP117 **Bottom up Research and Development for a Low-Voltage Three Level NPC Converter**
Berthold Benkendorff, Friedrich W Fuchs, Christian-Albrechts-University of Kiel, D; Detlef Friedrich, Tobias Mono, Hagen Reese, Fraunhofer-Institute ISIT, D; Roland Eiserle, Heinz-Hermann Letas, University of Applied Sciences Kiel, D; Frank Osterwald, Danfoss Silicon Power, D

PP118 **Ultra Long Lifetime Energy Storage System using Flywheels and Matrix Converters**
Koji Kato, Sanken Electric, J

PP119 **Synchrogenverter–Novel Hybrid Generator**
Piotr Szulawski, Wlodzimierz Koczara, Warsaw University of Technology, PL

Power Quality

Chairman: Elmar Stachorra, KoCoS Power Grid Services, D

PP120 **Control of Grid connected Converter with improved Power Quality Characteristic**
Boris Dumnic, Bane Popadic, Dragan Milicevic, Vladimir Katic, Zoltan Corba, Faculty of Technical Sciences, RS

PP121 **AC- and DC-Power Quality Improvement of Diode Rectifiers due to Parallel-Series active Filtering**
Andreas Reinhold, Rolf Grohmann, HTWK Leipzig University of Applied Sciences, D; Uwe Rädel, Jürgen Petzoldt, Technical University Ilmenau, D

PP122 **Better Line Current by LED Lamps less 25 Watt Equipped With a Six Diode Valley Fill Topology**
Reinhard Jaschke, Helmut-Schmidt-University, D

PP123 **Implementation of Flicker Meter in Power Quality Analyzer**
Pavel Štěpán, Viktor Bubla, Leoš Kukačka, Jan Kraus, Technical University of Liberec, CZ

PP124 **Simulation of an EMI Receiver in the Time Domain Using PLECS**
Michael Hof, Uwe Probst, Mittelhessen University of Applied Sciences, D; Johannes Visosky, Lti Drives, D

PP125 **Comparative Evaluation of Modelling Methods for the Harmonic Analysis of Three-Phase Voltage Source Converters**
JunBum Kwon, Xlongfei Wang, Frede Blaabjerg, Claus Leth Bak, Aalborg University, DK

PP126 **An Open Framework for Algorithm Based Multi Criteria Optimization of Power Electronic Systems**
Christian Pohl, HPF, D; Lutz Zacharias, Mirko Bodach, Sven Slawinski, University of Applied Sciences Zwickau, D; Thomas Barucki, Adapted Solutions, D

PP127 **Methodology for Optimizing Radiated EMI Characteristics of Power Electronic Circuits**
Lars Middelstaedt, Andreas Lindemann, Otto-von-Guericke-University of Magdeburg, D

PP128 **3D Electro-Thermal Simulation of multilayer Power MOSFET Structure under Electro-Thermal Stress**
Gaetano Bazzano, Daniela Cavallaro, Rosario Greco, Alessandra Raffa, Pier Paolo Veneziano, STMicroelectronics, I

Power Transmission

Chairman: Klaus F. Hoffmann, Helmut-Schmidt-University, D

PP129 **AC Line Fault Characteristics of an HVDC Link with Line- and self commutated Converters in parallel Operation**
Florian Fein, Bernd Orlik, University of Bremen, D

PP130 **Miniature Fast Close SwitchGear for Series Convertors**
Allen Carl Bonnici, Methode Electronics Malta, MT

PP131 **Investigation of a Solid-State Damping Resistor for HVDC Applications**
Ikenna Efika, David Trainer, Nick Wright, Colin Davidson, Alstom Grid, GB

PP132 **Performance of Power Semiconductor Devices and the Impact on System Level**
Stefan Buschhorn, Christian R. Müller, Infineon Technologies, D

PP133 **Design Considerations of 1.2kW Redundant Parallel DC/DC Power Supplies**
Zhixiang Liang, Sitthipong Angkititrakul, Intersil Corporation, USA

PP134 **Energy Consumption Comparison between two optimized limited motion Actuators topologies for an EGR System used in automotive Applications**
Christophe Gutfrind, Laurent Dufour, Vincent Lierbart, Efi Automotive, F; Jérôme Migaud, Mann+Hummel, F

Capacitors and Inductors

Chairman: Ionel Dan Jitaru, Rompower, USA

PP135 **Degradation from metallized polymer film Capacitors with the dielectric Polypropylene under the Influence of humid Heat**
Jörg Kirchhof, Sabine Kitterer, Fraunhofer Institute IWES, D

PP136 **Next Generation Dry Film AC Filter Capacitor Eliminates Catastrophic Failures**
Edward Sawyer, Michael A. Brubaker, Bob Backus, Terry Hosking, SBE, USA

PP137 **Calculation Method for core Losses of electrical Steel Inductors in Power electronic Applications**
Michael Owzareck, BLOCK Transformatoren-Elektronik, D

PP138 **Calculating Phase Currents for High Frequency Three Phase Inductors via the Inductance Matrix**
Tobias Stolzke, Alexander Stadler, Christof Gulden, Spezial-Transformatoren-Stockach, D

PP139 **Influence of Magnetic Materials Characteristic on Parameters for 3-Phase Choke including eddy Currents**
Jan Zimon, Kleintges Elektrogäretebau, D

