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PCIM Europe 2010
Internationale Messe und Konferenz für
LEISTUNGSELEKTRONIK – INTELLIGENTE ANTRIEBSTECHNIK
- POWER QUALITY

Nuremberg, 4 – 6 May 2010

PCIM Europe Young Engineer und Best Paper Awards

Stuttgart/Nuremberg, 4 May 2010: The winners of the Best Paper and of the three Young Engineer Awards at this years PCIM Europe Conference have been announced. Three outstanding conference papers were selected by the Conference Directors from more than 100 high quality papers. The determining criteria for the Best Paper Award were originality, topicality and quality. The Young Engineer Award is presented to exceptional contributions from young professionals (under 35 years old).

The recipient of the Best Paper Award is

- **Christian Nöding, University of Kassel, Germany**
  Evaluation of A three-phase two-HF-switch PV inverter with thyristor-interface and active power factor control

The three equal winners of the PCIM Young Engineer Award are:

- **Dayana El Hage, EPFL, Switzerland**
  A high current pulse-power supply for flash lamps in PV-panel measurement-facilities
- **Christoph Klarenbach, UAS Cologne, Germany**
  Fast and high precision motor control for high performance servo drives
- **Andreas Munding, Liebherr-Elektronik GmbH, Germany**
  Compact PCB-packaging and water cooling of a 25-kW inverter

As well as being able to present their papers at the PCIM Europe 2010 conference and seeing them published in the conference proceedings, the

winners will receive prize money or a paid trip to PCIM China 2011 in Shanghai (Young Engineer Awards and Best Paper Award respectively). The award ceremony and speech - to be delivered by the scientific Advisory Board Chairman, Prof. Alfred Rufer of EPFL, Switzerland - was part of the opening ceremony of the PCIM Europe 2010 conference, from 9.00 - 9.45 am on 4 May 2010.

PCIM Europe 2010 Best Papers Abstract:

Evaluation of a Three-Phase Two-HF-Switch PV Inverter with Thyristor-Interface and Active Power Factor Control
Christian Nöding, Benjamin Sahan, Peter Zacharias, University of Kassel, Germany

For generators connected to the medium voltage grid new rules of action have to be applied in Germany since 2008. These new rules are defined within the medium voltage grid code of the BDWE, the “Bundesverband der Energie- und Wasserwirtschaft” and require special features of the generators which have an effect on cost of the devices especially when standard components are used (like IGBT). The presented PCIM-paper deals with an inverter topology which combines the rugged properties of well known thyristors with functions of modern technology to comply with the requests of the grid code. Within this paper the “Minnesota Inverter” is evaluated, which was presented by Ned Mohan in 1995 for the first time. This topology uses only two high frequency switches to feed-in a three-phase sinusoidal current via a standard thyristor bridge. Thereby the power factor (cosφ) can be set within a specific range by a control strategy illustrated in this paper. Therefore a feed-in of reactive power into the grid is possible which allows new ranges of application for thyristor topologies. Using modern SiC switches the “Minnesota Inverter” is able to utilize the full potential of the SiC technology because of the high energy density within the high frequency switches. Next to a detailed description and control of the circuit the paper provides a comparison of the introduced topology to conventional circuits like 2-level and 3-level inverters. A table shows the field of application of the “Minnesota Inverter” in comparison to well known inverter topologies like 2- level, NPC and BS-NPC by using losses factors and the inductor volume. As a conclusion the results of a constructed prototype are presented. Scopes of the output signals at different power factors and a comparison of measured and calculated efficiency curves proves the operability of the system. Therefore the “Minnesota Inverter” presents an up to date alternative to common topologies due to the combination of cheap and rugged thyristors and modern high frequency switches like SiC switches.

PCIM Europe 2010 Young Engineer Award Abstracts:

A high current pulse-power supply for flash lamps in PV-panel measurement-facilities

Dayana El Hage, Y. Birbaum, Alfred Rufer, EPFL, Switzerland

In this paper, a high current pulse power supply for the feeding of a flash lamp has been developed, on the base of a multilevel converter with cascaded cells. The pulsed high power is provided by capacitive energy storage, directly connected to the cells of the converter. A low current ripple is reached by interleaved switching technique. The original topology, its design regarding the sizing of the storage cells, and the associated control are presented. Simulation results as well as a realization of a prototype for industrial use are described in details.

Fast and high precision motor control for high performance servo drives
Christoph Klarenbach, Jens Onno Krah, UAS Cologne, Germany

This paper reports a new architecture of a fast current controller with two feedback signals for high performance motion control. Due to parallel processing inside the Field Programmable Gate Array (FPGA), the control algorithm computing time is significantly less than 1 µs. Together with advanced control technologies in combination with a new current observer the bandwidth of fast switching IGBT or MOSFET power stages is not limited by the delay time of high precision (integrating) current measurement any longer. Using that technology high control bandwidth in conjunction with high precision current control is now possible at no trade off. The control strategy relies on a simplified machine model without incurring performance degradations. The presented results have been produced with a high speed Computerized Numerical Controlled (CNC) machine (high speed lathe).

Compact PCB-packaging and water cooling of a 25-kW inverter
Andreas Munding, E. Mongui, Liebherr-Elektronik GmbH; M. Thoben, T. Hong, Infineon Technologies; M. Nold, M. Kerkhoff, ZF Friedrichshafen; S. Lutz, BMW AG, Germany

In many power electronics applications, volume and weight is a cost factor which developers seek to minimize by increasing power density. Many approaches to achieve a higher power density focus on reducing wiring and tubing expenses by integrating the system components into the electric actuator. The resulting installation areas are typically exposed to high vibrational and high temperature stresses. This work features simulation results of a sandwich PCB assembly with an electronic board and a high current board attached to either side of an aluminum heat sink. This heat sink is thermally attached to the metal housing and to a liquid cooling channel which was optimized for low pressure drop. In addition, the effect of the low pressure drop cooler structure on the IGBTs of a directly cooled pin-fin based power module was simulated and characterized. It was found that a geometry with lateral coolant impingement exhibit lowest pressure drop and allows for a large flow rate operation range in automotive applications.

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The full manuscripts as well as photos of the award winners are available. Just contact presse@mesago.com.