PP140 **Magnetically Biased High Power Coil Module**
Michael Schmidhuber, Robert Ludwig, Michael Baumann, Markus Rossa, Markus Schmeller, SUMIDA Components & Modules, D

Intelligent Motion

Chairman: Helmut Knöll, University of Applied Sciences Würzburg-Schweinfurt, D

PP141 **Control of doubly fed Induction Generators during grid Faults**
Matthias Joost, Guido Tisborn, Bernd Orlik, University of Bremen, D

PP142 **Sensorless Control of Wound Field Synchronous Machines for the Whole Speed Range**
Alexander Rambetius, Bernhard Piepenbreier, Friedrich-Alexander-University of Erlangen, D

PP143 **Improvement of Speed Control Performance by using PMSM Position Sensorless Vector Control in the Inverter Overmodulation Range**
Kosuke Kondo, Shinji Doki, Nagoya University, J

PP144 **Design of a Highly Efficient Inductive Power Transfer (IPT) System for Low Voltage Applications**
Marinus Petersen, Friedrich W. Fuchs, Christian-Albrechts-University of Kiel, D

PP145 **A new complementary symmetrical Structure of using dual magnetic Cores for open loop Hall-Effect current Sensors**
Quan Zhang, Jigou Liu, Chenyang Technologies, D

PP146 **Optical Reflective Gear Tooth Sensor with Application to Rotational Speed Measurements**
Hui Sun, Jigou Liu, Chenyang Technologies, D

PP147 **A Novel Method for Measuring Current Derivative Signal with Closed Loop Hall-Effect Current Sensor**
Cheng Liu, Ji-Gou Liu, Quan Zhang, Chenyang Technologies, D; Huiling Yi, University of Shanghai for Science and Technology, CN

PP148 **Current Measurement of Motor Drives and Inverters – Influence of shielded and not-shielded Motor Cable**
Andreas Neuhold, Bernhard Grasel, Michael Oberhofer, Dewetron Elektronische Messgeräte, D

PP149 **Analysis of Ultra-fast Inverter Switching Transition (dv/dt) Impact based on SiC Semi-conductors to Pre-active Insulation Monitoring of a High Power Traction Motors**
Markus Vogelsberger, Bombardier Transportation Austria, A; Clemens Zöller, Thomas M. Wolbank, Hans Ertl, Technical University of Vienna, A

Conference Thursday, 21 May 2015, Morning und Afternoon Oral Sessions

Room Brüssel 1
08:45

KEYNOTE:
Electrochemical Battery Managements and Applications

Speaker: Daniel Chatroux, CEA-LITEN, F
Chairman: Jean-Paul Beaudet, Schneider Electric, F

More information on page 25.

09:30 Coffee Break

Room Brüssel

SiC Low Power

Chairman: Ulrich Kirchenberger, STMicroelectronics, D

10:00
Silicon Carbide Schottky-Barrier Diode Rectifiers with High Avalanche Robustness
Andrei Konstantinov, Thomas Neyer, Fairchild Semiconductor, D; Sungmo Young, Fairchild Korea Semiconductor, ROK

10:30
1200 V thinQ!™ SiC Schottky Diode Generation 5: What are the three Keys for simple, compact and high efficiency Inverter Designs?
Fanny Björk, Infineon Technologies Austria, A

11:00
Evaluation of GaN, SiC and Superjunction in 1 MHz LLC Converter
Haihua Zhou, Wenduo Liu, Eric Persson, International Rectifier and Infineon Technologies Company, USA

11:30
Short-Circuit Capability: Benchmarking SiC and GaN Devices with Si-based Technologies
Libiao Yu, Douglas Pappis, Samuel Araujo, Peter Zacharias, University of Kassel, D

12:00
Robustness in short-circuit Mode of SiC MOSFETs
Cheng Chen, Denis Labrousse, Stéphane Lefebvre, Satie, F; Hervé Morel, Cyril Buttay, Ampère, F

Room München 1

DC/AC Converters

Chairman: Jacques Laeuffer, Dtalents, F

10:00
Parallel Hybrid Three-Phase Inverter with Direct Current Control and Current Error Compensation
Julian Endres, Ansgar Ackva, University of Applied Sciences Würzburg-Schweinfurt, D

10:30
Advantages of IGBT Series Connection in 1.500 V PV-inverters
Christian Nöding, Peter Zacharias, Christian Felgemacher, Peter, Benjamin Dombert, University of Kassel, D

11:00
Experimental Verification of MHz Inverter Constructed from Frequency Multiplying Circuit with Soft-Switching
Koji Orikawa, Jun-ichi Itoh, Nagaoka University of Technology, J

11:30
Normally-on SiC-JFET Cascode under ZVS Conditions
Karsten Hähre, Wolfgang Heering, Fabian Denk, Rainer Kling, Karlsruhe Institute of Technology, D; Thomas Lueth, Trumpf Hüttinger, D

12:00
Power Semiconductor Loss Comparison of Low-Voltage, High-Power Two-Level and Three-Level Voltage Source Converters
Normann Schwingal, Steffen Bernet, Technical University of Dresden, D

→ 12:00 Ground Floor Lunch Break

Room Brüssel

Power Modules

Chairman: Yasuyuki Nishida, Chiba Institute of Technolgy, J

14:00
Parasitics in Power Electronic Modules – How parasitic Inductance influences Switching and how it can be minimized
Michael Meisser, Max Schmenger, Thomas Blank, Karlsruhe Institute of Technology, D

14:30
New PrimePACK(TM) Package to lever IGBT5
Andre Stegner, Thomas Auer, Wilhelm Rusche, Infineon Technologies, D

15:00
The New High Power Density Package technology for the 7th Generation IGBT module
Fumihiko Momose, Takashi Saito, Akira Hirao, Yoshitaka Nishimura, Yasuyuki Kobayashi, Eiji Mochizuki, Yoshikazu Takahashi, Fuji Electric, J

15:30
Integration Technologies for a Fully Modular and Hot-Swappable MV Multi-Level Concept Converter
Didier Cottet, Wim van der Merwe, Francesco Agostini, Gernot Riedel, Andrea Rüetschi, Bernhard Wunsch, Thomas Gradinger, Rudi Velthuis, ABB Switzerland, CH; Tormod Wien, ABB Norway, NO; Jonathan Bradshaw, DPS, NZ

Room München 1

Low Power Converters

Chairman: Francisco Javier Azcondo, University of Cantabria, ES

14:00
Integrated Gate Drive Architecture for High Step-down Multiphase Buck Converter
Giacomo Calabrese, Lorenzo Capineri, Universita degli Studi di Firenze, I; Maurizio Granato, Giovanni Frattini Texas Instruments, I

14:30
Performance Comparison for A4WP Class-3 Wireless Power Compliance between eGaN® FET and MOSFET in a ZVS Class D Amplifier
Michael de Rooij, Efficient Power Conversion Corporation, USA

15:00
Dual fed, step up Converter Topology and its Application
Alexander Isurin, Vanner, USA

15:30
Novel Analysis of a Boost-Buck Single Stage LED-Ballast
Alexander Pawellek, Thomas Dürbaum, University of Erlangen-Nürnberg, D

Room Athen

Power Quality Solutions

Chairman: Jean-Paul Beaudet, Schneider Electric, F

10:00
Voltage Control and Stabilization of 380 VDC Micro Grids
Bernd Wunder, Yunchao Han, Leopold Ott, Julian Kaiser, Fraunhofer-Institute IISB, D

10:30
Flexible, Modular and Universal Power Conversion for Small Cell Stations in Distributed Systems
Maurizio Salato, Vig, Harry, Vicor Corporation, USA

11:00
Achieving Unity Power Factor with a Unidirectional Single-Phase Four Reverse Blocking IGBTs Buck Type Rectifier
Christelle Saber, Denis Labrousse, Bertrand Revol, SATIE, F; Alain Gascher, Renault SAS, F

11:30
Voltage Balancing in Multilevel-Converter-Based UPS
Lorenzo Giuntini, GE Consumer & Industrial Sa, CH

Room Mailand

SPECIAL SESSION E-Mobility

Chairman: Nejila Parspour, University of Stuttgart, D

10:00
Smart Stator Tooth Design with novel Control and Safety Functions in Electric Vehicle Drivetrains
Hubert Rauh, Fraunhofer IISB, D; Philip Brockerhoff, Infineon Technologies, D; Yves Burkhardt, Siemens, D; Klaus Egger, ZF Friedrichshafen, D

10:30
Determination and Comparison of equivalent Circuit Parameters in Large-Air-Gap Transformers by different Methods
Thomas Komma, Monika Poebl, Siemens, D

11:00
Design of a Switched Reluctance Machine as a Near-Wheel Motor for Electric Vehicles
Samil Yavuz, Nejila Parspour, Amir Ebrahimi, University of Stuttgart, D

11:30
A Pareto-Based Comparison of Power Electronic Topologies for Inductive Power Transfer
Tobias Diekhans, Robert Bosch, D; Rik W. De Doncker, RWTH Aachen, D

Room München 2

Motors

Chairman: Edward Hopper, MACCON, D

10:00
Mitigation of Current Harmonics in Inverter-Fed Permanent Magnet Synchronous Machines with Nonlinear Magnetics
Jan Richter, Thomas Lannert, Tobias Gemassmer, Martin Doppelbauer, Karlsruhe Institute of Technology, D

10:30
FPGA-Based Real-Time Model of a Switched Reluctance Motor
Saeid Saeidi, Frank Puschmann, Matthias Deter, dSPACE, D

11:00
Structure of a Multiphase industrial Servo Drive with highly integrated Inverter
Jan Wettlaufer, Abdenbi Maghnaoui, Felix Klute, Torben Jonsky, Lenze SE, D

11:30
Software based Parameter Identification Method for Induction Machines
Markus Urech, Felix Jenni, University of Applied Sciences Nordwestschweiz FHNW, CH

Room Athen

Sensors

Chairman: Eric Favre, Norgren-Fluid Automation Systems, CH

14:00
Junction Temperature Measurement during Inverter Operation using a TJ-IGBT-Driver
Marco Denk, Mark-M. Bakran, University of Bayreuth, D

14:30
New Approaches to Improve the Performance of Inductive Current Sensors
Stefan Hain, Mark-M. Bakran, University of Bayreuth, D

15:00
Design and Evaluation of a Sensor for Measuring the IGBT On-State Saturation Voltage
Dennis Wagenitz, Christian Läuschner Roland Thewes, Sibylle Dieckerhoff, Technical University of Berlin, D

15:30
High Accuracy Current Transducer Can Reduce Cost and Size of HEV and EV Battery Pack
Gauthier Plagne, LEM Switzerland SA, CH

Room Mailand

Power Electronics in Automotive, Traction and Aerospace

Chariman: Hans-Günter Eckel, University of Rostock, D

14:00
Configurable Electric Vehicle (CEV) Demonstrator
Martel Tsirinomeny, Nicolas Cherix, Gina Steinke, Alfred Rufer, Industrial Electronics Laboratory, CH

14:30
Modular integrated Machine-Inverter System – Development of a high current SELV System
Marco Schilling, Ulf Schwalbe, Technical University of Ilmenau, D

15:00
Assisting Converter Based Integrated Battery Management System for Automotive Applications
Mahmoud Shousha, Zhe Gong, Aleksandar Prodic, Victor Marten, John Milios, University of Toronto, CA

15:30
Automotive Traction Inverter for Highest Power Density
Ole Mühlfeld, Lars Paulsen, Klaus Olesen, Danfoss Silicon Power, D

Exhibition

At PCIM Europe trends and developments are being presented all under one roof and therefore build an ideal platform for exhibitors and competent visitors.

The combination of the conference taking place in parallel to the exhibition creates a unique synergy effect and offers attendees, exhibitors and visitors a feasible overview of new products, system solutions and scientific concepts.

Amongst others, two exhibition highlights are the exhibitor forum and the industry forum where exhibitors have the chance to present their products or highly academic papers to a competent audience.

List of Exhibitors

3M Deutschland, D
A Media Bodo's Power Systems, D
Aalborg University, DK
Aavid Thermalloy, I
ABB France, F
ABB Switzerland – Semiconductors, CH
ACC Silicones, GB
Adapted Solutions, D
Advanced Cooling Technologies, USA
Advanced Techne – PRIATHERM DIVISION, I
Advanced Technology & Materials, CN
AgileSwitch, USA
AIC Europe, D
AixControl, D
AKG Thermotechnik International, D
ALCON Electronics, IND
alfatec, D
Alpha, GB
Alpha and Omega Semiconductor, USA
ALPHA-Numerics, D
alpitronic, I
alutec metal innovations, D
Alutronic Kühlkörper, D
Amantys, GB
Analog Devices, D
ANSYS Germany, D
Aperam Alloys Amilly, F
Apex Microtechnology, USA
APM Technologies (Dongguan), CN
APOJEE, D
Arcel, F
Arkansas Power Electronics International, USA
Arthur Behrens, D
ATHERM, F
Aurubis Stolberg, D
austerlitz electronic, D
AUXEL, F
Avago Technologies, D
Axson, D
BE Semiconductor Industries, NL
Beijing Sunking Power Electronic Technology, CN
BINDER-tecsys Kontakte, D
BLOCK Transformatoren-Elektronik, D
Bluestar Silicones France, F
BMF System Parts, NL
BROXING, CH
Bruco Integrated Circuits, NL
Caltest Instruments, D
CapComp, D
Cascade Microtech, USA
CEFEM INDUSTRIES, F
CeramTec, D
China Amorphous Technology, CN
CKE Products by Dean Technology, USA
Cluster Leistungselektronik im ECPE, D
Constellium Singen, D
COOLTECH, I
CoorsTek, D
CoorsTek Advanced Materials ANCeram, D
Cosmo Ferrites Limited, IND
CPS Technologies Corporation, USA
Cree, USA
CTX Thermal Solutions, D
DACO Semiconductor, TW
Danfoss Silicon Power, D
Danotherm Electric, DK
dataTec, D
DAU, A
Dean Technology, USA
Denka Chemicals, D
DETAKTA Isolier- und Meßtechnik, D
DEWETRON Elektronische Messgeräte, D
DFA Media, GB
Diotec Semiconductor, D
DODUCO GmbH, D
DOWA HD Europe, D
dSPACE, D
Ducati Energia, I
Dynetics, D
Dynex Semiconductor, GB
EACO Capacitor, CN
EBG Elektronische Bauelemente, A
ECOMAL Europe, D
ECPE European Center for Power Electronics, D
ECU Electronics Industrial, CN
EKL AG, D
Electronic Concepts (Europe), IRL
Electronic Specifier Limited, GB
ELECTRONICON Kondensatoren, D
ELEKTRISOLA Dr. Gerd Schildbach, D
EPA, D
EPCOS AG A TDK Group Company, D
EpiGaN, B
ET System electronic, D
ETH Zürich Power Electronic Systems, CH
EUROCOMP ELEKTRONIK, D
Eurofeedback High Voltage Electronic, F
Exagan, F
Exxelia Supply, F
F.E.EM., I
Fairchild Semiconductor, USA
Ferroxcube Deutschland, D
Filcap, D
Finepower, D
Fischer Elektronik, D
Franz Steger Transformatorenbau, D
Fraunhofer Institut für Integrierte Systeme und Bauelementetechnologie IISB, D
Fraunhofer Institut für Solare Energiesysteme, D
Fraunhofer-Institut für Keramische Technologien, D
Fraunhofer-Institut für Siliziumtechnologie, D
Fraunhofer-Institut für Werkstoffmechanik, D
Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, D
Frizlen, D
FTCAP, D
Fuji Electric Europe, D
GaN Systems, CDN
GED Gesellschaft für Elektronik und Design, D
Gemballa Electronics, D
GES Electronic & Service, D
GLYN, D
GT elektronik, D
Guangdong Fengming Electronic Tech, CN
GvA Leistungselektronik, D
H.C. Starck, USA
HAHN, D
HALA Contec, D
Hauber & Graf Electronics, D
HÄUSERMANN, A
HE System Electronic, D
HEIDEN power, D
HEINE Resistors, D
Hengdian Group DMEGC Magnetics, CN
Heraeus Deutschland, D
HF Instruments, D
High Voltage Power Solutions Products by Dean Tech, USA
Himag Planar Magnetics, GB
Hitachi Europe, GB
Hoffmann & Co Elektrokohle, A
Höganäs, S
Hollmén, FIN
HV Components Associates Products by Dean Technolo, USA
HVP High Voltage Products, D
HVR International, D
HY-LINE Power Components Vertriebs, D
I.C.E., I
IB-Billmann, D
ICAR – INDUSTRIA CONDENSATORI, I
imperix, CH
Indium Corporation of Europe, GB
Industrievertretungen W. Bieber, D
Ineltron, D
Infineon Technologies, D
InPower Systems, D
International Rectifier – an Infineon Technologies Company, D
InTiCa Systems, D
Isabellenhütte Heusler, D
Ise Magnetics, NL
IWATSU TEST INSTRUMENTS CORPORATION, J
IXYS Semiconductor, D
J&D Electronics, KR
JFE Steel Corporation, J
Jianghai Europe Electronic Components, D
Jinan Gude Electronic Device, CN
Johann Lasslop Induktive Bauteile, D
Junior Kühlkörper, D
KAMAKA Electronic Bauelemente Vertriebs, D
Kanthal Globar Sandvik Heating Technology USA, USA
Kaschke Components, D
KCC Corporation (AM Department), KR
KEMET Electronics Corporation, USA
Kendeil, I
KERAFOL – Keramische Folien, D
Keysight Technologies Deutschland, D
Kitagawa, D
KLEINER Stanztechnik, D
KOA Europe, D
Kojin, J
KRAH Elektronische Bauelemente, D
Krummer Kondensatoren, D
KUNZE Folien, D
Leclanché Capacitors, CH
LEM Deutschland, D
LEM International, CH
LS Mtron, KR
MACCON Elektroniksystementw. und Beratung, D
MacMic Science & Technology, CN
Magnachip Semiconductor, KR
Magna-Power Electronics, D
Magnetec (Guangzhou) Magnetic Device, CN
Magnetec Gesellschaft für Magnet-Technologie, D
Magnetics, USA
Malico, TW
Mareton, HR

MB Electronic, D
Mecc. AL a socio unico, I
Mentor Graphics (Deutschland), D
Mersen France, F
Methode Electronics Malta, M
MEV Elektronik Service, D
Michael Koch, D
Microchip Technology, D
Micross Components, GB
Miles Platts, GB
MinDCet NV, B
Mitsubishi Electric Europe Niederlassung Deutschland, D
MJC Elektrotechnik, D
MUECAP Bauelemente, D
Multi Measuring Instruments, J
Multi-Contact Deutschland, D
Nanjing New Conda Magnetic Industrial, CN
N'ERGY ELECTROTECHNIQUE, F
Nesscap Energy, D
NGK Electronics Devices, J
Ningbo Degson Electrical, CN
Nippon Rika Kogyosho, J
NORWE, D
NWL, USA
OMICRON electronics, A
ON Semiconductor UK, GB
PADA Engineering, I
Panasonic Automotive & Industrial Systems Europe, D
PARKER OVERSEAS, IND
Payton Planar Magnetics, ISR
PFARR STANZTECHNIK, D
PHOENIX CONTACT Deutschland, D
PHOENIX MECANO Power Quality HARTU, D
Piciesse Elettronica, I
PINK GmbH Thermosysteme, D
PLANSEE SE, A
Platthaus, D
Plexim, CH
PMK Mess- & Kommunikationstechnik, D
Power Electronic Measurements, GB
Power Integrations Switzerland, CH
Power Systems Design, USA
PowerCon, DK
Powerex, USA
POWERSEM, D
Prima Electro, I
Prodrive Technologies, NL
Projektron, D
Proton-Electrotex, RUS
publish-industry Verlag, D
Pulse Magnetic & Power Electronics, IND
R&D Electronics International, CN
Rame Service, I
Raytheon UK, GB
Rectificadores Guasch, E
Redtree Solutions, GB
RFMD Micro Devices, USA
Richardson Electronics, USA
Richardson RFPD Germany, D
RISSE electronic, D
Robert Bosch, D
Rödl & Lorenzen, D
ROGERS Germany, D
ROHM Semiconductor, D
Rudi Göbel, D
Rudolf Pack PACK Feindrähte, D
RUTRONIK Elektronische Bauelemente, D
S.I.R. Resistor, I
Samwha Europe, D
Sarnikon Metal ve Elektronik, TR
SAS IDEALEC, F
SBA-Trafobau Jena, D
SBA-TrafoTech, D
SBE, USA
Schmidbauer Transformatoren und Gerätebau, D
SCHROEDER + BAUER Werkzeugbau Stanztechnik, D
Schulz-Electronic, D
Schunk Sonosystems, D
schwa-medico Transformatorenbau & Industrieprodukte, D
Schweizer Electronic, D
Seifert electronic, D
SEMIKRON International GmbH, D
Sensitec, D
Serigroup, I
SERTO, D
SET Power Systems, D
Shaanxi Yihong Investment Management, CN
Shanghai Eagtop Electronic Technology, CN
Shanghai SK Transformer, CN
ShengYe Electrical, CN
Shenzhen Belta Technology, CN
Shenzhen Cenker enterprise, CN
Shenzhen Click Technology, CN
Shenzhen Gaoyu Electronic Technology, CN
Shenzhen Luguang Electronic Technology, CN
Shenzhen POCO Magnetic, CN
Shindengen UK, GB
Siba, D
SIGNALTEC, D
Silicon Power Corporation, USA
SIRECTIFIER ELECTRONICS TECHNOLOGY CORPORATION, CN
SIRIO ELETTRONICA, I
Smart Power Solutions, GB
SMP, D
Sonoscan, USA
Sree Vishnu Magnetics, IND
StandexMeder Electronics, D
Starpower Europe AG, CH
Stäubli Tec-Systems Connectors, D
STGCON Germany, D
STMicroelectronics International, CH
STS, D
SUMIDA Components & Modules, D
System Plus Consulting, F
Systemtechnik LEBER, D
Taiwan Chinsan Electronic Industrial, TW
Tamura Corporation, J
Tamura-Europe, GB
TCT Tores Composants Technologies, F
Team Pacific Corporation, PH
Tech Power Electronics, F
Tech Semiconductors, CN
TECNOAL, I
TELCON, GB
Teledyne LeCroy, D
THALES MICROELECTRONICS, F
The Bergquist Company, D
Thermacore Europe, GB
Thermatron Engineering, USA
Thomas Waidner, D
THORA Elektronik, D
Tianchang Fuan Imp. & Exp., CN
TOP-Electronics, NL
Toshiba Electronics Europe, D
trafomodern Transformatorengesellschaft, A
Traftor Europe, F
TRAMAG Transformatorenfabrik, D
TRANSPHORM, USA
Typhoon HIL, YU
United Silicon Carbide, USA
VACUUMSCHMELZE, D
Vicor Germany, D
Vincotech, D
Vishay Europe Sales, D
Vogel Business Media, D
Wacker Chemie, D
WAGO Kontakttechnik, D
Weidmüller Interface, D
Widap, D
WIMA, D
Wolverine Tube Inc. MicroCool Division, USA
WÜRTH ELEKTRONIK eiSos, D
Würth Elektronik ICS, D
Yangzhou Kaipu Electronics, CN
Yangzhou Pairui IMP. & EXP., CN
Yangzhou Positioning Tech, CN
Yangzhou Yangjie Electronic Technology, CN
Yixing Kexing Alloy Materials, CN
Yokogawa Deutschland Niederlassung Herrsching, D
Yole Developpement, F
Zeasset Electronic Technology, CN
ZES ZIMMER Electronic Systems, D
ZEZ SILKO, CZ
Zhejiang Guchi Electronics, CN

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Industry Forum

Hall 6 Booth 345

A perfect mix of panel discussions and round tables shows will take place at the industry forum during the exhibition opening days. Get an exclusive insight free of charge of the themes global players deal with and get inspired.

Tuesday, 19 May 2015

Time	Title/Description	Company/Speaker
10:00 – 10:15	**Presentation of the Elektronik-Study »DIN-Rail Power Supplies«**	WEKA Fachmedien Andrea Gillhuber Engelbert Hopf und Ralf Higgelke
10:15 – 11:00	PANEL DISCUSSION **Power Electronics and its applications**	
11:00 – 12:00	**The ECPE Network and its Joint Research Programme**	ECPE European Center for Power Electronics Thomas Harder
14:00 – 15:00	**Innovation of Power Semiconductor Development**	Infineon Technologies, Germany Thomas Schütze, Wilhelm Rusche
15:15 – 16:15	**SiC power transistors at 2 MHz / Reliability evaluation of SiC switches**	KIT – Karlsruher Institut für Technologie Karsten Hähre, Fabian Denk

Wednesday, 20 May 2015

Time	Title/Description	Company/Speaker
10:00 – 11:00	**How Hybrid and Electric are going the reshape the overall power electronics industry?**	Yole Développement
11:00 – 12:00	PANEL DISCUSSION **Reliable Volume Production of Wide Band Gap Semiconductors**	Bodo's Power Systems, A Media, Germany Bodo Arlt
13:00 – 13:30	**Value creation developing new Infineon HybridPACK with Micro Pattern Trench IGBT (750V EDT2) for automotive applications**	Infineon Technologies, Germany Thomas Geinzer
14:00 – 15:00	PANEL DISCUSSION **Gallium Nitride in Power Electronic Applications, especially in Automotive Electronics, featuring up to 6 leading Industry Experts**	Power Electronics Europe, Germany Achim Scharf
15:00 – 16:00	**The Smart Transformer and its impact on the electric grid**	Christian-Albrechts-Universität zu Kiel Marco Liserre

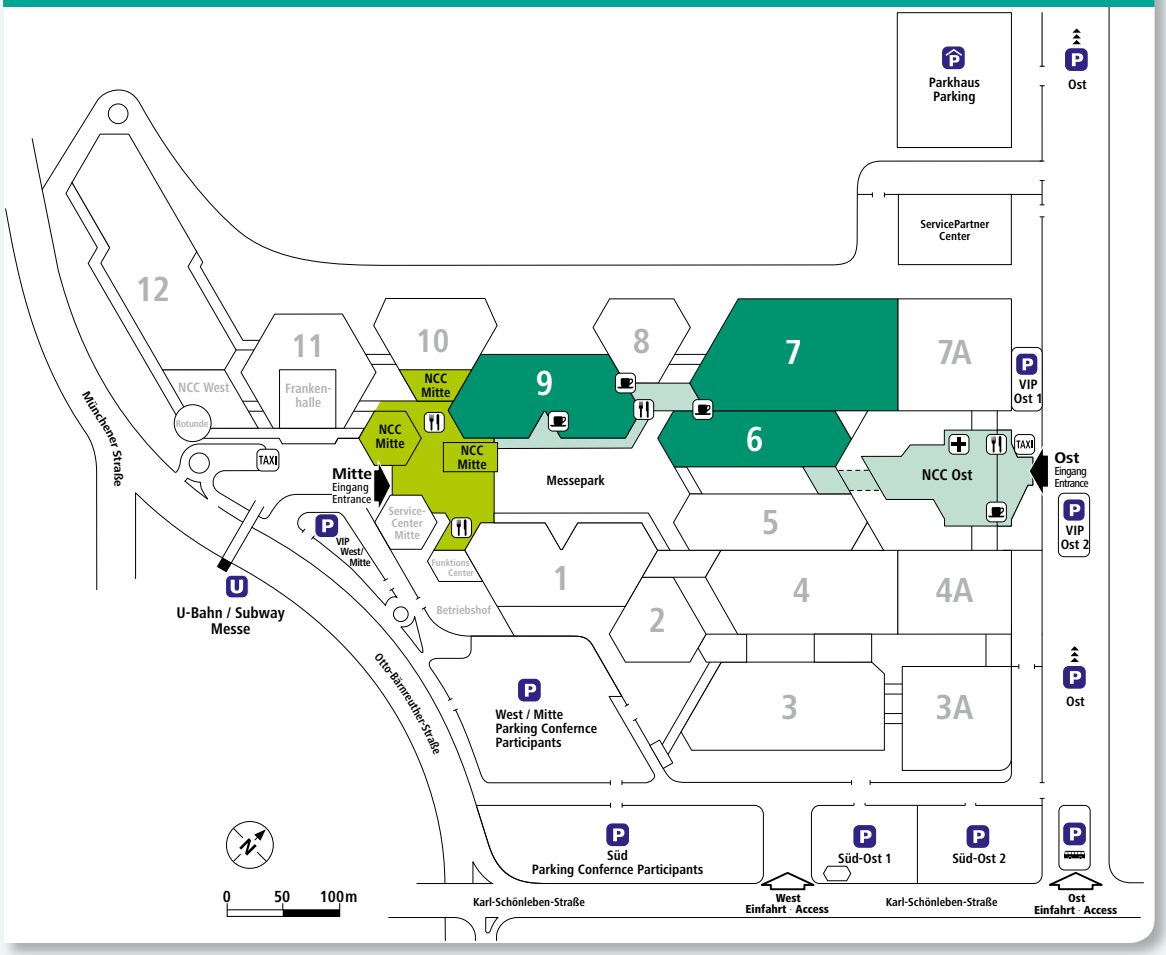
Thursday, 21 May 2015

Time	Title/Description	Company/Speaker
10:00 – 11:00	**An Open Source Approach to Synchronizing Mechatronic Systems Using Real-Time Ethernet**	Powerlink Analog Devices Sari Germano
11:00 – 12:00	**Managing Temperature Differences between IGBT Modules**	Mentor Graphics Andreas Simon-Kajda
13:00 – 14:00	**4th generation Field Stop (FS) IGBT with high performance and enhanced latch up immunity**	Fairchild Semiconductor, Korea Kevin Lee

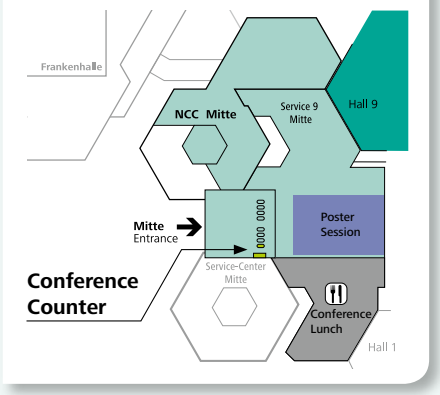
Extract of the program as of March 2015

Room Plan

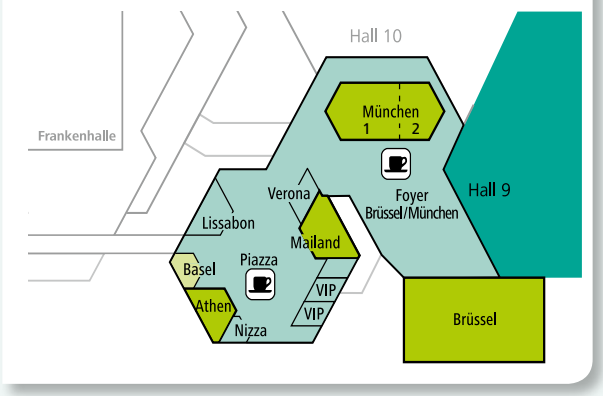
Exhibition Centre Nuremberg



NCC Mitte, Level 0



NCC Mitte, Level 1



Exhibition

Entrances and Services

Conference

Advisory Board/
Speaker's Room

Registration Information

Registration Fees

	Until 9 April 2015	From 10 April 2015
These are per named delegate as follows:		
One Conference Day	640 €	740 €
Two Conference Days	1,040 €	1,140 €
Three Conference Days	1,240 €	1,340 €
Tutorial Full Day	690 €	790 €
Seminar Half Day	345 €	395 €
University Staff*	890 €	890 €
Students	40 % Discount	40 % Discount
Exhibitor special rate**	250 €	250 €

* University staff and students may only register for the full conference at a reduced rate and must enclose a copy of their university ID-card.
A student discount of 40 % is available upon request. This discount can not be combined with the University Staff fee. Please contact Ms. Daniela Käser at Daniela.Kaeser@mesago.com for registration.

** A transferable ticket valid for the three keynote presentations including the conference proceedings is only available to PCIM Europe 2015 exhibitors. A special registration is required.

On-site registration: please add 30 EUR per participant.
All fees plus 19 % VAT

To register please go to pcim-europe.com

Registration Terms

Registration for the PCIM Europe Seminars, Tutorials and the Conference from 17 – 21 May 2015 is binding and only accepted online at pcim-europe.com. Participation fees are due on registration with payment by credit card (VISA, Master/Euro Card and Amex) via the Saferpay gateway. An invoice for the fees will be issued by mail.
Once the registration process is complete, you will receive an email booking confirmation including an entry voucher to the exhibition, please make sure to bring this along. Your conference documents will be issued on site at the conference counter.
Cancellations will be accepted in writing only. Cancellations received by Mesago by 23 April 2015 will incur a processing fee of 80 EUR. Thereafter if the participant does not attend, the full fee will be due. If a participant is unable to attend, a substitute can be nominated.
Mesago reserves the right to cancel the conference/seminars/tutorials due to poor bookings or other reasons beyond our control. No further claims beyond the reimbursement participation fees already paid will be accepted.
The program or speakers are subject to change and no claims may be made in this respect.
The conference language is English.

Payment of fees entitles you to the following services:

→ Conference:
Participation at the conference days as booked, proceedings, free admission to the exhibition (3 day ticket), exhibition catalogue, lunch and entry to the exhibition party on 19 May 2015.

→ Tutorials:
Participation at the tutorial as booked, printed and digital course documentation, free admission to the exhibition (3 day ticket), exhibition catalogue, lunch and entry to the exhibition party on 19 May 2015.

→ Seminars:
Participation at the seminar as booked, printed and digital course documentation, free admission to the exhibition (3 day ticket), exhibition catalogue and entry to the exhibition party on 19 May 2015.

General Information

Venue

The seminars on Sunday 17 May 2015 and the seminars and tutorials on Monday 18 May 2015 will take place at **Arvena Park Hotel,** Görlitzer Str. 51, 90473 Nuremberg, phone: +49-911-89220

The conference from Tuesday 19 May until Thursday 21 May 2015 will take place at Conference Center Mitte, NürnbergMesse, Otto-Bärnreuther-Strasse, 90471 Nuremberg

Registration Counter Opening hours

Arvena Park Hotel
Sunday 17 May 2015 from 13.00 until 17.00
Monday 18 May 2015 from 8.00 until 14.00

NCC Mitte, NürnbergMesse
Monday 18 May 2015 from 16.00 until 18.00
19 – 21 May 2015 from 8.00 until 17.00

Accommodation

Hotel Information
For hotel booking please contact the hotel directly.
PCIM Europe Head Quarter Hotel
Hotel Arvena Park
Görlitzer Str. 51
D-90473 Nürnberg
Tel: ++49 911 89 22 0
Fax: ++49 911 89 22 115
eMail: info@arvenapark.de
3 min. by underground U1 to the conference site.

Questions?

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Travel

There are several non-stop flights to Nuremberg daily. In addition, Nuremberg's closeness to international airports such as Frankfurt, Munich, Zurich, Amsterdam or Paris ensures optimum connections to the intercontinental flight network. Getting from the airport to the exhibition centre is fast and easy. The airport is close to the city with direct underground and taxi connections to the exhibition centre. The underground takes you in 20 minutes from the airport to the exhibition centre. At Nuremberg Airport, taxis to the exhibition centre are available around the clock. Take the taxi directly to the exhibition centre. Journey time from the airport to the exhibition centre by taxi is approximately 15 minutes and costs about 25 EUR.

You can reach Nuremberg's main train station »Nürnberg Hauptbahnhof« conveniently from every German city with the following trains: ICE, IC or EC.
There are also frequent train connections from major European cities such as Paris, Brussels, Zurich, Vienna, Amsterdam or Prague. From »Nürnberg Hauptbahnhof« the underground U1 or U11 (direction: »Langwasser Süd«) will take you directly to the exhibition centre in only 8 minutes. At the main train station in Nuremberg there are several taxis waiting for you. By taxi you reach the exhibition centre within 10 minutes.

Nuremberg is centrally located in the South of Germany. Its excellent connections to the European motorway and direct feeder roads make it easy and convenient to reach the exhibition centre by car. Destination address for your navigation system: NürnbergMesse, Karl-Schönleben-Str., Messeplatz 1, 90471 Nuremberg

For more travel and hotel information please visit pcim-europe.com

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